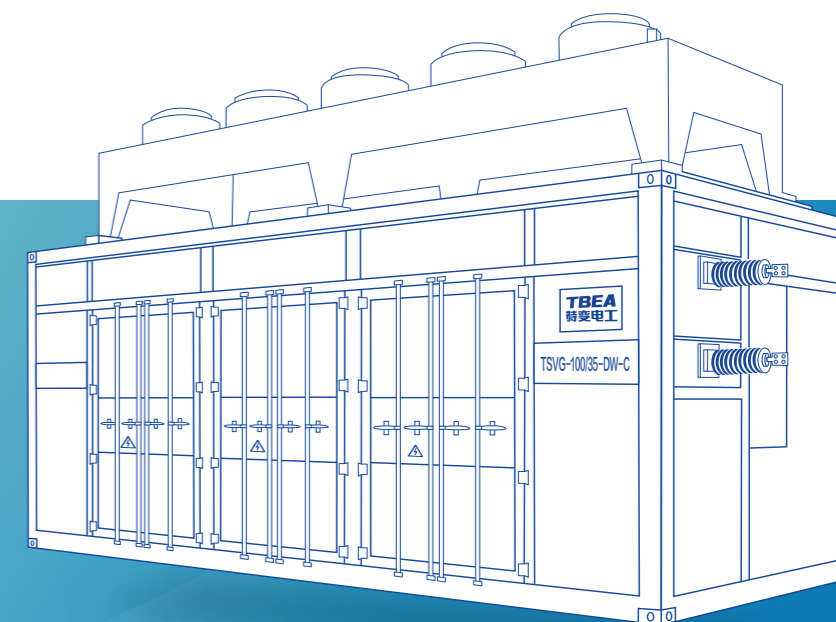


- Founded in 2000, one of the earliest enterprises devoted to clean energy
- The total amount of photovoltaic EPC construction exceeding 10GW, the top one in the world for three consecutive years
- Global Green Company No. 32 in Top 200
- Equipment digital production base with annual capacity exceeding 10GW
- 32GW inverter global shipment, TSVG sales exceeding 9GVar



TSVG Series SVG/STATCOM

Reactive Power Compensation and
Harmonic Control Device



Company website



Facebook QR Code



LinkedIn OR Code

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TBEA XI'AN ELECTRIC TECHNOLOGY CO.,LTD.

CONTENTS

TBEA



01 Company profile P-01

02 Product family P-03

3.3KV/6KV TSVG series products P-05

10KV TSVG series products P-07

35KV TSVG series products P-09

03 Dynamic reactive power compensation P-11

Principle of SVG P-11

Advantage of SVG P-12

04 Applications P-13

Saudi Arabia Sakaka solar plant

33KV 75Mvar project P-13

Pinghai Bay offshore Wind Farm 35KV 48Mar SVG Project P-13

Australian Santos gas station 3.3Kv2Mvar P-14

Xijiang chemical plant power quality management project P-14

Karachi 50MW Solar plant station, Pakistan 33Kv 10Mvar..... P-15

Istanbul 30MW wind farm ,Turkey , 35Kv 8Mvar P-15

吉木乃一期49.5MWp风电场项目P-16

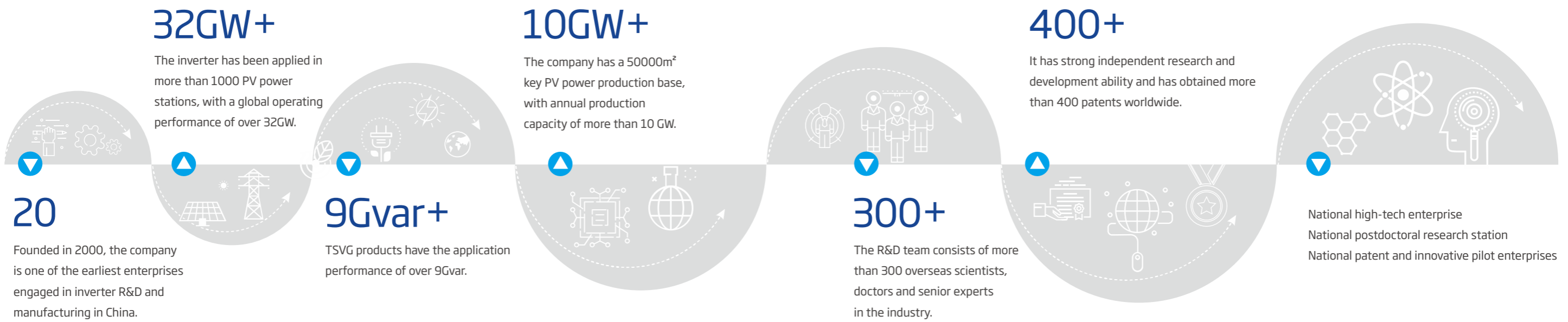
华能定边杨井升压站项目P-16

05 TBEA product service system P-17

01 Company Profile

Excellent Green and Smart Energy Service Provider

TBEA Xi'an Electric Technology Co, Ltd. was founded in 2010. The company is a high-tech enterprise affiliated to TBEA Group that specializes in R&D of core equipments and provision of core technical solutions in smart PV power generation, power quality management and smart micro-grid field etc. The Company mainly produces PV inverters, high-voltage SVGs, energy routers and energy storage system. With the support of power electronics technology, the company is dedicated to the technology exploration of clean energy power generation, smart power distribution and management of comprehensive energy and smart micro-grid, which lead technology advancement of the energy industry and drive innovation in energy technologies.



02 Product Line

Reliable Quality Continuous Grid Connection

With the increasing installed capacity of new energy power plants, in order to solve a series of power quality problems such as voltage fluctuation caused by grid-connected new energy power plants, unqualified grid-connected power factor and rapid reactive power change, static var generator has been widely used.

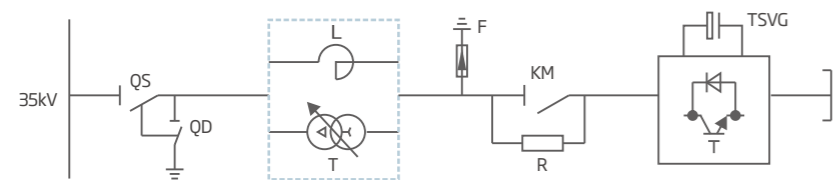
According to the special application conditions of renewable energy power station, TBEA insists on the principle of "reliability", "energy conservation" and "grid friendly", TSVG had developed series of static reactive power generation products. The fully enclosed control cabinet, high protected power module, power module temperature real-time monitoring, and master-slave coordinated parallel control technology, etc., improve product reliability.

Special harmonic compensation and resonance suppression function, unbalance compensation function, frequency overrun operation ability, high-precision module voltage equalization technology, sub-synchronous oscillation suppression technology, high-speed control ability, reactive power closed-loop within 300us can quickly and accurately solve the power quality problems of new energy power plants, escort for better and more power generation.

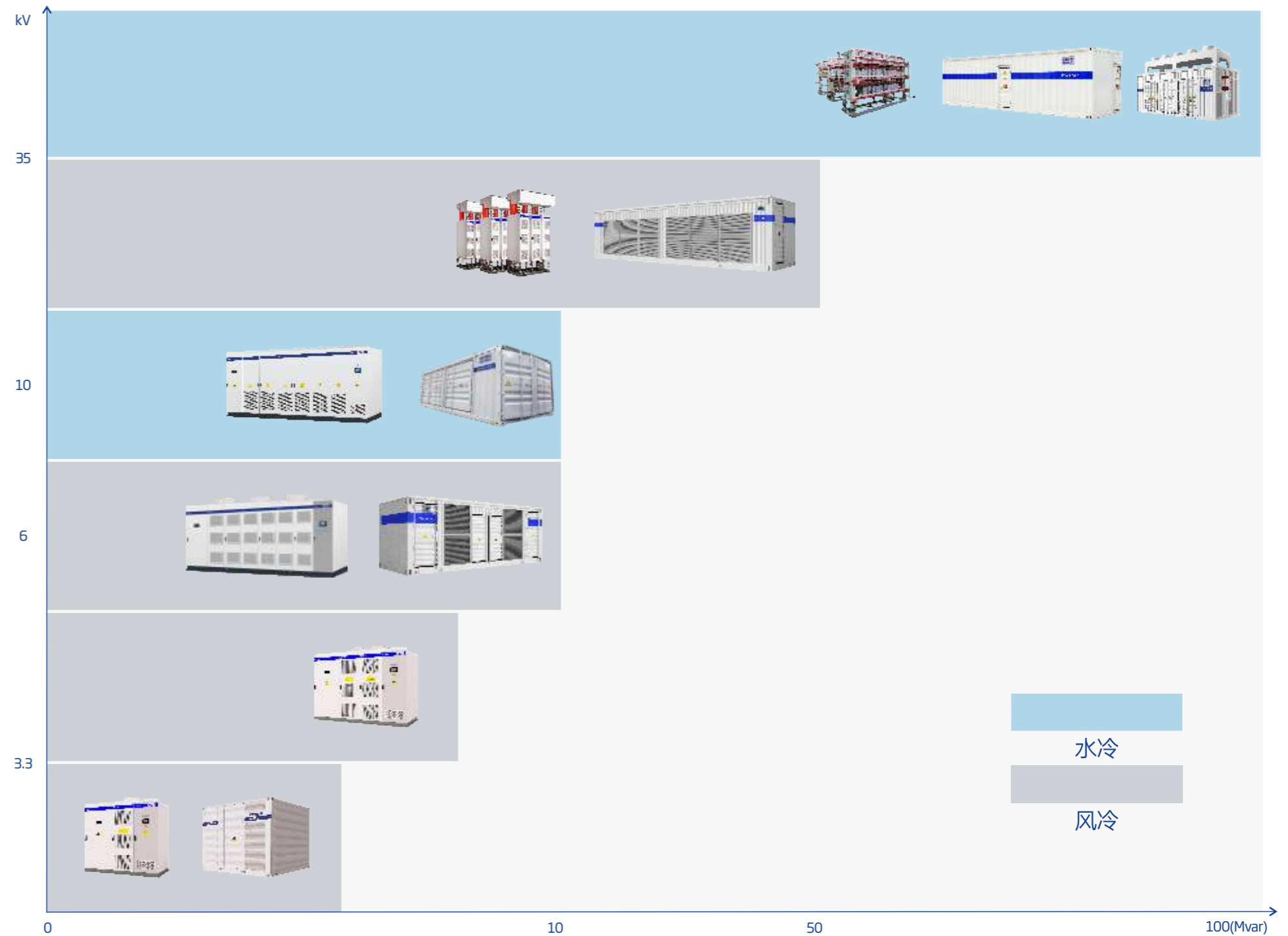
Containers with advanced heat dissipation system and IP54 protective grade can ensure reliable operation of products in extremely harsh environments.

The design of high power density power module and compact high voltage insulation structure of the whole machine make TSVG achieve the minimum floor area under the same compensation capacity and reduce construction investment.

► TSVG System Diagram



- T-Transformer(step-down)
- L-Reactor(Direct connection)
- QS-Disconnecter switch
- QD-Grounding switch
- R-Soft-start resistor
- KM-Soft-start Switch
- F-Arrester
- TSVG-Power unit



- Distributed Solar/Wind power station, Subway, Industry.
- Centralized Solar/Wind power plant, Electrified railways
- Substation of offshore wind power plant, Power station, Metallurgy industry.

3.3kV/6kV TSVG series products(Positive and Negative 5kV Adjustable)

3.3kV Indoor Water TSVG Series Products



The device is composed of a power cabinet (3Mvar ~ 4Mvar is two power cabinets), a control cabinet and a starter cabinet
Can be customized according to the actual capacity requirements
3.3kv step-down star connector is recommended for 35kv voltage rating with capacity less than 3Mvar

3.3kV Outdoor Air-cooling TSVG Series Products



6kV Indoor Water TSVG Series Products



The device is composed of two power cabinets (5Mvar ~ 7Mvar is four power cabinets), one control cabinet and one starter cabinet
Can be customized according to the actual capacity requirements
The capacity of 35kv voltage grade is greater than 2Mvar and less than 6Mvar. It is recommended to use 6kV step-down star connector

6kV Outdoor Air-cooling TSVG Series Products



System parameter		
Rated voltage	3.3kV±10%	6kV±10%
Rated current range	58A ~ 866A	
Input voltage range	0.15pu ~ 1.2pu	
Power grid frequency	50Hz±5Hz	
Reactive power regulation range	-Rating (perceptual) ~ +Rating (perceptual), continuously adjustable	
Full-load power loss	<0.8%pu	
Total Harmonic Current Distortion Rate	≤3%, meeting the requirements of GB/T 14549-1993	
Total Harmonic Voltage Distortion Rate of PCC	≤3%, meeting the requirements of GB/T 14549-1993	
Response time	Total response time is less than 5ms	
Overload capacity	1.1 times overload continuous operation, 3 minutes alarm; 1.2 times overload time, 1 minute lockout; 1.3 times overload, 1 second lockout	
Steady-state control accuracy	2.5%	
Fault handling	Adopt redundancy design to meet automatic N-1 operation	
Operation mode	Constant Reactive Power Mode, Constant Voltage Mode, Constant Power Factor, Load Compensation Mode, Integrated Reactive Power Control of Power Grid, No-load Hanging Mode	
Monitoring mode	Local/remote control	
Interface	LCD Touch Screen in Chinese and English	
Communication interface	Optical fiber communication	
Power supply mode Control power supply	380VAC、220VDC	
Main Protective Functions	Protection functions of SVG over-current, grid over-voltage, drive fault, power unit over-voltage, over-current, over-temperature and communication fault	
Connection mode	Star Connection, Angular Connection	
Cooling mode	Air-cooled	
Protection level	In-house: IP30	Container: IP54
Ambient temperature	-25℃ ~ 50℃ It is necessary to reduce the quota in the range of 50℃, and decrease the quota by 1% for every 1℃ rise.	
Storage ambient temperature	-40℃ ~ +70℃	
Altitude	2000m, 2000m ~ 5000m need customization	
Relative humidity	≤90%, without condensation	
Contamination level	Level IV	
Executive standard	DL/T 1215.1-2013, DL/T 1215.2-2013, DL/T 1215.3-2013, DL/T 1215.4-2013, DL/T 1216-2013, DL/T 1648-2016, NB/T 41005-2014, GB/T 2423.1-2008, GB/T 2423.2-2008, GB/T 2423.3-2008, GB/T 17626.8-2006, GB/T 17626.12-2013, GB/T 17626.18-2016	

10kV TSVG series products(Positive and Negative 5kV Adjustable)

10kV Indoor Water TSVG Series Products



10kV Outdoor Air-cooling TSVG Series Products



The device is composed of three power cabinets (7Mvar ~ 12Mvar is six power cabinets), one control cabinet and one starter cabinet
Can be customized according to the actual capacity requirements
The capacity of 35kV voltage grade is greater than 6Mvar and less than 10Mvar. It is recommended to use 10kV step-down star connector

10kV Indoor Water TSVG Series Products



10kV Outdoor Water Cooling TSVG Series Products



The device consists of a power cabinet, a control cabinet, an incoming cabinet.
Can be customized according to actual capacity requirements.
The 35kV Direct Star-Connect is recommended for projects with the capacity of over 10Mvar.

System parameter	
Rated voltage	10kV±10%
Rated current range	58A ~ 866A
Input voltage range	0.15pu ~ 1.2pu
Power grid frequency	50Hz±5Hz
Reactive power regulation range	-Rating (perceptual) ~ +Rating (perceptual), continuously adjustable
Full-load power loss	<0.8%pu
Total Harmonic Current Distortion Rate	≤3%, meeting the requirements of GB/T 14549-1993
Total Harmonic Voltage Distortion Rate of PCC	≤3%, meeting the requirements of GB/T 14549-1993
Response time	Total response time is less than 5ms
Overload capacity	1.1 times overload continuous operation, 3 minutes alarm; 1.2 times overload time, 1 minute lockout; 1.3 times overload, 1 second lockout
Steady-state control accuracy	2.5%
Fault handling	Adopt redundancy design to meet automatic N-1 operation
Operation mode	Constant Reactive Power Mode, Constant Voltage Mode, Constant Power Factor, Load Compensation Mode, Integrated Reactive Power Control of Power Grid, No-load Hanging Mode
Monitoring mode	Local/remote control
Interface	LCD Touch Screen in Chinese and English
Communication interface	Optical fiber communication
Power supply mode Control power supply	380VAC、220VDC
Main Protective Functions	Protection functions of SVG over-current, grid over-voltage, drive fault, power unit over-voltage, over-current, over-temperature and communication fault
Connection mode	Star Connection, Angular Connection
Cooling mode	Air-cooled, water-cooled
Protection level	In-house: IP30 Container: IP54
Ambient temperature	-25℃ ~ 50℃ It is necessary to reduce the quota in the range of 50℃, and decrease the quota by 1% for every 1℃ rise.
Storage ambient temperature	-40℃ ~ +70℃
Altitude	2000m, 2000m ~ 5000m need customization
Relative humidity	≤90%, without condensation
Contamination level	Level IV
Executive standard	DL/T 1215.1-2013, GB/T 14549-1993, GB/T 17626.2-2006, GB/T 17626.3-2006, GB/T 17626.4-2008, GB/T 17626.5-2008, GB/T 17626.11-2008

35kV TSVG series products(Positive and Negative 5kV Adjustable)

**35kV Indoor air cooling
TSVG series products**



**35kV Outdoor Air-cooling
TSVG Series Products**



**35kV Indoor Water
TSVG Series Products**



**35kV Outdoor Water Cooling
TSVG Series Products**



The device consists of a power cabinet, a control cabinet, an incoming cabinet.

Can be customized according to actual capacity requirements.

The 35kV Direct Star-Connect is recommended for projects with the capacity of over 10Mvar.

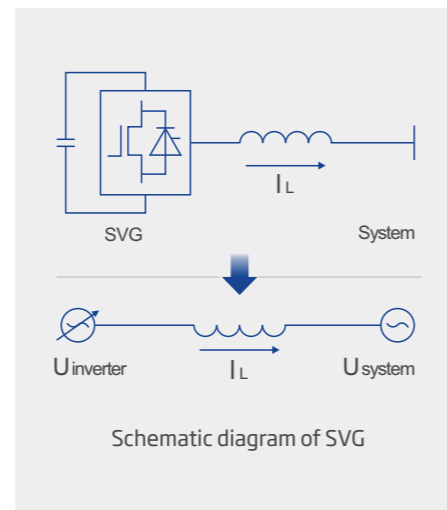
System parameter	
Rated voltage	35kV±10%
Rated current range	58A ~ 866A
Input voltage range	0.15pu ~ 1.2pu
Power grid frequency	50Hz±5Hz
Reactive power regulation range	-Rating (perceptual) ~ +Rating (perceptual), continuously adjustable
Full-load power loss	<0.8%pu
Total Harmonic Current Distortion Rate	≤3%, meeting the requirements of GB/T 14549-1993
Total Harmonic Voltage Distortion Rate of PCC	≤3%, meeting the requirements of GB/T 14549-1993
Response time	Total response time is less than 5ms
Overload capacity	1.1 times overload continuous operation, 3 minutes alarm; 1.2 times overload time, 1 minute lockout; 1.3 times overload, 1 second lockout
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Connection mode	Star Connection, Angular Connection
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Protection level	In-house: IP30 Container: IP54
Ambient temperature	-25℃ ~ 50℃ It is necessary to reduce the quota in the range of 50℃, and decrease the quota by 1% for every 1℃ rise.
Storage ambient temperature	-40℃ ~ +70℃
Altitude	2000m, 2000m ~ 5000m need customization
Relative humidity	≤90%, without condensation
Contamination level	Level IV
Executive standard	DL/T 1215.1-2013, GB/T 14549-1993, GB/T 17626.2-2006, GB/T 17626.3-2006, GB/T 17626.4-2008, GB/T 17626.5-2008, GB/T 17626.11-2008

03 Dynamic reactive power compensation

Operation principle

SVG, also known as Static Compensation (STATCOM), is the latest technology in dynamic reactive compensation field. The basic principle of SVG is that Voltage source inverter (Voltage Sourced Converter, VSC for short) connect to power grid through a shunt reactor or transformer, by adjusting the inverter AC output voltage amplitude and phase, or directly control the amplitude and phase of the AC current, absorb or release reactive power rapidly, achieve the goal of fast dynamic adjusting reactive power. When using direct current control, the AC side current can be controlled directly, which can not only track the impact current of compensating load, but also track the harmonic current.

The system is a power source, and SVG could equivalent to another power source. After the two power sources are connected through a transformer or reactor, SVG is equivalent to a controllable current source with adjustable output current. The figure shows how SVG works in three modes of operation.



The design of high power density power module and compact high voltage insulation structure of the whole machine make TSVG achieve the minimum floor area under the same compensation capacity and reduce construction investment.

Advantage of TSVG

运行模式	波形和相量图	说明
空载运行模式		$U_1 = U_s, I_L = 0$, SVG不吸发无功
容性运行模式		$U_1 > U_s, I_L$ 为超前电流, SVG可连续发出无功
感性运行模式		$U_1 < U_s, I_L$ 为滞后电流, SVG可连续吸收无功

Technical advantages

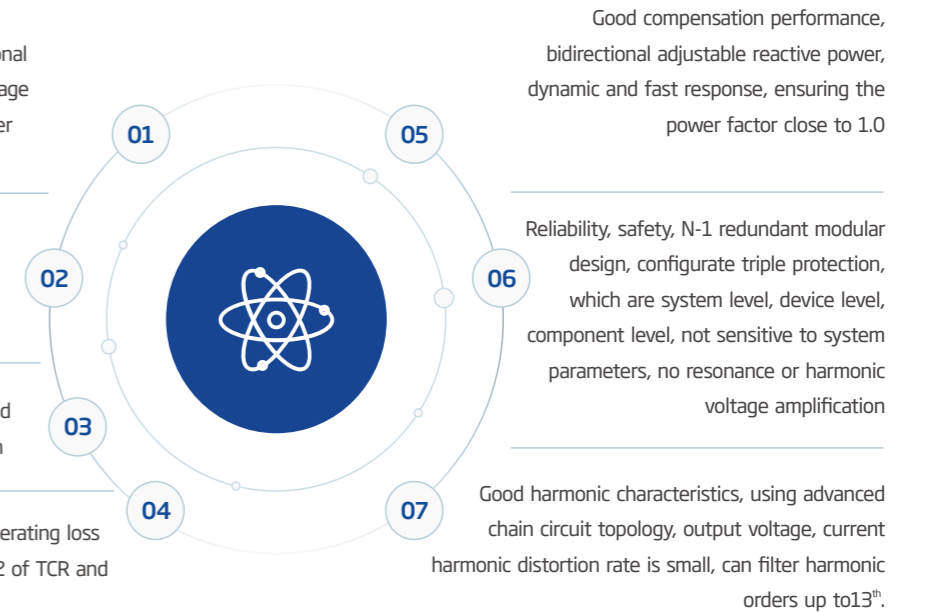
SVG do not adopts large-capacity capacitors and reactors, but realizes the reactive power transformation through switches of power electronic devices. Compared with conventional reactive power compensation devices, SVG has the following features and advantages:

Fast response, the speed of reactive power adjustment is directly proportional to the device's ability to suppress voltage flicker. SVG can suppress voltage flicker more effectively

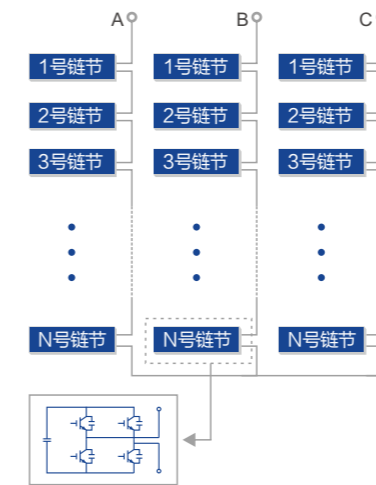
Good performance at low voltage, SVG has current source characteristics and output current is not affected by bus voltage.

Smaller floor area, it could be designed for mobile, flexible engineering design

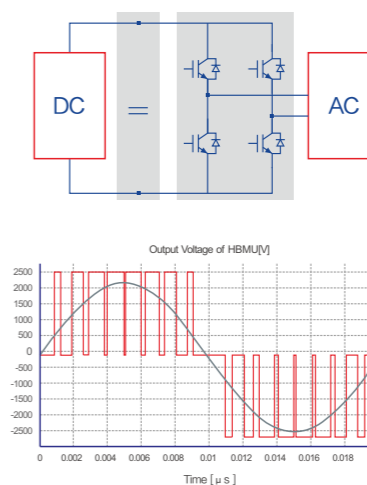
Lower loss and high efficiency, the operating loss of the complete equipment is only 1/2 of TCR and 1/3 of MCR



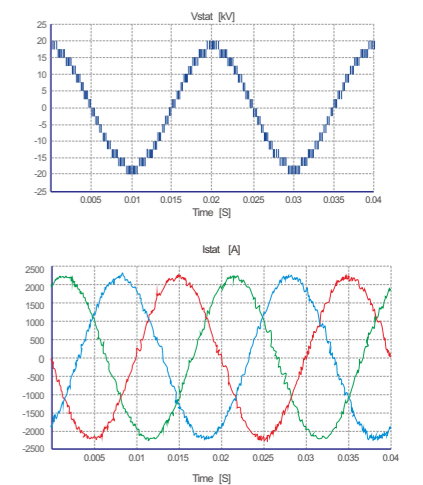
FACTS technology



Cascade multilevel SVG topology



Single module output voltage waveform



Cascade multilevel SVG output waveforms

04 Application Case

Saudi Arabia Sakaka solar plant 33KV 75Mvar project



Installation location: Sakaka, Saudi Arabia.

System voltage: 33kV **Compensation capacity:** 75Mvar

Project features: Sakaka solar plant locate at northern desert area of Saudi Arabia, maximum temperature up to 60 degrees Celsius, high temperature and serious dusty is a huge challenge for equipment's ingress protection, operation reliability and power quality management.

Effect: Water and electrical separation design avoid the circuit short failure caused by leakage of water pipe. Real-time IGBT temperature monitoring technology make system monitor IGBT status and cooling system performance, water pipe parallel connection and pipe flow balance strategy improve the system heat dissipation ability. After long time operation tracking and comprehensive analysis, it proved TSVG has good environment suitability on high temperature and desert area.

Australian Santos gas station 3.3Kv2Mvar



Installation location: Moomba Australia

System voltage: 3.3kV **Compensation capacity:** 2Mvar

Project features: The project is located in the remote area and the environment temperature up to 48°C, belonging to the end of the power grid. This project is equipped with two ABB pressurized pump systems. When the motor starts up, the system voltage is greatly lowered, which leads to the motor starting failure and voltage instability due to load fluctuation.

Effect: TSVG-2/3.3-C type equipment was adopted. After the equipment was put into operation successfully at one time, the system voltage was stabilized within the range of 0.5%, the range and duration of the grid voltage fluctuation were reduced by 90% compared with the previous range, and the SVG grid oscillation suppression operation stabilized the 3.3kV busbar voltage of the whole project.

Pinghai Bay offshore Wind Farm 35KV 48Mar SVG Project



Installation location: Putian, Fujian Province, China.

System voltage: 35kV **Compensation capacity:** 48Mvar

Project features: Pinghai Bay offshore Wind Farm 35KV 50Mar SVG Project locate at Putian, Fujian province, China, SVG equipment place on seaside. The environment is high humidity, salty air and intensive ultraviolet radiation, the harsh environment makes higher demands for equipment's structure and environment suitability.

Effect: TBEA proposed dedicate solution for offshore wind power plant. The container has good anti-corrosion, fire-proof, waterproof, dust-proof (anti-sand), shock-proof, UV-proof and other functions, anti-corrosion coating ensure the appearance and mechanical strength meet the design standard. Power module integrate technology, IGBT temperature real-time monitoring technology, water and electrical separation design and others dedicate technology ensuring the TBEA SVG has higher environment suitability and reliability.

Xijiang chemical plant power quality management project



Installation location: Urumchi, Xinjiang Uygur Autonomous Region, China

System voltage: 10kV **Compensation capacity:** 15Mvar

Project features: This project is a typical chemical enterprise application. The traditional solution for reactive power compensation and harmonic control has nature deficiencies, due to the dramatic load fluctuation in chemical smelting process, the passive filtering effect is invalid, resulting in long-term harmonic pollution. As a result, the reactive compensation capacitor is burned down, resulting in many power supply accidents and huge losses to the economic benefits of enterprises. Additionally, the chemical industry pollution corrosive gas serious also has a negative effect on device.

Effect: For this industry application, adopts high performance active reactive power compensation and harmonic control integrated power quality control solution. The practical operation shows excellent results, the harmonic control effect of the system is greater than 80%, and the power factor remains above 0.98, which is completely solved flicker, harmonic and unbalanced power quality caused by load fluctuation.

Karachi 50MW Solar plant station, Pakistan 33Kv 10Mvar



Installation location: Karachi, Pakistan

System voltage: 33kV **Compensation capacity:** 10Mvar

Project features: This project composed of two set 33Kv 5Mvar SVG device. Project location are high wind, high temperature and dusty area. It required high ingress protection level and high power quality management ability.

Effect: The project adopts integrated container with unique wind channel design in response to the climatic conditions of serious sandstorms, the design of inlet and outlet ensures that the system can prevent sand from entering the equipment during operation and shutdown. Using 2.5Gbit rate fiber optic parallel system, master and slave dynamic competition, ensuring the overall response speed of the system and the complete single machine consistent.

Istanbul 30MW wind farm ,Turkey , 35Kv 8Mvar



Installation location: Istanbul Turkey

System voltage: 35kV **Compensation capacity:** 8Mvar

Project features: The project site has large sandstorms, large climatic changes in different seasons, and the harsh natural environment has higher requirements on the reliability of on-site electrical equipment. At the same time, the power quality requirement of booster station is more stringent than that of ordinary wind farm.

Effect: For areas with greatly climate change, water-cooled models are used for isolation from the external environment, with high heat dissipation effect and reliable environmental protection. Standardized product design, water-cooled models with better cost performance, to provide customers with reliability, cost-effective products.

06 TBEA Service



Consulting service

Telephone answering, E-mail asking, Fax informing, on-site promoting, scheme communicating

No matter where you are, you can call the service hotline 400-606-6029 to know about our products and services at any time. We have professional engineers answering the phone 24 hours.



Training service

On-site teaching, company teaching, production line observing, brand displaying, case introducing

No matter what product knowledge users want to know, we will develop professional training programs to help you.



Field service

Installation guiding, wiring guiding, grid-connected debugging, operation and maintenance, troubleshooting

No matter what product problems the users encounter, the after-sales service engineer of TBEA will be on standby 24 hours for you. After receiving your feedback, he will respond quickly in 2 hours and arrive at the project site in 24 hours to solve the problem for you. Reliable service means that whenever, day and night, regardless of the wind, frost, rain and snow, we will always meet the needs of users and safeguard their interests.

