145KV COMPACT GIS SUBSTATION
The TGOOD 145kV Compact GIS Substation reduces construction times to between 3 and 6 months and uses only 20% of the space required by a traditional substation.

**PRODUCT CONCEPT**

- TGOOD engineers set out to create a better urban substation, patenting 38 features that combine to create a next generation solution for modern cities and industrial sites around the globe.
- Increased urbanization and growing demand for electricity necessitates new substation construction in congested built-up areas.
- Traditional substations create fears of noise and radiation and may be prone to vandalism.
- Traditional substations require a footprint of up to 3300m² and require at least 18 months to construct, straining scarce land resources and subjecting the area to expensive and unsightly construction projects.

**KEY BENEFITS**

**SPEED**

- Compared to traditional substations, construction times are reduced to between 3 and 6 months and commissioning times are reduced to just one month or less.

**SPACE SAVINGS**

- Compact substations reduce the land space required to as little as 420m², conserving valuable land in congested urban and industrial areas.

**SAFETY AND APPEARANCE**

- Acoustic and electromagnetic shielding reduce noise and radiation for safe and silent operation (below 40dB). E-House enclosures are safe to touch and provide exceptional protection against vandalism. Custom paint work helps the station blend in with surroundings.
Entire substations ready for turnkey operation in just 6 months

Typical Timeline: 145kV Compact GIS Substation

- Configurable modules vastly reduce design and manufacturing times.
- In-house manufacturing of E-House shells and electrical components allow for rapid customization.
- Modular E-House reduces shipping costs and allows for easy transport.
- TG00D is strategically located in major port city of Qingdao, China.
- Rigorous factory testing reduces commissioning times to one month or less.
TGOOD holds 38 patents on technologies used in the 145kV Compact GIS Substation

Typical layout with 2 x 50MVA transformers requires a footprint of only 550m² (pictured)

PRODUCT OVERVIEW

- Sealed design provides outstanding performance in harsh environments, including high altitude, heavily polluted, coastal, desert and arctic sites.
- Modular “building block” structures allow for multiple arrangements that maximize available space.
- Low audible noise and electromagnetic emissions make this product attractive for densely populated areas.
- Intelligent design eliminates the need for traditional buildings, walls, and support structures while allowing for remote control and operation.
- Damping technology eliminates seismic effects on GIS in earthquake-prone areas.
- Corrosion resistant coatings and maintenance free GIS modules deliver an operational lifespan of up to six decades.
Substation modules are designed to maximize use of available space and can be arranged to fit a wide variety of locations.
THE WORLD’S MOST COMPACT GIS SUBSTATION SOLUTION

“BUILDING BLOCKS” – SEVEN COMPACT MODULES

- 145kV prefabricated GIS module.
- 36kV prefabricated GIS switchgear module.
- 15kV prefabricated AIS switchgear module.
- Monitoring and control equipment module.
- Prefabricated transformer module.
- Neutral grounding module.
- Reactive power compensation module.

KEY COMPONENTS – PREFABRICATED MODULES

- Incoming and outgoing connections made with shielded cables.
- Air to overhead GIS bushings also available.
- Lightning surge arrestors.
- Perimeter protection systems and video surveillance systems.
- Internal and external lighting, emergency lighting.
- Positive pressure environmental control system.
- Smoke detection and SF6 monitoring system with alarm.
- Balconies, stairways, escape doors with panic bars.

KEY ADVANTAGES – PREFABRICATED MODULES

- Customized layouts conform to space and topography requirements.
- Electrical equipment kept in a constant temperature and humidity, dust-free operating environment.
- The substation is largely maintenance-free, remotely controlled and operated.
- Custom paint schemes enhance appearance and beautify neighbourhoods.
- Advanced construction methods deliver a useful lifespan of six decades.
GIS MODULE FEATURES

- Incoming and outgoing 145kV lines: overhead, cable.
- Largely maintenance free GIS modules.
- Compact inline arrangement.
- Operating voltage up to 145kV, short-time withstand current of 40kA, breaker rated current of 3150A, busbar rated current of 4000A.
- Arc-quenching breaker design has a lifespan of 10,000 mechanical operations and short-circuit trip lifespan of up to 22 operations.
- Three position switch integrates isolation and earthing switches into a single module.
- Each three-phase GIS module is only 0.8m wide.
- Aluminum alloy tanks provide corrosion resistance and eliminate eddy current losses.

STRUCTURAL ARRANGEMENT

- Standard, configurable prefabricated modules for fast assembly.
- Modules shipped separately for fast transport.
- Inline layout with fixed maintenance corridor.
- SF6 monitoring system with alarm and automatic ventilation system.
- Utilizes damping technology to reduce effects of seismic activity on GIS.
15KV AND 36KV PREFABRICATED SWITCHGEAR MODULES

15KV MODULE FEATURES
- Incoming and outgoing 15kV lines: outdoor busbar, cable.
- Maintenance-free vacuum circuit breakers available.

36KV MODULE FEATURES
- Incoming and outgoing 36kV lines: cable.
- Fully insulated and sealed gas insulated switchgear eliminates maintenance and ensures safe and reliable operation.
- Maintenance-free SF6 and vacuum circuit breakers available.
- One quarter the size of the equivalent conventional AIS switchgear module.

STRUCTURAL ARRANGEMENT
- Standard, configurable prefabricated modules for fast assembly.
- German-engineered arc-resistant switchgear design ensures highest level of personnel safety.
- Arc-resistant switchgear cabinet doors incorporate mechanical interlock labyrinth seals.
- Integrated switchgear cabinets allow for compact and transportable modules.
- Single-row layouts simplify maintenance access.
- Cable shaft integrated into module.
- Very early warning fire alarm and fault detection.
MAIN TRANSFORMER

- Capacity range of 20MVA~60MVA without fans depending on power load density.
- Main transformer windings may be two or three winding.
- On-load tap changers available.
- Transformer body is completely enclosed while radiator cabinet is perforated to facilitate cooling.
- Online dissolved gas-in-oil analyzer.
- Insulated cable bushings at 145kV primary and 36/15kV secondary.
- Standard, configurable prefabricated modules for fast assembly.
- Sound barrier technology: German technology reduces transformer noise to below 40dB.
- Firewall technology: double steel casing allows the inner wall of the module to completely replace a traditional firewall.
- Electromagnetic shielding technology: full metal shielding attenuates electromagnetic radiation.
PROTECTION AND CONTROL MODULE

PROTECTION SYSTEMS
- State of the art protective relaying systems designed to meet the highest utility standards.

AUTOMATION AND CONTROL
- Remotely accessible control systems allow for real-time operation of the substation with a wide range of SCADA systems for remote metering and data collection.

MAINTENANCE ACCESS
- Rear access door allows for easy overhaul of secondary equipment modules.

STATION SERVICE POWER
- Highly reliable and redundant DC charger and battery systems provide uninterruptible power to all circuit breakers and control devices. Absorbent Glass Mat battery technology eliminates the need for a separate ventilation battery room.

UTILITY SYSTEM
- Fire alarm systems, security systems, video surveillance and environmental monitoring available.
AUXILIARY SYSTEMS

REACTIVE POWER COMPENSATION MODULE
- Substation power-factor correction and/or harmonic filtering may be included as a module.
- Capacitor banks may be tuned or detuned as required for the application.
- Fixed or variable stages of compensation available.

CLIMATE CONTROL AND ALARM SYSTEMS
- System guarantees ideal environment for reliable operation and long lifespan of electrical components.
- Patented positive-pressure and air conditioning system provide a constant temperature and constant humidity, dust-free operating environment.
- Positive pressure environmental control system ensures that internal cabin pressure is always greater than external atmospheric pressure (typically 105%) to repel dust. This technology has been tested and proven in the world’s harshest operating environments, including the world’s highest railway in Tibet.
- Alarm system detects deviations from standard operating tolerances to ensure safe and reliable operation.
- Early warning fire alarm is calibrated to detect a fire hazard hours before visible smoke is produced while eliminating the risk of false positives.
- Climate control system utilizes a heat pump to precisely control the cabin temperature and humidity at all times.

NEUTRAL GROUNDING MODULE
- Customers may choose between solid grounding, resistive grounding, reactor grounding or resonant (Peterson coil) grounding.
- Zigzag transformer grounding also available.

Constant temperature and humidity, with an internal air pressure greater than outside (typically 105%), ensures dust does not infiltrate building.

Positive Pressure Environmental Control System

1. Foam-Insulated Panels (with Bridge-Cutoff Insulation Technology)
2. Make-up air from outside
3. Heat pump exhaust, shown cooling building
4. Return air (inside air combined with make-up air to maintain positive-pressure environment)
5. Inside air
Our insulation methods effectively eliminate thermal bridging across steel parts, providing the best overall thermal performance in the E-House industry.

**TYPICAL SPECIFICATIONS**
- Switchgear cabinets are welded to the cabin floor for structural integrity.
- Wall construction: 2.5mm cold-rolled steel plate.
- Roof panel construction: 2mm cold-rolled steel plate.
- Mechanical impact protection rating: 1K10.
- Seismic intensity rating: horizontal acceleration of 0.25g.

**DUAL LAYER PANELS**
- Insulated panels are at least 50mm thick to effectively maintain internal E-House temperatures in all seasons and environmental conditions.

**THERMAL BARRIER**
- Injected foam insulation with a thermal break between panels effectively prevent heat conduction and eliminates condensation.

**SEALED SEAMS**
- Rubber seals qualify for IP33D rating on doors. E-House panel seams are not less than IP54.

**FIRE RATING**
- Optional two hour fire rated designs available.

**WINDPROOF DOOR**
- Windproof door remains open at an angle of 90 degrees to ensure personnel safety in high wind areas.

**ANTICORROSION TECHNOLOGY**
- Layered anti-corrosion technology ensures thirty years of corrosion resistance before refinishing is required and an overall lifespan of six decades.
- Coating and spraying production lines are developed by the Nordson company in the United States.
- Hammertone finish incorporates anti-UV coating that provides at least a decade of fade and oxidation resistance.
FLOOR LAYOUT OF THE 145KV CENTRAL POWER STATION IN THE CITY OF YULIN, SHANXI PROVINCE, CHINA

Project Final Stage Current Phase Remarks
Primary Transformer 2X50MVA 2X50MVA
145kV Outgoing Line 6-outlet 5-outlet 1 backup outlet
35kV Outgoing Line 14-outlet 140-outlet
10kV Outgoing Line 10-outlet 10-outlet
10kV Capacitor Bank 1X4.8+1X3.6MVar 1X4.8+1X3.6MVar
10kV Arc-Suppression Coil 2x230kVA 2x230kVA
FLOOR LAYOUT OF THE 145KV CENTRAL POWER STATION IN THE CITY OF HANDAN, HEBEI PROVINCE, CHINA

- Primary Transformer: 2X50MVA, 2X50MVA
- 145kV Outgoing Line: 2-outlet, 2-outlet, Backup 1-outlet
- 10kV Outgoing Line: 8-outlet, 8-outlet

The reactive compensation capacitor is configured as the prefabricated cabin-type three-phase assembly shunt capacitor set device (SVG reactive compensation device)