

# CONTROLLED SHUNT REACTOR

In 2018, in the branch of PJSC IDGC of Siberia Omskenergo implemented the project "The reconstruction of Substation Tara with the installation of a controlled shunt reactor with thyristor control (CSRT) 25 Mvar, 110 kW" within the program section "Application of new technologies and materials in the power industry".

CSRT is one of the types of Static thyristor compensator (STK).

## *CSRT IS A UNIQUE DOMESTIC PRODUCT THAT HAS NO ANALOGUES IN WORLD PRACTICE.*

CSRT is a transformer, on the secondary winding of which thyristor valves are turned on, and can provide a reduction in voltage fluctuations, as well as balancing (balancing) the voltages across the phases caused by the presence of a powerful asymmetrical load. In this case, the phase-by-phase control of reactive power is used.

To control the power of the device, thyristor valves are used that control the current of the valve winding of the device. By changing the magnitude of the current of the valve winding, an inertia-free regulation of the magnetic flux in the core of the reactor is achieved, which ensures a high rate of change in power in any direction. Automatic power control is made according to the deviation of the measured three-phase voltage.

The reactors allow to ensure smooth adjustment of reactive power with high speed in order to unload the equipment of grids and substations from reactive power flows and reduce losses in this equipment, stabilize the voltage on the substation buses, and increase the static and dynamic stability of the power system.

### **CSRT has the following advantages over STK with transformer connection:**

**high reliability of the circuit, since the short-circuit mode for CSRT is nominal**

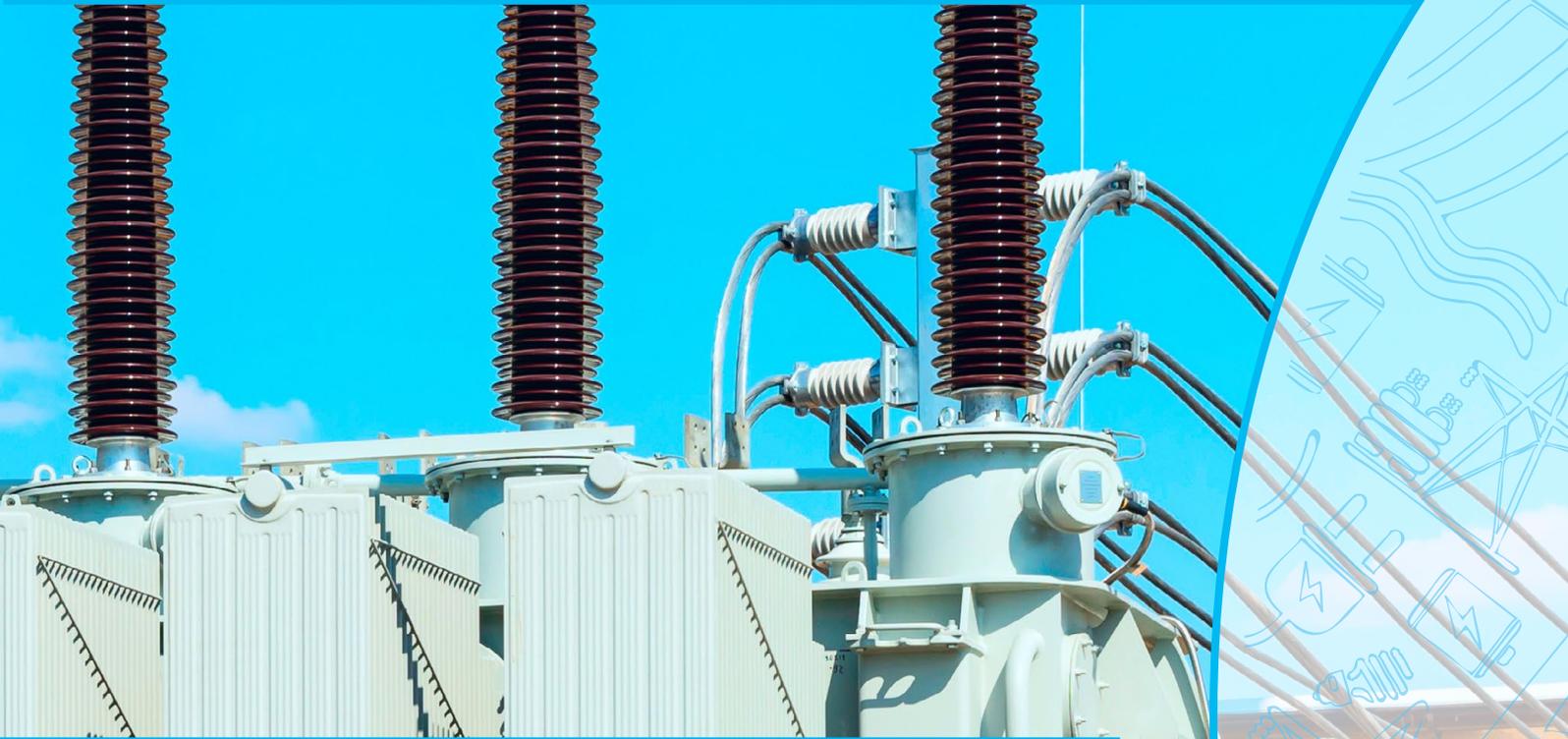
**ability to perform at any desired voltage class**

**reducing the size, cost and losses in the JCC as a whole**

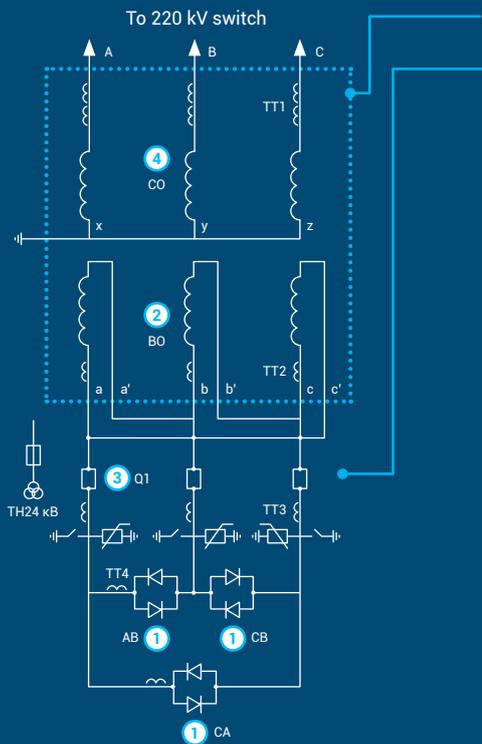
The implementation of this project is necessary for the normalization and smooth regulation of voltage levels on buses of 110 kW substations in the northern regions of the Omsk region, where the voltage levels in some substations exceed the allowable values.

Installing CSR at 110 kW substation Tara will also reduce power losses in 110 kW grids.

Completion of construction is scheduled for 2020, according to the results of 2018 project documentation was developed for this project, construction and installation works of the main electrical equipment are underway.



### The structure of CSRT



Electromagnetic part of CSRT (EMP)

Thyristor controller consisting of:

- three-phase high-voltage thyristor valve (VTV)
  - ① connected to the valve winding (VO) ② of the EMP
  - connected in a triangle through the switch Q1 ③
- digital system of automatic control and protection of CSRT (ACS), providing control of VTV and switching in switch Q1 in accordance with predetermined algorithms comprising:
  - control cabinet (CC)
  - relay protection cabinet (SRS)
- liquid cooling system of thyristor valves (CO) ④, including:
  - consisting of a cooling system cabinet (SS)
  - an air cooler (AC)

CSRT is connected to the selected section of the HV bus substation. The CSRT control is performed by the SHU in the automatic mode by the commands of the PS operator from the remote control (RC) or the operator's automated workplace and does not require the presence of operating personnel. There is a manual control mode for CSRT from the front panel SHU.