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ENERGY EFFICIENCY AUDIT

SINCE LATE 2019 THROUGH EARLY 2020, ALL CPC OIL PUMP STATIONS SAW POWER SUPPLY RELIABILITY ANALYSIS. COMPLETION OF WORKS COINCIDED WITH INTRODUCTION OF QUARANTINE MEASURES RELATED TO THE COVID-19 PANDEMIC, AND THEREFORE SPECIALISTS OF JSC CPC-R AND RTSOFT JSC DISCUSSED RESULTS OF THE JOINT RESEARCH IN THE FORMAT OF A CISCO WEBEX CONFERENCE

CUTTING-EDGE EQUIPMENT

"Facilities of the Caspian Pipeline Consortium are outfitted with cutting-edge power electrical equipment having a high level of automation and integration with modern data acquisition and transmission systems," says Aleksandr Simonov, Chief Project Engineer of RTSoft JSC.

The expert notes that CPC's equipment is manufactured by foreign and Russian leading companies: Siemens, Schneider Electric, Areva MiCom, ABS Elektro, Tavrida Electric, and EKRA. Relay protections and controls (RP&C) of the electrical equipment's power part are implemented on microprocessor units with connection via communication links to the SCADA technological oil pipeline control system. Incorporated engineering solutions make it possible to promptly receive information on the equipment status and to control the equipment operating conditions not only remotely from an electrical technician's automated workstation, but also in the automatic mode.

Five oil pump stations were reconstructed and 10 new ones were built in the course of execution of a project of expansion of CPC

pipeline system's capacities up to 67 million tonnes of oil per annum (Expansion Project) in 2011 to 2017. External high-voltage networks were created for power supply of new facilities. So, in order to provide PS-2, PS-3, and PS-4 with electricity, three substations were put into operation, with a power of 2x25 MW each (two with a voltage of 220 kV; one—110 kV). High-voltage overhead power transmission lines over 585 km long in total were entered in the books. Of these, over 140 km were 110 kV lines, and 445 km were 220 kV lines.

RELIABILITY AS A CRITICAL FACTOR

Reliability of the electrical equipment is a critical factor in ensuring trouble-free operation of the pipeline system, to be specially monitored by specialists at all times. One of relevant areas for improvement of stability indicators of energy systems is elimination of errors in design setpoints of relay protections and controls (RP&C) at stations built within the Expansion Project. These nonconformities result from the fact that design setpoints were based on design parameters of the external power grid at the time of design engineering in 2009, and actual values have changed since then.

An energy consulting project for comprehensive power supply analysis of some pump stations was executed by specialists of RTSoft JSC in two stages. The first stage consisted in collection of initial data with visits to facilities, while second stage included calculations and development of recommendations.

"RTSoft JSC has performed a deep survey of the power supply system and created precise digital models of the internal electrical grid and the adjacent external one for facilities under study, using the PowerFactory software complex," explains Vitaliy Chumachenko, Head of the Electrical Behaviour Simulation and Study Department of RTSoft JSC.



COMPUTER COMPLEX

PowerFactory developed by DigSI-LENT GmbH, a German company, includes functions for studies, design, calculations, and simulation of energy facilities in all voltage classes. The software complex is used by electricity specialists in 150 countries across the globe for solving the entire range of behaviour planning and control tasks with regard to electrical grids and systems with a voltage of 0.4 kV to 1150 kV. The concept of vertically integrated software allows PowerFactory to be used in various segments: electricity generation, transmission, and distribution; power supply systems of enterprises, design organizations, and others.

The program supports functions calculating symmetrical and asymmetrical steady-state conditions as well as short-circuit currents for 1/2/3-phase grids with arbitrary AC and DC configurations. PowerFactory simulates station master controllers, analyzes voltage behaviours, plans reactive-power reserves using methods of PV and QV curves and VQ sensitivity, simulates and analyzes heavy and emergency conditions, etc.



RP&C MONITORING ALLOW THE OPERATING EXPENSES TO BE DECREASED BY UP TO

50%

But let's get back to comprehensive analysis of external power supply systems at CPC pump stations. Developed digital models were used as a basis for calculations of electrical power modes, short-circuit currents, electromechanical transients, and RP&C setpoints.

Analysis of calculation results made it possible to identify circuit and behaviour situations that require closer attention. The experts are certain that implementation of a RP&C performance monitoring system will potentially decrease the number of

emergency shutdowns at pump stations by 5 to 10 % and reduce the operating expenses by up to 50 % in case of switching to maintenance of microprocessor-based RP&C based on their actual condition.

In order to prevent risks of disruptions in processes due to disturbances in the external grid, RTSoft's specialists offered to install dynamic voltage restorers (DVR) or uninterruptible power supplies for critical consumers the shutdown of which may stop the main pump. The experts also advised that additional

loading resistors should be installed to ensure operation of voltage transformers located in 10 kV input cells, external connections should be reinforced, static VAR compensators should be installed on 10 kV buses at PS-2, PS-3, and PS-4, or frequency converters should be used for main pump units.

"Well-coordinated interaction of CPC-R's specialists and technologists and RTSoft Group's specialists allowed us to complete execution of the energy consulting project with high quality and within the scheduled time frame. The results of this work will enable us to bring performance reliability of the Consortium's electrical equipment to a new, even higher level in the immediate future," sums up Valeriy Cherginets, CPC Chief Electrician. ●