

TRANSMISSION "BEST PRACTICES TO INCREASE POWER SUPPLY AND RELIABILITY IN AFGHANISTAN-CENTRAL ASIA GRID

U.S. Transmission Experts Share Experience with Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan

by Jason Hancock



Delegates of the Workshop on Special Protection Systems for Transmission Operations and Emergencies in Almaty, Kazakhstan February 18-21, 2009.

The **United States Agency for International Development (USAID)** sponsored the second in a series of three workshops on "Special Protection Systems for Transmission Operations and Emergencies" for transmission operators from Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan in Almaty, Kazakhstan 18-21 February 2009. The series of workshops is being organized by the **United States Energy Association's (USEA)** Energy Utility Partnership Program (EUPP).

BACKGROUND

The objective of this series of workshops is to bring together energy sector representatives from the Central Asia Republics to meet with their Afghan counterparts to improve reliability of the Central Asia regional transmission grid and facilitate increased power exchanges with the Afghanistan electricity system as it completes construction on its North East Power System (NEPS) 220kv transmission system. Once fully operational, the NEPS transmission system will allow electricity from Central Asian producers to be exported to Afghanistan, greatly improving supply reliability and coverage to North Eastern Afghanistan and providing Central Asian generators with expanded market opportunities.

TOPICS: SPECIAL PROTECTIONS SYSTEMS AND PROTECTIVE RELAYS

The workshop in Almaty had two central topics: Special Protection Systems (SPS) and Protective Relays. The first topic Special Protection Systems (SPS) - focused on automatic protection systems designed to detect abnormal, emergency or predetermined system conditions and take corrective actions other than and/or in addition to the isolation of faulted components to maintain system reliability. Such action includes changes in demand, generation, or system configuration to maintain system stability, acceptable voltage, or power flows. The second area of focus was on Protective Relays. Protective relays are

devices that measure variances in current and voltage. The relay can then trip various switches and initiate routines to compensate or correct any abnormal conditions throughout the transmission process.

SPECIAL PROTECTION SYSTEMS (REMEDIAL ACTION SCHEMES)

Dan Weston, an electrical engineer working on the Remedial Action Scheme (RAS) Design team at the Bonneville Power Administration (BPA), led the discussion on Special Protection Systems. BPA uses the term Remedial Action Schemes (RAS) to identify its Special Protection Systems (SPS). BPA's RAS plays a significant role in efficiently operating its transmission system.

RAS is a fast, automatic control scheme that is designed to mitigate a power system disturbance. RAS schemes are designed to react much faster than a person and to do so automatically, without human intervention. Typically a RAS scheme will open or close one or more breakers to change the power systems characteristic. BPA also ensures that its RAS schemes have no single point of failure which adds an additional layer of system stability.



Bonneville Power Administration's presentation on Special Protection Systems (SPS) captivates the audience.

In addition to the benefit of system stability, RAS also allows transmission lines to be loaded closer to their maximum capacity by more closely monitoring limits on the line. Loading lines closer to their maximum capacity is much less expensive than building new lines.

PROTECTIVE RELAYS

Thomas Roseburg, an Electrical Engineer in BPA's System Protection Maintenance discussed the transmission line protection at BPA. BPA utilizes protective relays throughout its transmission system to monitor current and voltage fluctuations. These protective relays play a critical role in BPA's RAS schemes. Relays are installed in various configurations so that they can monitor potential trouble areas and initiate appropriate responses to properly mitigate problems.

Programming relays for the proper response to mitigate a problematic situation is based on BPA's fault studies. BPA maintains a database of the faults of most of the utilities in the BPA service area that is continually updated as the system changes. In order to maintain consistency, all relay settings in the BPA system are coordinated to this database. Based on analysis of past problems with the system, BPA plans solutions that can be input into protective relays so that when a similar fault occurs, it can be dealt with effectively.

Protective relays deal with fault situations by opening and closing breakers to isolate problem areas or shift load around the problematic area. If the problem area cannot be isolated nor redirected, as a method of last resort, BPA may shed load. Relays are also used to reclose breakers after the problem situation has been resolved.

RECOMMENDATIONS BY U.S. TRANSMISSION EXPERTS

The Almaty workshop introduced new methods including equipment and procedures used by the Bonneville Power Administration in the United States to protect the integrity of its transmission system and to deal with emergency situations to lessen their overall impact on the transmission system. Through the course of the workshop, the BPA experts made the following recommendations to the Central Asian countries and Afghanistan:

- They should work together to develop a common power system model to maintain consistency between countries;
- Existing systems should be evaluated to determine potential fault areas and compile this information in a comprehensive fault study;
- They should develop multiple interties in order to have back up should any one fail;
- They should set and adhere to reliability standards;
- They need to improve emergency response of their Special Protection Systems; and
- They should adopt wider use of automated protective relays.

RESULTS

- Participating utilities indicated that they would implement processes presented by BPA experts to improve their Transmission Protection Systems to avoid emergencies and improve reliability.
- Afghanistan applies for membership in the United Energy System for Central Asia. As a direct result of interaction with the Central Asia participating utilities and with CDC Energia, Dr. M.J. Shams sent a letter to Mr. B.M. Teshaboyev, Chairman of the Council of Coordination of the Electric Energy of the United Energy System for Central Asia and Chairman of Uzbekenergo, requesting Afghanistan's consideration for Membership in the Central Asia United Energy System. This step will be crucial in the integration of the Afghan power system with power system in Central Asia. It is critical for Afghanistan to secure its relationship with its neighboring countries in order to improve its own electrical stability.
- Participating utilities indicated that they would adopt new practices to improve their use of protective relays; and
- Participating utilities indicated that they would adapt practices to improve training of their personnel.