AMSC's STATCOM System: A Power Quality Gold Mine for Prominent Hill

Photo Courtesy of OZ Minerals

A Case Study by AMSC • September 2013

The Background

In 2001, a significant copper-gold deposit was discovered approximately 650 kilometers northwest of Adelaide, the capital city of South Australia. In 2005, this site was acquired by OZ Minerals Limited, which launched the Prominent Hill mining operation. To date, the company has invested over $1.2 billion (AUS) to create a mine with a capacity of 100,000 tons of copper and 115,000 ounces of gold in concentrates a year. The mine has become an important supplier of precious metals, but it also has become a showcase for power quality solutions by virtue of its use of AMSC's STATCOM D-VAR® system.

Courtesy of OZ Minerals

The Problem

The OZ Minerals copper concentrator uses high-powered electrical crushing, grinding and flotation equipment. The plant's peak demand can be as high as 35 megawatt (MW), depending on shift production. As a consequence of the large individual motor loads at the plant and the characteristics of the local grid, OZ Minerals early on sought electrical engineering studies to identify whether reinforcement was needed to a) protect the broader power grid from disturbances stemming from the mining operation and b) ensure that the Prominent Hill mine maintained high power quality in order to ensure maximum uptime and return on investment.

AMSC's Analysis

In anticipation of the new 35 MW load at the mine, Areva, and later AMSC, carried out System Planning studies of the local area grid. These studies substantiated the need for additional steady-state reactive support at the Prominent Hill 11 kV bus, serving the mine, over and above that for unity power factor correction of the large motor loads. Specifically, design for the power factor correction included 42 MVAR of reactive support.

Load flow studies showed the likely effects of uncompensated normal mill motor starts. The mine features two sets of motors for the ball mill and SAG mill. Each mill start-up includes two 6 MW motors that draw a maximum of 130% of rated full load current for up to 20 seconds. The two mills are typically started at about a 30-minute interval.

Start-up of such large motors could cause voltage at the Prominent Hill 11 kV bus to drop to 84% of nominal, low enough to cause loss of load due to undervoltage tripping, as well as unacceptable voltage dips on the High Voltage transmission backbone in the area, namely the Olympic Dam 132 kV line. The resulting degradation in power and torque of the mill motors clearly confirmed the need for dynamic reactive support to mitigate the voltage depression during mill starting.

Classified as a Flexible AC Transmission Systems (FACTS) device, AMSC's D-VAR® STATCOM utilizes the company's proprietary and advanced control and monitoring algorithms that detect and instantaneously compensate for voltage disturbances by injecting leading or lagging reactive power (VARs) precisely when and where it is needed. The reactive power is generated by AMSC's proprietary four-quadrant IGBT inverters that are capable of fully injecting capacitive or inductive VARs in one line cycle. The system's full dynamic capability of 3 times its rated output can be provided for up to two seconds.

The Solution

The mine owner, in cooperation with the utility, opted for AMSC's D-VAR system. This D-VAR system was sized by AMSC to mitigate the step voltage drops caused during the start-up of the mine. Among the key requirements were to maintain the 11 kV load power factor at around unity and limit the step voltage change during start-up of each set of two 6 MW motors to a maximum of 5%. In addition, all this had to be done at the least possible cost. The D-VAR system that was deployed is a shunt-connected voltage control and dynamic reactive compensation system.

The D-VAR system employed by OZ Minerals delivers continuous reactive power, controls each phase individually, and has overload capability. Using control and monitoring software, the ability of OZ Minerals' D-VAR solution to detect and compensate for voltage disturbances by injecting leading or lagging reactive power is well documented. The solution has reduced rapid voltage variations and provided post-fault voltage support to mitigate any tendency for voltage collapse, in addition to acting as a fast transient voltage support device. By integrating the dynamic VAR output of the reactive power compensation device with a mechanically switched capacitor bank, this system is a very economical alternative to SVC's and is equally effective at solving common transmission grid problems such as voltage instability. In addition, the D-VAR system does not produce substantial harmonics that a traditional SVC system would, further simplifying the installation. When not performing the motor start assistance, OZ Minerals' D-VAR system regulates the power factor of the 11 kV mine load to unity by utilizing a portion of the D-VAR and by switching the 11 kV substation capacitor banks.

"Since commencing production at the Prominent Hill Mine in early 2009, AMSC's D-VAR system has delivered as promised – providing the voltage support needed for our operation to maintain a high utilization rate. "

Paul Barac,
Engineering Manager
The OZ Minerals Limited

Courtesy of OZ Minerals

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About AMSC

AMSC (NASDAQ: AMSC) generates the ideas, technologies and solutions that meet the world's demand for smarter, cleaner … better energy. Through its Windtec Solutions, AMSC provides wind turbine electronic controls and systems, designs and engineering services that reduce the cost of wind energy. Through its Gridtec Solutions, AMSC provides the engineering planning services and advanced grid systems that optimize network reliability, efficiency and performance. The company's solutions are now powering gigawatts of renewable energy globally and enhancing the performance and reliability of power networks in more than a dozen countries. Founded in 1987, AMSC is headquartered near Boston, Massachusetts with operations in Asia, Australia, Europe and North America.

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