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# Customer Case Study

## Sipansihaporas Hydro-Electric Station

### Introduction

*Customer:*
Perusahaan Umum Listrik Negara (PLN)

*Sector:*
Power Utilities

*Location:*
Sibolga, North Sumatra, Republic of Indonesia

The Sipansihaporas development consists of two power stations and two 150kV switchyards. Each station contains a Toshiba turbine and Meidensha generator unit, with associated auxiliaries.

### Requirements

Indonesia's national power utility constructed these stations to cope with an annual 10% increase in electricity consumption in this remote part of Sumatra.

Due to the importance of these stations to the local economy and the lack of local technical support, it was essential to have full control system redundancy to achieve the high levels of availability required in these unmanned stations.

User-friendly controls were also a high priority as the stations are normally controlled from the dispatching centre located 500km away in Medan. As this station is unmanned, monitoring of symptoms such as increased temperature and vibration is critical to early fault diagnosis.

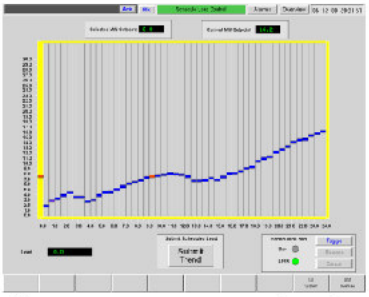
The Sipansihaporas Hydro-Electric Power Station project involved the automation and remote control of two Toshiba turbines, two switchyards and all associated auxiliaries. This was achieved using two Schneider Quantum hot-standby controllers networked together and to FactoryLink supervisory systems using a redundant Ethernet ITP network and Power Line Carrier.

*Control room activity on the first day of production*

The upstream station has a 35MW unit and takes its water from a storage dam. It is controlled based on a power output setpoint that can be entered directly by the operator as a constant value or can be setup as a daily schedule that the PLC will repeat on a daily basis. The daily schedule allows the operator to graphically input 48 set-points, one for every half hour of the day, as shown below.

The water output from this station passes through a 5km tunnel, at a rate of between 10 and 30 tonnes/sec. This feeds into a head tank and from there into the downstream power station, which has a 17MW unit.

As the head tank only provides a small storage buffer between the two stations (typically less than a minute), the downstream power station is normally controlled automatically by the PLC, based on the head tank water level.



*Power output set-points for Power Station No. 1*

Maintenance of the control system is simplified using several SCADA diagnostic screens. These graphic representations, along with

## Technology

Schneider Quantum hot-standby controllers were used in each station to control the turbine, switchyard and auxiliaries.

These PLCs are networked to FactoryLink supervisory systems that provide detailed graphical display of all plant status, real-time & historic alarms and trend graphs.

There is a redundant Ethernet ITP network within the station. A Power Line Carrier is used to provide communication between the stations and to the Dispatch Centre.

## Scope of Supply

The Sipansihaporas Hydro-Electric Power Station Control System project was a sub-contract to the main electrical contractor for these power stations and sub-stations. The Horizon Automation Solutions Ltd. scope included:

- Control software
- Electrical panels
- SCADA system
- Dispatch centre communications
- Commissioning and on-site support during first month of commercial operation.

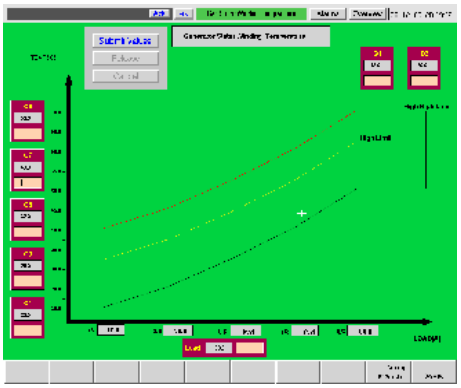
detailed manuals, allow operators with even a basic knowledge of the system to perform some of the first-line maintenance functions. More detailed diagnostics for technical personnel is also simplified by the use of structured programming in the PLC which can be viewed in real time on the maintenance terminal.

*Sipansihaporas Hydro Power Station No.2 & Switchyard*

The performance of the turbine and generator is continuously monitored by the control system to warn the operator of faults. For example, high temperature and high rate-of-change of temperature is monitored for the thrust bearings, guide bearing and the stator windings. The SCADA mimic below shows the current stator winding temperature, marked by a cross-hair, and its alarm and trip limits, which are a function of the power output.

Other items of equipment such as the main transformer and station services transformers are also monitored in this way.

The downstream power station was commissioned and handed over to the Indonesian national utility, PT PLN (PERSERO), in November 2002 and is now supplying 17MW to the grid. The upstream power station was pre-commissioned in August 2003, with final commissioning due in early 2005.



*Graph of the Stator Winding Temperature*

*Horizon staff training local operators*

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