

# Success Story

Digital Transformation Solution for Safe and Efficient Operation of Cogeneration Power Plant

## TP Utilities Pte. Ltd.

**Location:** Tembus District, Jurong Island, Singapore  
**Order date:** 2014  
**Completion:** 2017  
**Industry:** Power



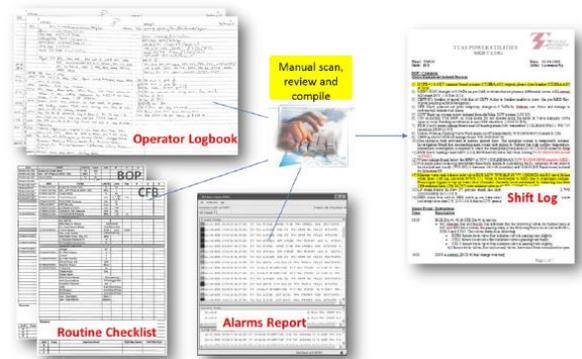
### Executive Summary

Recognized as one of the top three players in the Singapore power sector, Tuas Power is a fully owned subsidiary of the NYSE-listed Huaneng Power International and a member of the power giant China Huaneng Group. TP Utilities Pte. Ltd. (TPU), a subsidiary of Tuas Power, operates a utility complex on Jurong Island in Singapore that provides steam, power, and other utility services to customers in the Tembusu industrial area, and also supplies electricity to the national grid. The core facility at the Tembusu Multi-Utilities Complex is a biomass clean coal (BMCC) co-generation plant that was built in phases, with the first part of the plant beginning commercial operation in 2013 and the completion of all construction in 2017.



- Miscommunication of work instructions
- Manual data collection and reporting
- The need to source data from multiple systems

Retrieving information from handwritten operation logbooks was tedious and time-consuming, and shift personnel had to access multiple systems to collect information such as critical DCS parameters in order to prepare the shift reports required for handover. The entire process was manual, took a lot of time to complete, and was prone to human error. The paper-based work instructions were also not always up to date, so operators would have to make assumptions when deciding what to do. In addition, the reliance on paper documentation made it difficult to share and pass on knowledge about plant operations.



From 2014 to 2017, Yokogawa Engineering Asia worked with TP Utilities to provide solutions under its Co-innovation program that improved reliability and availability at the BMCC plant. Yokogawa's Co-innovation program offers a totally integrated and enhanced set of Operations Management, Alarm Management, Decision Support, and Asset Management solutions for field instruments and rotating equipment. This success story focuses mainly on the Operations Management solution.

Yokogawa's Operations Management solution has helped to ensure safe, reliable, and efficient operations as well as regulatory compliance at the Tembusu Multi-Utilities Complex by enabling all information on key operations management practices to be handled in digital form. This has improved productivity by helping to standardize work practices, streamline processes, and improve communication and coordination across departments.

### The Challenges and the Solutions

Before implementing Yokogawa's Operations Management solutions, the customer was facing the following challenges:

- Paper-based logbooks
- Manual shift handovers
- Manual progress tracking and monitoring



### Digitized operation records

To address the limitations of the existing system, Yokogawa first identified which information needed to be collected from different systems for shift hand-over:

- Operation log books
- Routine task checklists, information on ad hoc tasks
- Maintenance work orders and permit tracking information
- Information on critical processes and overrides
- Information required for efficient shift hand over reporting
- Alarm handling information
- Information on standard operating procedures

With the Yokogawa Operations Management solution, field operators, panel operators, and shift managers throughout the Tembusu complex are able to access digital operation logs on a centralized system and update status information on their activities. This enhances visibility by giving everyone access to the same information, and also makes it easier to search for and retrieve information.

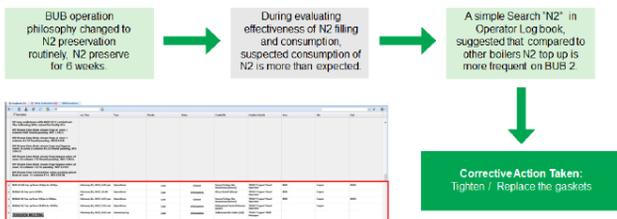
Id	Description	Log Time	Type	Priority	Status	Created By	Creation Subrole
58	Fire water ABC isolated. (Leaking point underneath pipe rack nearby A112.)	12/15/2017, 11:28 am	RR_LT	High	Open	OP_RR_S53 (sectest4.1) oca1\OM_RR_S53	YKGM Plant*SG Site*RRArea *RR-AC3*RR Shift supervisor 3
59	Adjusted feed ratio hot feed from 0.22-0.30	12/15/2017, 11:26 am	RR_LT	High	Closed	OP_RR_S53 (sectest4.1) oca1\OM_RR_S53	YKGM Plant*SG Site*RRArea *RR-AC3*RR Shift supervisor 3
58	Routine checks on all units	12/15/2017, 11:18 am	RR_LT	Medium	Information	OP_RR_S53 (sectest4.1) oca1\OM_RR_S53	YKGM Plant*SG Site*RRArea *RR-AC3*RR Shift supervisor 3

### Digitized knowledge base

Yokogawa’s Operation Management solution also provides a database that functions as a central repository of all relevant operation knowledge. Such information includes:

- Automated standard operation procedures
- Work instructions and checklists
- Operator logbooks
- KPIs for monitoring the execution of SOPs, and history data

Example for making use of Operations Knowledge Base

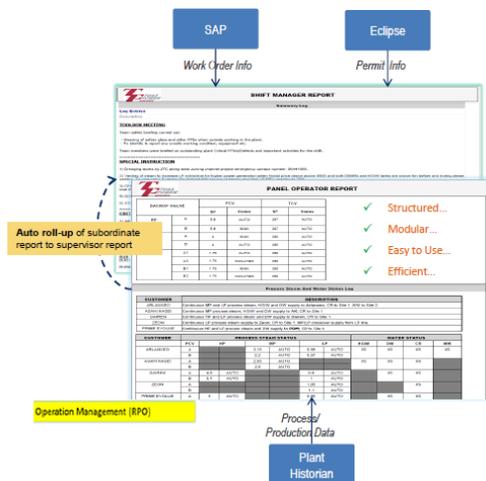


The above figure shows how this operations knowledge base can be used. A shift manager wishes to examine whether there are any issues with the nitrogen filling process and decides to consult the database for more information on this topic. From the information provided there, the manager concludes based on the frequency of nitrogen top-up for one boiler that there is a leak somewhere in the equipment. Further checks reveal that a defective gasket is at fault and the problem is corrected with its replacement.

### Digitized shift handover reports

Yokogawa’s Operations Management solution enables the following important items to be incorporated in the digital shift handover reports for all roles in the plant:

- Consolidated information from the following sources: SAP, Eclipse, Process Historian
- Automatically generated information reporting on the process envelope, work order status, permit status, panel check list, and standing alarms
- Created/updated shift logs



At the end of each shift, the personnel working that shift only need to review this information with the next shift’s personnel and enter comments acknowledging this review in the report. Time is saved by having all the information in one place (no need to check data on multiple systems) and eliminating the need to manually input this information into the shift report.

### Benefits of the Operations Management solution

With the Yokogawa Operations Management solution, digital operation records are created that have the following benefits:

- 30 minute reduction in shift handover report preparation time
- Single-window view of plant-wide operation log entries
- Accurate and reliable shift handover reports
- Integration with SAP & Eclipse systems and improved productivity by avoiding double entry
- Efficient tracking and status reporting
- Retention of valuable knowledge on plant operations

### Co-Innovation program

In addition to Operations Management, Yokogawa also deployed the Alarm Management, Decision Support, and Asset Management components of its Co-Innovation program. These innovative and practical solutions improved operation decision support and the monitoring of critical auxiliary equipment at this power plant.

#### Program 1: Expert operation decision support system (EODSS)

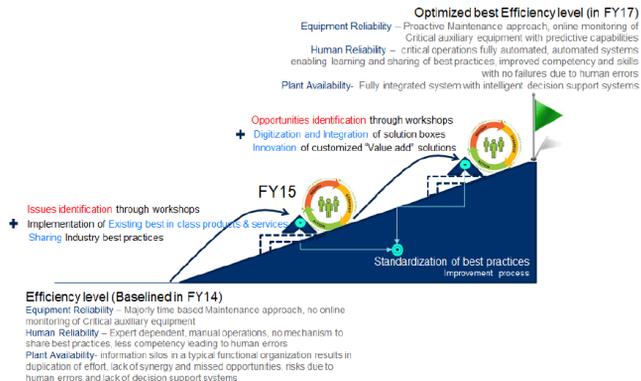
The EODSS enables intelligent self-learning and procedural automation based on good manufacturing practices and the actions of experienced operators. The EODSS adds intelligence to the existing decision support system to keep it current and provide pre-alerts before the occurrence of critical events. Thus, this new solution helps in building a knowledge historian and provides guidance to less experienced personnel on how to optimize power plant operations and improve reliability.

#### Program 2: Enhanced predictive condition monitoring system (EPCMS)

The EPCMS enhances the monitoring of critical auxiliary rotating equipment and other production assets, and has an advanced diagnostics module that makes automatic estimates of asset health for predictive maintenance. The key element in this was the development of a data fusion method that combines vibration and oil analysis with process data, thus accurately and consistently integrating multi-time and multi-scale data from multiple sources that are collected during the same sampling interval.

### Benefits of Co-Innovation program

Upon the completion of this project in fiscal year 2017, a follow-up reevaluation of equipment reliability, human reliability, and plant availability was conducted at this plant. The data showed that the value created through the Co-Innovation Program exceeded the targets set at the outset of the project (fiscal year 2014).



- **Equipment reliability:** Proactive (predictive) maintenance has been achieved through the online monitoring of critical auxiliary equipment.
- **Human reliability:** Fully automated systems have enabled the learning and sharing of best practices, which helps to eliminate human error by improving competency and skills.
- **Plant availability:** A fully integrated system with intelligent decision support systems has been achieved.

### Customer Satisfaction

Customer is very satisfied with the results of Yokogawa Co-innovation program and mentioned, “It was a fruitful learning and competencies building experience.”



**For more Information and Contact**

[Operations Management Solutions/  
Power Industry](#)

**YOKOGAWA ELECTRIC CORPORATION**

World Headquarters  
9-32, Nakacho 2-chome, Musashino-shi, Tokyo  
180-8750, Japan  
[www.yokogawa.com/](http://www.yokogawa.com/)

**Yokogawa Engineering Asia Pte. Ltd.**

5 Bedok South Road, Singapore 469270, Singapore  
[www.yokogawa.com/sg/](http://www.yokogawa.com/sg/)