

## Case note

# ABB drives control pumps at the Changi Water Reclamation Plant

Ten ACS 1000 variable speed drives, each of 3500 kW (4690 hp), control pumps at the Changi influent pumping station in Singapore. The Changi Water Reclamation plant will initially treat 176 million gallons of used water per day.



Pumps in one of the two giant pump shafts at the Changi influent pumping station. The pumps are controlled by ABB's ACS 1000 drives.

### **PUB, Singapore's national water agency**

PUB, the national water agency in Singapore manages Singapore's water supply, water catchment and used water in an integrated way.

### **The Deep Tunnel Sewerage System (DTSS) and Changi Water Reclamation Plant**

The DTSS was conceived by PUB as an efficient and cost-effective solution to meet Singapore's long-term needs for used water collection, treatment and disposal.

The Changi Water Reclamation Plant is at the heart of the DTSS. It will treat 176 million gallons of used water per day. Provisions have been made to allow it to be expanded to treat 528 million gallons of water per day.

Used water is pumped to the influent pumping station, which consists of two giant shafts, each 35 meters in diameter and 70 meters deep. Each pump shaft has five pumps, which can each pump 88 million gallons of water per day. This is enough to fill an Olympic-sized swimming pool in five minutes.

### **Highlights**

Soft starting of motors with 11 m long shafts

Elimination of water hammer

Flow regulation of used water inflow

Integration with automation system

## Challenge

The used water that flows into the Changi Water Reclamation Plant needs to be regulated to match the sewage inflow to the treatment capacity.

Also, a soft starter is required for the pump motors. The motor shafts are 11 m long. If the motors are started direct-on-line (DOL), the torsional stress may cause the shafts to break.

## Solution

ABB supplied ten ACS 1000 medium voltage variable speed drives to control the pumps of the influent pumping stations. Controlling the pumps' flow and pressure with variable speed drives, ensures they operate at best efficiency under a variety of flow conditions, considering the actual demand.



ACS 1000 variable speed drives controlling the pumps.

## Benefits

### Soft starting

Due to the long motor shafts, DOL start is not possible. The ACS 1000 act as soft starters reducing the stress on the motors. During the starting process, the ACS 1000 progressively increases the motor speed and smoothly accelerates the load to its rated speed.

### No water hammer

Water hammer occurs when the flow of water in a pipe is stopped suddenly, causing a shock wave to ripple through the water. The impact on the structure of the pipes can lead to damage, which, over time, can result in burst pipes.

The ACS 1000 reduces sudden stops and starts which lead to water hammer.

### Reduction of maintenance cost and longer lifetime of equipment

The smooth starting and soft stopping protects the mechanical and electrical equipment, thus prolonging its lifetime and reducing maintenance cost.

## Efficient flow regulation

By controlling the pump motors with variable speed drives, pump speed can be matched to the used water inflow and treatment capacity.

## Reduced energy consumption

The regulation of the used water inflow using variable speed drives instead of other motor control methods improves the system performance and reduces the energy consumption.

## Customer satisfaction

Based on the drives' performance and their smooth system integration into the customer's process, another eight, 1800 kW, ACS 1000 medium voltage variable speed drives have been ordered for the effluent pumping stations.

### ACS 1000 key data

Inverter type	Three-level Voltage Source Inverter (VSI)
Power range	Air cooling: 315 kW - 2 MW Water cooling: 1.8 MW - 5 MW
Output voltage	2.3 kV, 3.3 kV, 4.0 kV, 4.16 kV (optional: 6.0 kV - 6.6 kV with step-up transformer)
Maximum output frequency	66 Hz (optional: 82.5 Hz)
Converter efficiency	Typically > 98%
Type of motor	Induction motor

For more information please contact:

### ABB Switzerland Ltd Medium Voltage Drives

CH-5300 Turgi

Phone: +41 58 589 27 95

Fax: +41 58 589 29 84

E-Mail: [mvdrives@ch.abb.com](mailto:mvdrives@ch.abb.com)

[www.abb.com/drives](http://www.abb.com/drives)

Acknowledgement is made to:

PUB, Singapore's national water agency

[www.pub.gov.sg](http://www.pub.gov.sg)

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