ABB supplied 32 ACS 1000i medium voltage drive systems, rated at 1000 and 1250 kW, for one of Australia’s largest coal export terminals on Kooragang Island, New South Wales, Australia.

The drives provide soft start and speed and torque control for 20 conveyors. Eight of the conveyors feature a single drive, while 12 conveyors each have two single drives in a master-follower arrangement. Among the benefits are energy savings, accurate and fast load sharing, high availability and smooth ramp up.

**Highlights**

- Accurate load sharing
- Energy savings
- Extended lifetime and increased availability of conveyors
- Low speed operation for belt inspection
- Smooth ramp up
- High control accuracy

**Newcastle Coal Infrastructure Group**

The Newcastle Coal Infrastructure Group Pty Limited (NCIG) owns and operates one of Australia’s largest coal export terminals with rail, storage and ship loading facilities and associated infrastructure. The terminal serves long life coal mines in New South Wales by providing access to port infrastructure for exporting the coal.

NCIG’s terminal started operation in 2010 and has a current installed capacity of 53 million tonnes per annum (Mtpa) which will be increased to 66 Mtpa with the completion of the current expansion in 2013.

**Coal export conveyors**

The coal export terminal features 20 conveyors which transport the coal from the unloading facilities to the stockpiles or to the wharf for loading onto ships.
Challenge
To sustain the coal supply chain, the conveyors, which have a total length of more than 13 kilometers, have to be available 24 hours per day, seven days a week.

This requires the coordination of the 20 conveyors to maximize the terminal’s throughput.

The conveyors need to start up smoothly to avoid mechanical stress and tripping. Furthermore, the material demand might require that the conveyors start up at short notice.

Solution
ABB supplied 32 ACS 1000i medium voltage variable speed drives with integrated transformers and 32 ABB induction motors, rated at 1000 and 1250 kW. The drives and motors soft start and control the speed and torque of the 20 conveyors.

Two different variable speed drive configurations are implemented, depending on the load requirement of the conveyor:
− single drive
− two single drives in master-follower configuration

To simplify maintenance and spare part handling, the same type of drives and motors are installed for all conveyors on site.

Benefits
Energy savings
Starting and stopping conveyors with variable speed drives (VSDs) does not cause additional stress to the equipment. Therefore, conveyors can be stopped or operated at reduced speed if material demand is intermittent or low, resulting in less energy consumed.

Accurate and fast load sharing
ABB medium voltage drives provide an accurate and fast load sharing between several drives. This is useful for conveyor applications, where two or more motors operate on the same conveyor, making sure all motors are loaded as needed. The converter control provides speed limitation to prevent belt slippage.

At NCIG’s coal export terminal, 12 of the 20 conveyors are equipped with two ACS 1000i variable speed drives in master-follower configuration.

In a master-follower configuration, two motor shafts are either hard coupled, i.e. connected to the same pulley (same shaft), see Fig. 1, or they are soft coupled, i.e. connected to different pulleys, see Fig. 2.

![Fig. 1: Hard coupled conveyor configuration](source: NCIG)
The two configurations require different converter control schemes which are part of the standard software package available for ABB’s medium voltage drives. This software ensures accurate load sharing in either master-follower configurations.

High availability
The master-follower configuration permits the continued use of the conveyor system with reduced power in case of failure of one variable speed drive system.

Due to the power loss ride through function, ABB drive systems are able to withstand disturbances on the power supply. The drive will continue to operate in an active but non-torque producing mode if the incoming supply voltage is cut off. The drive is active as long as the motor rotates and generates energy to the drive. It will bumplessly resume normal operation immediately upon return of the power supply.

Low speed operation for belt inspection
For maintenance inspection, belt changes and repairs it is possible to run the conveyor at low speed.

Smooth ramp up
VSDs provide a smooth ramp up of conveyors. They deliver high starting torque for the current drawn from the power system and have a programmed upper limit to reduce peak torque during the start of the conveyor. The low starting currents and high starting torque enable a smooth start-up of the conveyor, even when it is fully loaded.

High control accuracy
ABB’s drive control platform is based on the award-winning Direct Torque Control (DTC), resulting in the highest torque and speed performance, as well as lowest losses ever achieved in medium voltage drives. Control of the drive is immediate and accurate under all conditions.

Extended lifetime and increased availability
Variable speed drives provide accurate torque and speed control of conveyors. This reduces the stress on mechanical equipment such as gearboxes, pulleys and belts, especially during start-up and stopping, but also during operation and maintenance.

### ACS 1000 key data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverter type</td>
<td>Three-level Voltage Source Inverter (VSI)</td>
</tr>
<tr>
<td>Power range</td>
<td>Air cooling: 315 kW - 2 MW</td>
</tr>
<tr>
<td></td>
<td>Water cooling: 1.8 MW - 5 MW</td>
</tr>
<tr>
<td>Output voltage</td>
<td>2.3 kV, 3.3 kV, 4.0 kV, 4.16 kV</td>
</tr>
<tr>
<td>Maximum output frequency</td>
<td>66 Hz (optional: 82.5 Hz)</td>
</tr>
<tr>
<td>Converter efficiency</td>
<td>Typically &gt; 98%</td>
</tr>
<tr>
<td>Type of motor</td>
<td>Induction motor</td>
</tr>
<tr>
<td>Special feature</td>
<td>Air-cooled ACS 1000 available with integrated transformer and input contactor (ACS 1000i)</td>
</tr>
</tbody>
</table>

ABB's scope of supply includes 32 induction motors, rated 1000 and 1250 kW at 1000 rpm and 32 ACS 1000i variable speed drives.
For more information please contact your local ABB representative or visit:

www.abb.com/drives
www.ncig.com.au