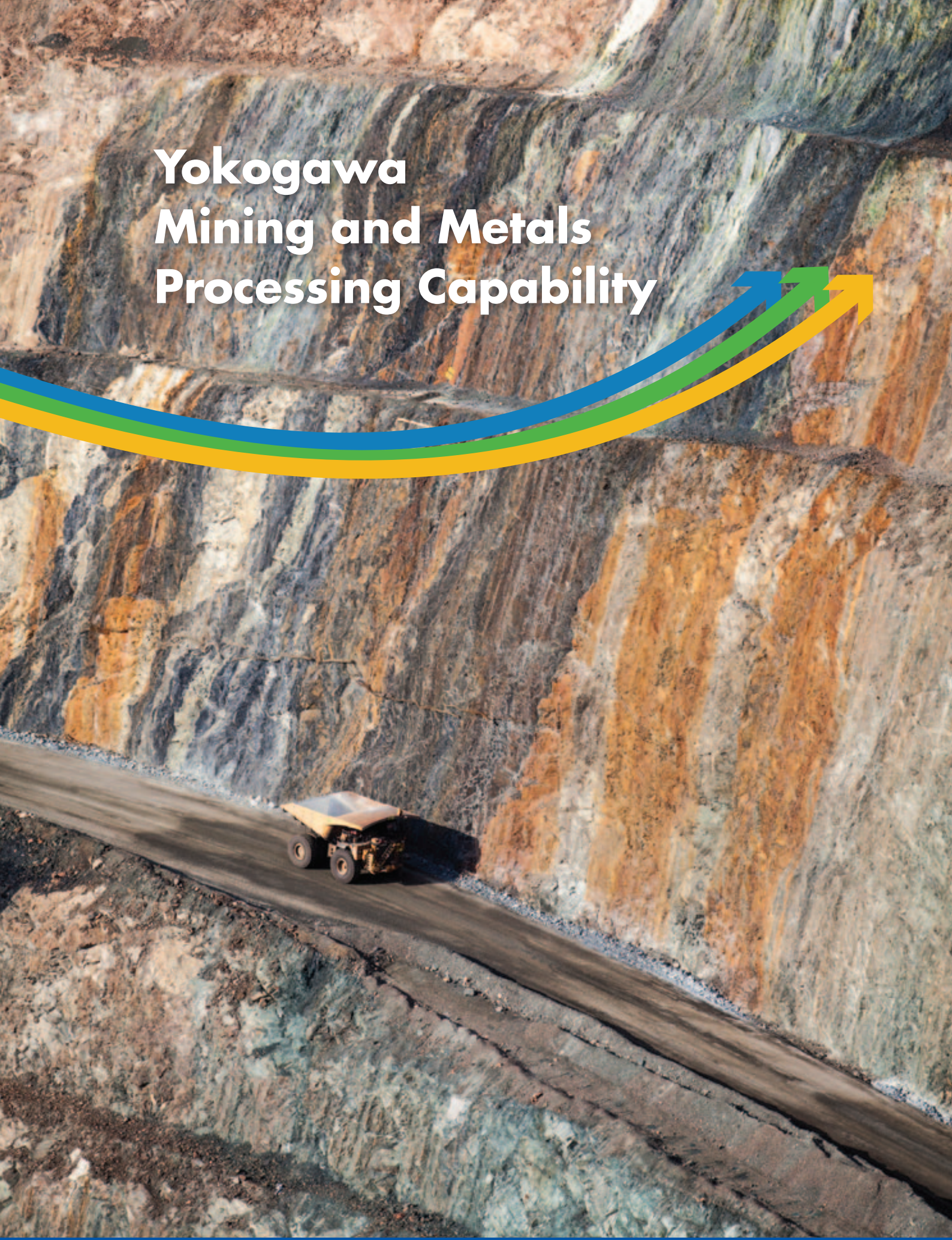
Yokogawa Mining and Metals Processing Capability



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Yokogawa Mining and Metals Processing Capability

Contents

Coal

C

Uses: For coking coal in steel making and power generation

Factors influencing demand: Steel production and electricity demand

Yokogawa's involvement with coal

We have control systems in these mines

- Integra Coal
- Oaky Creek

Integra Coal

The Vale coal mine is located in the Hunter Valley of NSW. It is owned by the Brazilian mining company, Vale. It is both an open cut and underground mine producing 4.5mtpa of semi hard coking coals.

A Centum CS3000 production control system and Exaquantum plant information system are used to control the wash plant. FA-M3 PLC controllers are used at the coal preparation plant, the stackers and reclaimers.

The mine also uses Yokogawa AXF flow meters and EJX transmitters.

Oaky Creek

The Oaky Creek mine is located in the Bowen Basin in Queensland. Its majority owner is GlencoreXstrata. It produces premium quality medium volatile coking coals from 2 underground mining operations. It produces 11mtpa.

A Centum CS3000 production control system and Exaquantum plant information system are used to control the wash plant.

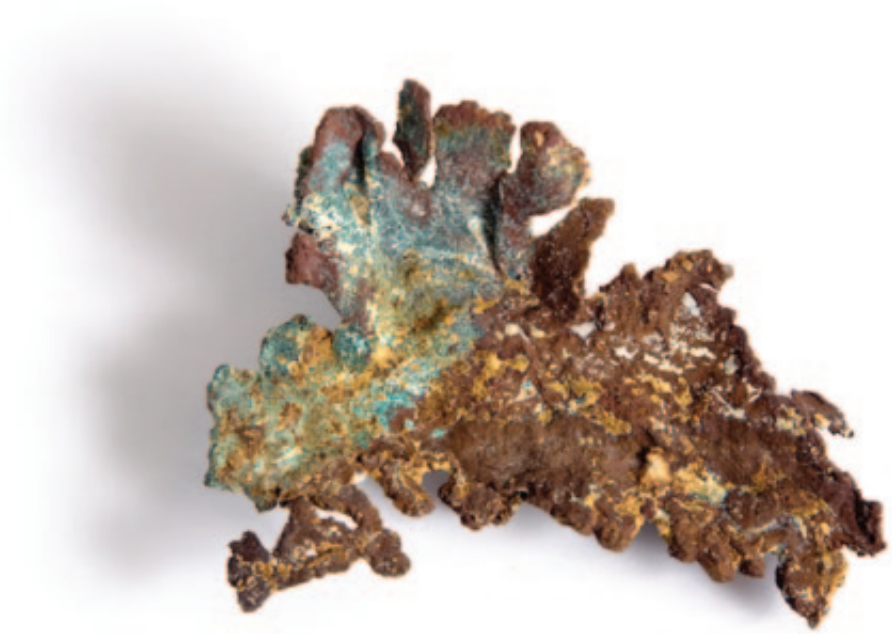
The mine also uses AXF flow meters.

Yokogawa Instrument Users

- **Anglo Coal's Capcoal mine** – Bowen Basin Qld
  – AXF flow meters and EJX pressure transmitters
- **Anglo Coal's Dawson mine** – Bowen Basin Qld
  – AXF flow meters, EJX transmitters, Rotamass
- **Anglo Coal's Moranbah North** – Bowen Basin
  – AXF flow meters and analytical products
- **Yancoal's Austar Coal mine** – Hunter Valley
  – EJX transmitters, analytical products
- **BHP Billiton's BMA** – Bowen Basin Qld
  – AXF flow meters, EJX transmitters
- **GlencoreXstrata's Bulga mine** – Hunter Valley NSW
  – AXF flow meters
- **Caledon Coal** – Bowen Basin Qld
  - AXF flow meters, EJX transmitters
- **Integra Coal** – Hunter Valley
  - AXF flow meters, EJX transmitters
- **GlencoreXstrata's Newlands Coal** – Bowen Basin Qld - *EJX transmitters*
- **Peabody's North Goonyella Coal** – Bowen Basin Qld - *Rotamass*
- **GlencoreXstrata's Oaky Coal** – Bowen Basin Qld
  - AXF flow meters
- **Port Waratah Coal services** – Hunter Valley NSW
  – AXF flow meters
- **Rio Tinto Coal** – Bowen Basin
  - AXF flow meters and EJX pressure transmitters
- **Peabody's Coppabella mine** – Bowen Basin
  - AXF flow meters and EJX pressure transmitters
- **GlencoreXstrata's Ulan Coal** – western NSW
  - AXF flow meters and EJX pressure transmitters
- **Wesfarmers Curragh** – south west WA
  - AXF flow meters and EJX pressure transmitters

Copper

Cu



Uses: As copper is an excellent conductor of electricity, most of the copper consumed is used in electrical application

Factors influencing demand:

Current demand is being driven by the demand for housing and automobiles in China

Image courtesy of GlencoreXstrata

Yokogawa's involvement with copper

We have control systems in these mines

GlencoreXstrata's Ernest Henry Mine

- Cloncurry NW Queensland

An Underground mine producing 34,000 tonnes of copper concentrate in 2012. Processing plant controlled by a Yokogawa Centum DCS system. The mine also uses AXF flow meters, EJX pressure transmitters and analytical products.

GlencoreXstrata's Mt Isa Mine

- Mt Isa NW Queensland

An underground mine producing 142,000 tonnes of copper concentrate in 2012. Copper smelter controlled by a Yokogawa Centum DCS.The mine also uses AXF flow meters, EJX pressure transmitters and analytical products.

Yokogawa Instrument Users

- **Aditya Birla's Nifty and Mt Gordon mines** –
  – Nifty is located in the Pilbara
  – Mt Gordon is near Mt Isa
  – *AXF flow meters*
  – *EJX transmitters and analyser products*
- **Hillgrove Resources – Kanmantoo mine**
  – Located west of Adelaide in South Australia
  – *AXF flow meters*
  – *EJX transmitters and analyser products*
- **Snowpeak Mining**
  – Several mines located in North Queensland
  – *AXF flow meters*
  – *EJX transmitters and analyser products*
- **Oz Minerals Prominent Hill mine**
  – Located in north west South Australia
  – *AXF flow meters*
  – *EJX transmitters and analyser products*
- **BHP Billiton Olympic Dam mine**
  – Located in north west South Australia
  – *AXF flow meters*
  – *EJX transmitters and analyser products*

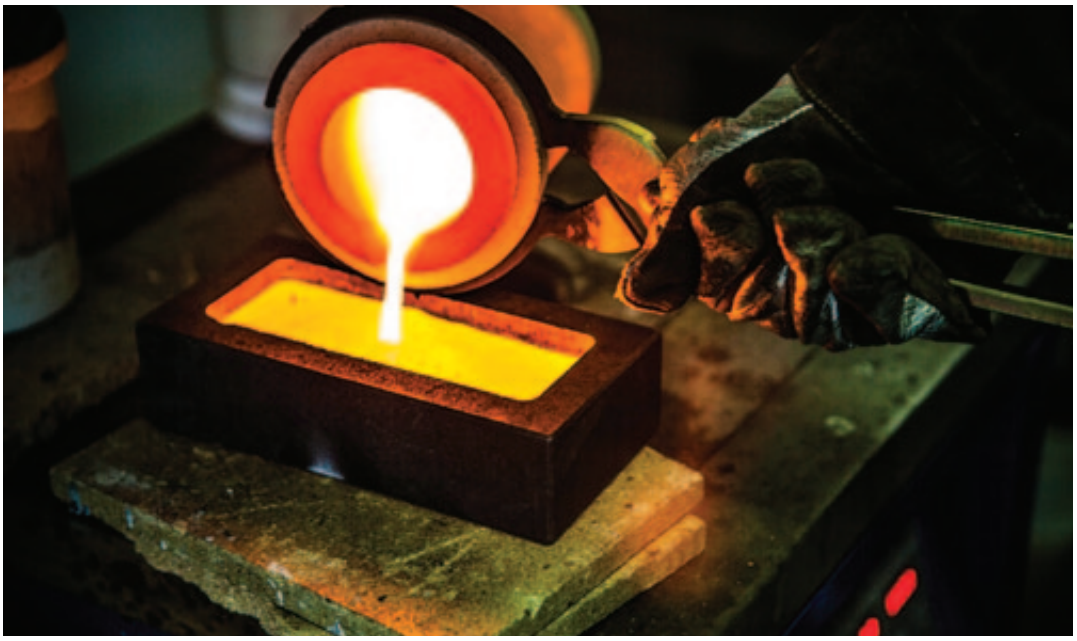
Gold

Au

Uses: For jewellery, in investments and uses in electronics and dentistry

Factors influencing demand:

Jewellery demand especially in India and China and for financial speculation



Yokogawa's involvement with gold

We have control systems in these mines

Cowal – Barrick Gold

Located in Western NSW, Cowal mine in 2011 produced 269,000 ounces of gold. It is an open pit. It is 100% owned by Barrick Gold Corporation of America. The gold is processed by carbon in leach and flotation methods. A Yokogawa Centum DCS controls the production process.

Hidden Valley Gold Plant - Newcrest

In the Morobe province of Papua New Guinea, the Hidden Valley mine is 50% owned by Newcrest Mining and 50% by Harmony Gold. Hidden Valley is an open pit mine, consisting of three main ore bodies: Hidden Valley, Kaveroi and Hamata. The processing plant utilises conventional gravity and carbon in leach circuits for gold and a Merill Crowe circuit for silver. In 2013 Hidden Valley produced 170,008 ounces of gold and 1.7 million ounces of silver. A Yokogawa Centum DCS controls the production process with an Exaquantum plant information system.

Boddington – Newmont

Located in south west Western Australia. It is owned 100% by the Newmont Mining Corporation of America. In 2011, Boddington produced 741,000 ounces of gold and 30,000 tonnes of copper. Processing methods include Flotation gravity recovery and carbon in leach. It is an Open pit. A Yokogawa Centum DCS controls the production process with an Exaquantum plant information system.

Kalgoorlie Consolidated Gold Mines KCGM – Newmont and Barrick JV

Kalgoorlie, Western Australia. It is an open pit mine. It produces 800,000 ounces per year. The processing takes place at the Fimiston Plant and the Gidji Roaster and involves froth flotation, roasting and CIL. A Yokogawa Centum DCS controls the production process.

Telfer – Newcrest

In the Great Sandy Desert in Western Australia, the mine is 100% owned by Newcrest. The mine consists of the Main Dome and West Dome open pits and the Telfer underground mine. The ore from the mining operations is processed by a large, dual train, comminution circuit followed by flotation and cyanide circuits, which produce gold doré and a copper-gold concentrate. The process is complex because of the need to accommodate differing ore types. In 2013 the Telfer mine produced 525,500ounces of gold and 26,453tonnes of copper. A Yokogawa Centum DCS controls the production process..

Image courtesy of Newcrest Mining

Cadia - Newcrest

Cadia Valley Operations (CVO) is 100 per cent owned by Newcrest and located approximately 25 kilometres from Orange in central west New South Wales. CVO comprises three mines - the Cadia Hill open pit mine, and the Cadia East and Ridgeway underground mines. These are all large scale mining operations using either block and panel caving or open pit mining methods. At CVO, Newcrest produces gold doré from a gravity circuit and gold-rich copper concentrates from a flotation circuit. In the financial year ending 30 June 2013, CVO produced 446,879 ounces of gold and 53,912 tonnes of copper. A Yokogawa Centrum DCS controls the production processing while Yokogawa Stardom SCADA plc's control the underground conveyors some of which are 3kms away.

Reefton – Oceana Gold

Located on the west coast of the South Island of New Zealand, Oceana Gold's Reefton is an open pit mine that produced 63,000 ounces in 2012. Its processing plant produces a refractory concentrate for further processing at Macraes plant. The processing plant is controlled by a Yokogawa Centum DCS.

Macraes – Oceana Gold

Located in the Otago region of the South Island of New Zealand it consists of the Macraes open cut mine and the Frasers Underground mine. The mine produced 169,000 ounces in 2012. The processing plant uses a pressure oxidation plant for the processing of the sulphide ore. The processing plant is controlled by a Yokogawa Centum DCS.

Didipio – OceanaGold

Located in the northern island of Luzon in the Philippines, this mine was commissioned in late 2012. The mine is designed to produce 100,000 ounces of gold and 14,000 tonnes of copper per year. It consists of an open pit and an underground mine. The processing point is controlled by a Yokogawa Centum DCS.

Obuasi – AngloGold Ashanti

Located in south west Ghana. In 2004 it produced 255,000 ounces of gold. It is an underground mine and surface mine. It produced approximately 260,000 ounces of gold in 2012. The processing point is controlled by a Yokogawa Centum DCS.

Yokogawa Instrument Users

- **Gold Field's Agnew mine**
  – Goldfields region of WA
  – *AXF flow meters*
- **AngloGold Ashanti's Sunrise Dam**
  - Goldfields region of WA
  – *EJX transmitters and analyser products*
- **Alacer's Avoca Mine** - Goldfields region of WA
  – *analyser products*
- **Evolution Mining's Ballarat Gold mine**
  – Victoria
  – *AXF flow meters and Analyser products*
- **Barrick's Darlot, Lawlers, Plutonic and Cowal Mines** – WA & NSW
  – *AXF flow meters, EJX transmitters and analyser products*
- **Newcrest's Cadia Valley mine** – NSW
  - *AXF flow meters, EJX transmitters and analyser products*
- **Resolute's Carpentaria Gold mine**
  – northern NSW
  – *analyser product*
- **Norseman Gold's Central Norseman**
  - Goldfields region of WA
  - *AXF flow meters, EJX transmitters and analyser products*
- **Crocodile Gold's Cosmo Mine** – NT
  - *AXF flow meters, EJX transmitters*
- **KingsGate's Challenger mine** – SA
  – *analyser products*
- **Evolution Mining's Edna May mine**
  - Goldfields region of WA
  - *AXF flow meters, EJX transmitters*
- **St Barbara's Gold Ridge mine**
  – Solomon Islands
  - *AXF flow meters, EJX transmitters*
- **Silverlake Resources' Randall mine**
  - Goldfields region of WA
  - *AXF flow meters and analyser products*
- **Newmont & Barrick JV SuperPit mine**
  – Kalgoorlie WA
  - *AXF flow meters, EJX transmitters and analyser products*
  - *Rotameter & DY vortex meters*
- **Evolution Mining's Mt Rawdon mine**
  – central QLD
  - *EJX transmitters*
- **Newcrest's Lihir Gold mine** – PNG
  - *AXF flow meters, EJX transmitters and analyser products*
- **Evolution Mining's Cracow mine** – central QLD
  – *AXF flow meters*
- **Navigator Resources' Bronzewing mine**
  – Eastern Goldfields WA
  – *analyser product*
- **Newcrest's Telfer mine** - East Pilbara WA
  - *AXF flow meters, EJX transmitters and analyser products*
- **Newmont's Boddington mine** – south west WA
  - *AXF flow meters, EJX transmitters and analyser products*
- **Newmont's Tamani mine** – NT
  - *AXF flow meters, EJX transmitters*
- **Norton's Paddington gold mine**
  - Goldfields region of WA
  - *EJX transmitters and analyser products*
  - *UT temperature controllers*
- **Gold Field's St Ives mine**
  - Goldfields region of WA
  - *AXF flow meters and analyser products*
- **Crocodile Gold's Stawell Gold mine** – Victoria
  - *AXF flow meters, EJX transmitters and analyser products*
- **Oceana Gold's Reefton and Macrae's mines**
  – South Island New Zealand
  - *AXF flow meters, EJX transmitters and analyser products*

Iron ore

Fe

Uses: Iron Ore is the second most abundant mineral after aluminium, making up 5% of the Earth's crust. 98% of the world's iron ore production is used to make steel. Iron ore comes in the form of hematite (Fe_2O_3) or magnetite (Fe_3O_4)

Factors influencing demand:

Current demand is being driven by Chinese steelmakers who are producing steel for housing in China

Yokogawa's involvement with iron ore

Yokogawa Instrument Users

- **Citic Pacific Mining** - Western Australia

  – Yokogawa EJX pressure transmitters and analytical products

- **Rio Tinto – Pilbara Iron Company** – Western Australia

  – Yokogawa analytical products, DY vortex flow meters and EJX pressure transmitters

- **Arrium** – South Australia

  – Yokogawa analytical products, AXF flow meters and EJX pressure transmitters

Mineral Sands

Ti
Zr

Uses: Minerals sands consist of 2 major mineral groups. The titanium minerals – ilmenite, leucoxene and rutile and zircon. Titanium minerals are mainly used in pigments while zircon is used in the production of ceramics.

Factors influencing demand:

The demand for these products is strongly related to overall growth of the economy

Yokogawa's involvement with mineral sands

We have control systems in these mines

Yaraman and Enterprise mine.

Located on the North Stradbroke Island, Queensland. This operation dredges 50m tonnes of sand each year to product 70k tonnes of rutile, 50k tonnes of zircon and 150k tonnes of ilmenite each year.
A Yokogawa Centum DCS controls the processing plants on both mines as well as Sibelco's further processing plant at Pinkenba.

Yokogawa Instrument Users

- **Tronox's integrated titanium dioxide mine, mill and pigment plant** - Western Australia
  – *Yokogawa AXF flow meters, EJX pressure transmitters and analytical products.*
- **Iluka Resources** – operations across Australia
  – *Yokogawa AXF flow meters, EJX pressure transmitters and analytical products*
- **Sibelco Australia**
  – North Stradbroke operations Queensland
  – *Yokogawa AXF flow meters, EJX pressure transmitters and analytical products*
- **Murray Zircon**
  – Mindarie Sands project South Australia
  – *Yokogawa analytical products*
- **Mitsubishi's Cape Flattery Silica**
  – Cape York Queensland
  – *Yokogawa AXF flow meters and EJX pressure transmitters*
- **Cristal Mining**
  – Ginkgo and Snapper mines, Broken Hill separation plant and Bunbury processing plant
  – *Yokogawa AXF flow meters , EJX pressure transmitters, analytical products and UT controllers*

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Nickel

Ni

Uses: 80% of nickel is used to make alloys for industrial purposes, the main alloy being stainless steel

Factors influencing demand:

As stainless steel production is its main use, the demand for this product determines the demand for nickel

Image courtesy of BHP Nickel West

Yokogawa's involvement with nickel

We have control systems in these mines

BHP Billiton Nickel West

BHP Billiton Nickel West's operations are located in the northern Goldfields area of Western Australia. It is a fully integrated mine consisting of mines, smelter and a refinery. The mines are the Leinster underground mine and the Mt Keith open cut. At Kalgoorlie there is a concentrator and smelter and at Kwinana the refinery is located. Nickel West produced 46,000 tonnes of nickel in 2012. Nickel West's processing and concentrating processes are control by Yokogawa Centum DCS systems. Nickel West is also a user of Yokogawa AXF flow meters, EJX pressure transmitters and analytical products, Rotamass and Rotameters.

Murrin Murrin

GlencoreXstrata's Murrin Murrin nickel and cobalt mining and refining project is in the North Goldfields area of Western Australia. In 2011 production was 30,000 tonnes of nickel and 2,100 tonnes of cobalt. The ore processing comprises pressure acid leaching, mixed sulphide precipitation and cobalt and nickel refining. Murrin Murrin's processing and refining processes are controlled by Yokogawa Centum DCS systems with the Exaquantum plant information system and the PRM plant resource manager. Murrin Murrin is also a user of Yokogawa AXF flow meters, EJX pressure transmitters and analytical products, Rotamass and DY vortex meters.

Yokogawa Instrument Users

- **GlencoreXstrata's Cosmos mine**
  - – northern Goldfields Western Australia
  - – *Yokogawa AXF flow meters*
  - – *EJX pressure transmitters and analytical products*
- **First Quantum Minerals Ravensthorpe mine**
  - – southern Goldfields Western Australia
  - – *Yokogawa AXF flow meters and analytical products*
- **Panoramic Resources Savannah mine**
  - – south Goldfield of Western Australia
  - – *Yokogawa AXF flow meters*
  - – *EJX pressure transmitters and analytical products*
- **Vale** – New Caledonia
  - – *Yokogawa AXF flow meters*
  - – *EJX pressure transmitters and analytical products*

Uranium

U

Uses: As fuel for nuclear power reactors for electricity operation. Nuclear power provides about 14% of the world's electricity generation

Factors influencing demand:

The use of electricity which is expected to double by 2030

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Yokogawa's involvement with uranium

We have control systems in these mines

Heathgate

Heathgate's Beverley and Four Mile mines located near Lake Froome in South Australia. This in situ leach operation produces 413 tonnes of uranium hydroxide concentrates. These mines control their well heads and processing plants with Yokogawa Centum DCS & Stardom SCADA's. These mines also use Yokogawa EJX pressure transmitters, AXF flow meters and analytical products.

Yokogawa Instrument Users

- **Uranium One** – Honeymoon mine in South Australia.

  – Yokogawa EJX pressure transmitters, AXF flow meters and analytical products.

- **Energy Resources of Australia** – Ranger mine in the Northern Territory

  – Yokogawa EJX pressure transmitters, AXF flow meters and analytical products.

Zinc, Lead & Silver

Zn

Uses: Over 50% of the consumption of zinc is for galvanising steel. 80% of lead production is used in vehicle batteries. Most of the silver uses are industrial with 31% used for jewellery and coins

Factors influencing demand:

Current demand is being driven by the increasing demand from China and India

Yokogawa’s involvement with zinc, lead and silver

We have control systems in these mines

McArthur River Mine

GlencoreXstrata’s McArthur River Mine in the Northern Territory. An open cut mine producing 390,000 tonnes of zinc concentrate and 40,000 tonnes of lead in 2012. The Processing plant is controlled by a Yokogawa Centum DCS system.

The mine also uses AXF flow meters, EJX pressure transmitters and analytical products.

Mt Isa Mine

GlencoreXstrata’s Mt Isa Mine Mt Isa NW Queensland. An Underground mine producing 390,000 tonnes of zinc concentrate and 153,000 tonnes of lead in 2012. The Zinc/lead processing plant is controlled by a Yokogawa Centum DCS.

The mine also uses AXF flow meters, EJX pressure transmitters and analytical products.

Snow Peak Mining

Snow Peak Mining operates in Northern Queensland with 4 mines and three processing plants. The mines produce 40,000 tonnes of zinc and lead as well as 22,000 tonnes of copper. The Processing plant is controlled by a Yokogawa Centum DCS system.

The mine also uses AXF flow meters, EJX pressure transmitters and analytical products.

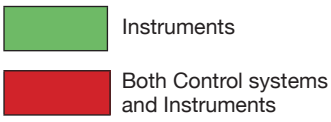
Golden Grove

MMG’s Golden Grove mine located in Western Australia’s mid-west. The mine in 2011 produced 71,000 tonnes of zinc concentrate and 22,000 tonnes of copper concentrate from 2 underground mines and an open pit. Processing is by conventional grinding and a flotation process. The processing plant is controlled by a Yokogawa Centum DCS system and the Exaquantum plant information system. The mine also uses AXF flow meters, EJX pressure transmitters and analytical products.

Dugald River

Dugald River is a world class zinc, lead and silver ore body located in north western Queensland about 85 kilometres north of Mt Isa. This underground mine is planned to produce about 220,000 tonnes of zinc in concentrate, 30,000 tonnes of lead in concentrate and 0.9 million ounces of silver in concentrate per year. First shipment is expected in the 4th quarter of 2015. The mine has a projected life of 20 years.

Mining companies using Yokogawa products



Mining Company	Mineral								
	Coal	Copper	Gold	Iron Ore	Lead	Mineral Sands	Nickel	Uranium	Zinc
Adita Birla									
Anglo Coal									
Anglo Gold									
Alacer									
Arrium									
Barrick Gold									
BHP Billiton Mitsubishi									
BHP Billiton Nickel West									
Bloomfield Coal									
Caledon Coal									
Citic Pacific Mining									
Crocodile Gold									
Cristal Mining									
ERA									
Evolution Mining									
First Quantum Minerals									
GlencoreXstrata Murrin Murrin									
Gold Fields									
Heathgate									
Hillgrove									
Iluka Resources									
Integra Coal									
Kingsgate									
MMG									
Mitsubishi Cape Flattery Silica									
Murray Zircon									
Navigator Resources									
Newcrest									
Newmont									
Norseman Gold									
Norton									
Oceana Gold									
Panoramic Resources									
Peabody									
Pilbara Iron Company									
Resolute									
Rio Tinto									
Sibelco									
Silverlake Resources									
St Barbara									
Snow Peak Mining									
Tronox									
Uranium One									
Vale									
Wesfarmers									
Yancoal									

Outotec's Ausmelt TLS smelting processes incorporating Yokogawa Centum DCS control systems

Location of smelters

- **Daye non-ferrous metals** – China
- **Wuxin Copper** – China
- **HCHM Hulunbeier** – China
- **Huludao copper** – China
- **Yunnan Tin copper** – China
- **Hindustan Zinc Chanderiya** India
- **Karabash copper** – Russia
- **Ongopolo Copper** - Namibia

Smelters & Refineries

Alumina smelters

- **Alcoa Alcoa Port Henry** - Victoria
  – uses AXF flow meters, EJX pressure transmitters and analytical products
- **Alcoa Pinjarra** – Western Australia
  – uses AXF flow meters, EJX pressure transmitters and analytical products
- **Rio Tinto's Queensland Alumina** - Queensland
  – uses AXF flow meters, EJX pressure transmitters and analytical products
- **Pacific Aluminium's Boyne Smelter** – Queensland
  – uses DY flow meters, EJX pressure transmitters and analytical products
- **BHP Billiton Worsley Alumina** – Western Australia
  – uses DY flow meters, EJX pressure transmitters and analytical products
- **Tomago Smelting** - NSW
  – uses DY flow meters, EJX pressure transmitters and analytical products
- **Pacific Aluminium Tomago** - NSW
  – uses AXF flow meters and EJX pressure transmitters
- **Pacific Aluminium Gove** – Northern Territory
  – Yokogawa analytical products, AXF flow meters and EJX pressure transmitters

Zinc Smelters

- **Sun Metals** - Queensland
  – uses DY flow meters, EJX pressure transmitters and analytical products
- **Nyrstar** Hobart Tasmania
  – uses AXF flow meters and EJX pressure transmitters
- **Nyrstar** Port Pirie South Australia
  – uses AXF flow meters, EJX pressure transmitters and analytical products

Notes

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