Outotec–TOMRA sensor-based ore sorting solutions remove waste from the ore feed in your crushing and grinding circuit, increasing productivity and significantly reducing energy and water consumption. This is vital at a time when declining ore grades – coupled with high energy and production costs, water shortages, and stricter environmental regulations – are creating increased pressure on the mining industry.

**BENEFITS**

- Increase the head grades
- Decrease milling costs based on metal in concentrate production
- Increase in-situ value of deposit
- Reduce energy consumption
- Increase efficiency of water use
- Reduce amount of fine tailings
Almost half of the energy consumed in the mining industry results from crushing and grinding operations. Together with declining ore grades and water shortages, this means that innovative, sustainable process solutions are urgently needed to improve efficiency and meet ever-stricter environmental regulations in both greenfield and brownfield operations.

Thanks to rapid development in established sensor technologies, sensor-based ore sorting is capable of transforming the outlook for the mining industry. By combining TOMRA’s sorting application expertise and state-of-the-art equipment with Outotec’s comprehensive process knowhow, plant-engineering expertise, and leading technology, we can offer the most productive and sustainable process solutions for customers in the base and precious metals segments.

Sensor-based ore sorting increases your productivity.

Reliable and cost-effective solutions
Our user-friendly, reliable, and low-maintenance technology is designed to meet the demanding uptime and durability requirements of your mining project. Wear is limited to a small number of parts, enabling your personnel to perform basic maintenance onsite.

Our sorting equipment is easy to integrate into your process. It includes a secure data connection for software updates and remote access for performing diagnostics. Our solutions are designed for high performance in a wide range of operating conditions.

Sensor-based sorters are cost-effective, as they require no chemicals and minimal water – only electricity and clean pressurized air are needed.
SENSOR-BASED SORTING: BASIC PRINCIPLES

Sorting is used at mine sites to separate waste from ore. The rejected waste rock can be sold as aggregate to local markets. Sensor-based ore sorting consists of the following sub-processes:

Material preparation
Particles are crushed and screened for applicable size, typically in the range 20–150 mm, with a maximum to minimum size ratio of 1:3.

Material presentation
Individual particles need to be presented to the sensor system. Typically, this is done using vibrating feeders followed by a chute or fast-moving conveyor belt.

Sensor detection
Sensors are essentially divided into two different system types:

- Reflection systems including technologies such as optical cameras that identify particles based on surface properties.
- Transmission systems such as X-ray transmission that detect particles based on density differences.

Data processing
The data received from the sensor system needs to be processed in real time. Data processing makes the “yes or no” ejection decision for each particle.

Physical separation
After decision-making the particle to be separated is selectively ejected by air jets that push the particle out of the main stream.
SENSOR TYPES

With a broad portfolio of cutting-edge sensor technologies, we have the capability to offer a versatile combination of solutions for a broad range of sorting tasks. Our full range of sensors is composed of the following technologies:

**Color recognition**
Our color camera capabilities go beyond the visible spectrum and include infrared, ultraviolet, and other spectra. It is typically used for precise discrimination of low-grade and contaminant particles for various applications.

**Near infrared (NIR)**
Our near-infrared spectrometry sensor recognizes materials based on the specific and unique spectral properties of reflected light in the near-infrared region of the electromagnetic spectrum. It can be used to differentiate between minerals – a process that can be difficult with the human eye or by using standard cameras.

**X-ray transmission (XRT)**
XRT technology enables materials to be recognized and separated based on their specific atomic density. This makes it possible to obtain a higher purity level, regardless of surface moisture or dust coating. For example, this technology can be used to detect sulfide inclusions.

**Electromagnetic sensor (EM)**
The highly sensitive EM sensor sorts materials based on electromagnetic properties, including conductivity and permeability. This sensor is suitable for applications such as sulfide ores and metal slags.

**Photometry (PM)**
The PM sensor system is based on our monochromatic laser attenuation and photo multiplier reflectance measurement technology. The PM sensor sorts materials based on color, structure, size, and shape differences. It is used as a supplementary detector to complement other sensors in order to distinguish the particles from the background.
OUTOTEC'S SENSOR-BASED ORE SORTING PRODUCT PORTFOLIO

Outotec can fulfill most of your minerals processing sorting requirements, from equipment-only solutions through to complete turnkey sorting plant solutions.

COM (common belt) series
These sorting systems are general-purpose belt sorters covering applications with inhomogeneous feed or critical moisture content. Simple and reliable, the COM series specializes in detection and recovery of the smallest particles.

The COM series supports EM sensors and XRT, and can handle particle sizes from 8–120 mm. Our high-sensitivity EM sensor with SUPPIXX® resolution enhancement allows for reliable and precise detection and recovery of metal particles, as well as the production of high-metal concentrate at high tonnage. XRT technology adds density separation capability.

PRO (processing) series
This series is based on a free-fall (chute) principle, with a simple and compact design that maximizes efficiency and reliability.

The three PRO series models can handle particle sizes from 2–300 mm, and all are available with a range of sensors. These can include, for example, Color and NIR to detect material properties for optimal separation performance.

Turnkey sorting plant solutions
Outotec has the expertise and capability to design, supply, and build state-of-the-art sorting plants with fast and reliable ramp-up to meet the needs of most mining projects. Our global presence means that we can provide support for customers worldwide during the entire plant lifecycle. We can provide the following for green and brownfield mining projects:

- Assistance in ore sorting test-work and sample selection
- Ore sorting test works
- Conceptual studies for sorting plant
- Ore reserve evaluation and mine planning
- Downstream process optimization
- Basic and detail engineering for sorting plant
- Process equipment and consultation
- Automation and instrumentation
- Construction, installation, and commissioning services
- Operation and maintenance services
OUTOTEC SORTING SOLUTIONS ADD VALUE THROUGHOUT YOUR MINING PROCESS

1) Increase minable tons
Sensor-based ore sorting rejects waste rocks from run-of-mine ore. This enables mining with a lower cutoff grade, which means beneficiation of more diluted ore with lower ore loss in mining.

2) Decrease haulage costs
Sensor-based ore sorting reduces ore transportation costs per ton of produced metal when a sorting plant is installed at the mine.

3) Reclaim old waste dumps
Many waste and mine-development dumps are marginal reserves. These can be upgraded to ore-grade material and converted to cleaner waste material by using sensor-based ore sorting.

4) Divert ore types
Our sorters allow you to separate ore types based on their characteristics. Treating different ores separately can increase recovery and concentrate grades.

5) Increase productivity
Boost concentrate production by replacing rejected waste with higher-grade feed ore to the mill.

6) Reduce energy consumption
Waste rejection before the mill reduces your energy consumption and carbon emissions per ton of produced metal in concentrate.

7) Reduce water consumption
Using sensor-based ore sorting technology reduces your water consumption per ton of produced metal in concentrate.

8) Reduce mass of fine final tailings
Rejecting waste from ore at an early stage in the processing circuit allows the mass of fine final tailings to be reduced, which in turn reduces the space required for tailings storage and the related costs per ton of produced metal in concentrate.

9) Access additional sources of revenue
Once separated, coarse waste can be sold as aggregate to local markets, offering an additional source of revenue.
Outotec creates sustainable and reliable life-cycle solutions to ensure the best return on your investments.

Through our global network of service centers in more than 25 countries, we provide life-cycle service solutions from spare parts, maintenance, and technical service to modernizations and O&M agreements. Our ambition lies in maximizing productivity, while providing optimized and sustainable solutions for plant specific needs:

- Unparalleled service expertise and experience
- Certified Best Available Techniques (BAT)
- Improved equipment and environmental efficiency, reliability, and safety
- Optimized operating costs

Outotec has a worldwide network of service engineers with in-depth experience in the mining industry. We can accurately configure and adjust our high-performance systems to ensure maximum output and trouble-free operation.
Outotec provides leading technologies and services for the sustainable use of Earth’s natural resources. As the global leader in minerals and metals processing technology, we have developed many breakthrough technologies over the decades for our customers in metals and mining industry. We also provide innovative solutions for industrial water treatment, the utilization of alternative energy sources and the chemical industry. Outotec shares are listed on NASDAQ OMX Helsinki. www.outotec.com

Outotec® is a registered trademark. Copyright © 2015 Outotec Oyj. All rights reserved.