Autonomous and automated equipment use in a new iron ore mine

2001   - Ongoing   Countries covered: European Union
Other

Summary:

The truckless design of the operation: If S11D had been structured as a conventional operation, no fewer than 100 off-highway trucks, each with a 240 metric ton capacity, would have been required. Without these trucks, fuel consumption will be approximately 70% lower.

Description:

Extending from Pará to Maranhão in Brazil, the S11D iron ore mine is the result of an investment of US$14.3 billion, the largest private sector investment in Brazil this decade. In each part of the operation, spanning the mine, plant, railway and port, technologies were adopted to enable S11D to operate

sustainably while producing highquality iron ore for low costs.

One of the main technology solutions that make the mine a technology leader is its truckless system. This is a set of structures consisting of mobile excavators and crushers, interconnected by conveyor belts, which together extend for roughly 30 km. Spanning the mine, plant and piles of overburden and waste rock, the system replaces the offhighway trucks traditionally used in mining. The mine has four mobile excavator and crusher systems working simultaneously. After being initially crushed in the mine area, the raw ore, fragmented into smaller pieces, is carried by conveyor belts to a central transfer station. There, the iron ore, ore-rich overburden and waste rock are redirected to long-distance conveyor belts, which take the materials to the plant or to the piles. The whole process is automated. An operational control centre enables complete viewing of operations, 24/7. In addition to remotely monitoring key equipment conditions, the centre adds a strategic overview to the business and contributes to the adoption of preventive measures to strengthen safety, optimize operations and reduce impacts on production. From the centre, it is possible to activate all kinds of equipment, including conveyor belts, feeders, crushers, sieves and yard machines. All the most important equipment has transducers that monitor variables such as temperature and vibrations, allowing early identification of defects that may occur. It is also possible to monitor the performance variables of equipment and processes, such as production rates and operating performance.

Good practice areas:

Economic sustainability

The truckless in-pit crushing and conveying system is new to the iron ore industry. There is nothing else like it operating on this scale in the current market.

Environmental sustainability

From its inception, the project was designed to have the least possible impact on the environment and neighbouring communities. To this end, technology had to be present in the project's roots, starting from the planning stage. Furthermore, a strong link was made between knowledge, technology and the operation. Innovative solutions will improve safety and ensure the operation's high productivity, besides cutting water, power and fuel consumption, and consequently reducing greenhouse gas emissions. Alternatives were also sought to reduce the need to remove vegetation, contributing to biodiversity conservation.

Organisations involved:

Vale SA

http://www.vale.com/EN/Pages/Landing.aspx

Innovation category:

System

Impact on the mining value chain

- EXTRACTION (incl. Permitting)
- mineral and metallurgical PROCESSING (incl. Permitting)
- MINE CLOSURE / WASTE management (incl. Permitting)
- DATA and knowledge base

Extraction

- increased environmental performance

Processing

- increased environmental performance

Linked policies

Environmental policies (waste, water, land use, etc); mining policies and legislation - especially with regards to permitting of the mine and the system; tax policies; "Social License to Operate".

Transferability:

S11D has been a great source of learning for the company. It developed new solutions in the iron ore segment, improved quality control processes and adopted new practices that enabled them to follow plans, without ever losing sight of safety as a core value.

Innovation drivers and barriers

Drivers:
Policy
Environmental and social policies.
Economic
Economic considerations (i.e. the rising iron ore demand from China) were the key driver for S11D overall and also for setting it up as a truckless, autonomous operation (lower operational costs and greater operating efficiency).
Other
The location of the mine in the Amazon forest was also a key driver into setting the mine up as described above, aiming to minimize the environmental footprint.

Barriers:
Policy
The mine was planned to have the lowest possible environmental impacts and to be installed outside Carajás National Forest as far as possible. In practice, this meant dealing with land ownership issues in the Amazon, as the project is located in a remote region, featuring various illegally occupied settlements and areas, as well as large expanses used for extensive cattle grazing. In order to implement the project, the company purchased many properties around the site of the plant and future waste rock piles, covering over 25,000 acres in all. Part of this area is being restored to make up the project's legally mandated minimum area of native habitat, as part of a program to join up forest fragments.
Economic
Despite the decline in ore prices seen in the last few years, S11D's start-up will help the company remain competitive, delivering very high-quality products to the market at low production costs.

Impact Area

Area:

Environment, Ecosystem services and quality of natural resources

Impact on listed area:

+/-: The truckless mine design minimises the land footprint of the mine

Area:

Environment, Quantity of natural resources

Impact on listed area:

+: Significant reduction in energy and water use and air emissions

Area:

Human/Social, Occupational welfare (health and safety)

Impact on listed area:

+: The truckless and automated design improves safety at the mine site

Area:

Human/Social, Employment

Impact on listed area:

-/+: The high level of automation decreases the number of local jobs; on the other hand, it provides higher skilled and better jobs

Area:

Economic, Financial flows and profitability

Impact on listed area:

+: Reduction of costs to the company

Area:

Economic, Competitiveness

Impact on listed area:

+: Increased competitiveness due to lower operating costs