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Vale inaugurates the largest project in the history of the mining industry

The Eliezer Batista S11D Complex will start commercial operations in January 2017

Vale inaugurates today, December 17th, the largest mining project in its history and in the mining industry's history. Eliezer Batista S11D Complex - a construction work worth US\$ 14.3 billion - includes a mine, plant, railroad and port logistics and will enable the company to consolidate its position as the mining company with the lowest production cost in the industry. The enterprise integrates productivity, innovation and respect to the people and the environment. This is also the largest private investment made in Brazil in this decade, which will positively impact Brazilian exports, giving a new boost to the economic and social development of the country, particularly in the states of Pará and Maranhão. Vale's operations in Minas Gerais will also benefit from the project, since their ore will be blended with that extracted from S11D in distribution centers abroad.



[See more pictures of the S11D Project](#)

“For me, seeing the completion of S11D is much more than just witnessing a new landmark in the mining industry. More than an enterprise embodying the latest technology, low cost and high productivity, the S11D portrays Vale’s ability to make things happen,” states Vale’s CEO, Murilo Ferreira. “We have accepted the challenge to implement one of the largest iron ore mining operations in the world, even faced by uncertainties in the external scenario. Trusting our strategic management and our human capital, we went ahead with the mission of bringing out of blueprints one of the most daring projects of our company and starting it up,” he adds.

The inauguration is the result of a 15-year journey, which started in 2001, when the first technical and economic feasibility studies were developed, leading to the final configuration of the S11D Project. The Preliminary License (LP) was granted in June 2012 and, a year later, the Installation License (LI) was issued. On December 9th, the Operation License (LO) was granted. Today, the mine’s lifespan is expected to be 30 years.

Although the S11D mine and plant are located in Canaã dos Carajás, Southeast Pará, construction works were developed both in that state and in Maranhão. Out of the US\$ 14.3 billion invested in the project, US\$ 6.4 billion accounted for the mine and plant, and US\$ 7.9 billion refer to the construction of a 101km-long railroad branch, and to expansions of the Carajás Railroad (EFC) and of the Ponta da Madeira Maritime Terminal in São Luís (MA).

The rail spur, which connects the S11D mine to the EFC railway, had its start-up in early October with the circulation of the first 330-car train throughout the whole branch, including the railway loop. The new berth on Pier IV in Ponta da Madeira is being hot commissioned. Until November, five vessels totalling 1.3 million tons of iron ore had already been loaded through the new berth. S11D’s plant and mine have successfully started its hot commissioning, with approximately 300,000 tons of iron ore processed until November.

The ramp-up will be phased over four years in order to maximize margins and optimize the mix of products. The nominal production of 90 million tons per year (Mtpa) will be reached in 2020, adding a 75 Mtpa net capacity to the Northern System, which also includes the mines in the Carajás Complex and Serra Leste. The Northern region alone should offer about 155 Mtpa in 2016. In 2020, it is expected to offer 230 Mtpa, contributing to Vale’s estimated annual production between 400 and 450 Mtpa in four years, compared to 340 to 350 Mtpa forecast for 2016.

Together with new mines in operation in Carajás, Pará, and expansion projects already implemented in Minas Gerais, S11D will enable Vale to increase its competitiveness in the international market over the next few years. The cost of the S11D ore delivered at the Ponta da Madeira Maritime Terminal in São Luís (MA), the so-called C1 cash-cost, is estimated to be at US\$ 7.7 per tonne - 41% less than Vale’s current average C1 cost. The high quality of the ore extracted from the new mine will provide flexibility for the company to blend it at ports in China and distribution centers in Malaysia and Oman, with the ore produced in the South and Southeastern Systems, in Minas Gerais, improving the pricing of the final product.

The project was named after its location: it is on block D of the S11 body, on the South Range of Carajás. On the north range, since 1985, Vale operates the Carajás Mine, located in Parauapebas, a neighboring municipality of Canaã dos Carajás. For geological purposes, S11D is only one block of the ore body, which was divided in four: A, B, C, and D. S11’s

mineral potential is 10 billion tons of iron ore, and blocks C and D together have reserves of 4.24 billion metric tons. The first geological surveys in the region occurred in the 1970's.

S11D comprises a mine and an iron ore processing plant, with three production lines - each with a processing capacity of 30 million tons/year. The ore is extracted from an open pit mine and transported to the plant via a Long-Distance Belt Conveyor (TCLD). The plant, product and buffer stockyards, the waste and canga (iron ore with higher impurity grades) piles, and the train maneuvering and loading area are located in a pasture land, outside the Carajás National Forest (Flonaca). With this solution, it was possible to reduce in more than 40% the vegetation clearance inside the forest when compared to the initial master plan, which covered almost 2,600 hectares. Carajás National Forest has 412,000 hectares and, even after the implementation of the S11D, only about 4% will have seen interference from mining activities since Vale began operations in the region 30 years ago.

Besides reducing the impact on the forest, Vale also acquired several properties, totaling 10,300 hectares, around the plant and the future waste and canga piles. Part of this area is being rehabilitated to compose the project's Legal Reserve and to connect forest fragments, forming a green buffer around the project. Most of the acquired properties were made of pasture land, deforested by the former owners and, after revegetation, will be reconnected to the native forest. Up to now, more than 2,200 hectares, the size of 2,000 soccer fields, are being revegetated in a partnership with the Vale Institute of Technology (ITV), with the supervision of the Chico Mendes Institute for Biodiversity (ICMbio) and the Brazilian Institute for the Environment and Natural Resources (Ibama).



[Fly over the S11D Project in drone images](#)

Jobs

At the peak of the construction works, the project absorbed a workforce of more than 40,000 workers, most of them living in Pará and Maranhão, considering the project's work fronts (mine, plant, rail spur, Carajás Railroad and Ponta da Madeira's Port). Currently, about 15,000 people continue to work in the mine and at the plant and duplication works of the Carajás Railroad, which reached almost 60% of its physical advance in late November. Once the ramp-up is completed, about 2,700 employees will be working directly at the plant and mine and, at least, 10,000 indirect jobs will have been created.

The experience gained in several projects recently implemented by Vale raised the company's knowledge in managing the impacts generated by a project as big as S11D. One of the first actions developed by Vale's teams at the beginning of

the project, during the hiring process, was a capacity building program, including the training of staff from local employment and migrant public agencies. In partnership with the municipality of Canaã dos Carajás, the agencies' infrastructure was also improved, such as the National Employment Service (Sine) office, which was renovated. Vale also developed a demobilization plan, managed by a multi-sector work group including representatives from the municipality and other institutions in order to implement and monitor the proposed actions.

Technology

One of the main technological solutions that made the S11D an unique iron ore mining project, bringing huge environmental benefits, is the adoption of the truckless system, a set of structures comprised of mobile excavators and crushers interconnected by conveyor belt. In a truckless system, the shovels dump the ore in fully mobile crushers, which feed a system of mobile and fixed conveyors installed inside of the mine, and long distance conveyors connecting the mine to the plant and waste piles. The total length of the truckless conveyor belts operating in the mine and plant is 68 km.

The system replaces traditional off highway trucks (OHT) used in mining. If S11D had been structured as a conventional operation, 100 off highway trucks with a 240t capacity would be required. Without trucks, Vale will reduce fuel consumption by 70%. With less mining equipment, there will be a significant reduction in waste generation, such as tires, oil filters and lubricants.

The truckless technology is commonly used in coal mining, where the ore layers are continual and homogeneous. The characteristics of the S11D's mineral body enabled the application of this mining configuration, since it is an elongated, relatively homogenous mineral body, 9.5 km long per 1.5 km wide, and 300 meters deep.

Located 400 meters above the processing plant level, S11D mine will be divided into four mining system operating simultaneously, each with one shovel and one fully mobile crushing plant. After being crushed, the mined material will be transported through in pit conveyor belts to a transfer station, where the iron ore, canga and waste will be redirected to one of the three long distance conveyors: iron ore to the processing plant and canga and waste to stocking piles. The ore is transported through the Long-Distance Conveyor Belt Conveyor (TCLD), which is more than 9 kilometers long, while the canga and waste are transported through two parallel overland conveyors, each measuring five kilometers. Despite the high phosphorus content, considered a contaminant in the iron and steel process, canga has a high iron content; so it will be stocked at a different pile and may be used as product in the future.

Another technological driver of S11D project is the use of dry processing of the ore, with equipment developed by Vale in partnership with manufacturers, specially tailored to process the natural high moisture ore of Carajás. Dry processing is already in use in some plants in Carajás and will enable a 93% reduction in water consumption, which corresponds to the water supply for a city with 400,000 inhabitants. Another benefit of dry processing is that there is no need for a tailings dam, due to the high quality of the ore and to the dry processing. The ultrafine fraction of high grade iron ore, which would end up in the dam, will be part of the final product.

A final technological driver to be mentioned is the modularization of the processing plant, similar to the one used in the oil industry to build maritime platforms. The buildings of the processing plant were divided in modules during the project development and engineering. Then the modules, 109 in total, weighing from 80 to 1.3 thousand tons, were assembled at a construction site more than 40 km away from the place where the plant is now working. Before being put together, welded and bolted as if they were large Lego pieces, to form the plant buildings, the modules were transported through a road specially prepared and paved to support the weight and dimensions of the modules. This road also brought benefits to the farmers at the rural area of the municipality.

The transportation of the 109 modules was completed in August 2015 and their assembly at the mine was done in October of the same year.

With the truckless system, together with the dry ore processing, Vale will see a reduction of at least 50% of its Greenhouse Gas Emissions, which means about 130 thousand tons of CO₂ less per year in the environment. Also, 18,000 MWh/year of electricity are going to be saved, which corresponds to the consumption of 10,000 residences. This is a project that reinforces the company's commitment to reduce its emissions and the use of natural resources in its processes.

Logistics

After being processed, S11D's iron ore will be carried by railway to the Ponta da Madeira Maritime Terminal (TMPM) in São Luís. To enable the transportation, it was necessary to build a whole set of logistics, which will consume almost 55% of the US\$ 14.3 billion total investment. The S11D Logistics comprises the construction of a 101km-long railroad branch; the expansion of the Carajás Railroad (EFC); and the expansion of TMPM.

The works on the S11D rail spur began on February 2014 and have already been completed; its Operating License was issued on September 14th. Most of the branch goes through pasture areas. Only three of the 101 kilometers are within the forest. One tunnel and two railway bridges have been built with the purpose of ensuring the least possible interference in the Carajás National Forest, and ensuring the wildlife migratory flow. Additionally, throughout its extent, 32 wildlife crossings, of which three are primate crossing bridges, were installed to enable the circulation of wild animals.

The rail branch connects to the Carajás Railroad in Parauapebas, Southeast Pará. Considered one of the most efficient railroads in the world, EFC is 892 kilometers long. As part of the EFC expansion, 570 kilometers of new railway lines are being implemented alongside the existing lines, interconnecting 48 crossing yards. In addition, 220 kilometers of railroad tracks on 55 crossing yards are being remodeled to allow trains to transit at designed speed. About 60% of EFC duplication works are completed.

Currently, 56 trains can circulate at the same time in the Carajás Railroad, including ore trains, general cargo and passenger trains. The iron ore train is one of the largest cargo trains in the world in regular operation, with 330 cars and 3.3 kilometers long. It is possible to carry 33,000 tons of iron ore at once on it, corresponding to 1,000 cartloads. With the duplication of the railroad, it will be possible to increase circulation to 69 simultaneous trains, enabling to meet the iron ore production increase to be seen with the S11D and the expansion projects in the Carajás Mining Complex.

Port

Finally, the S11D Logistics includes expansion works at the Ponta da Madeira Maritime Terminal. At the end of the first semester of 2016, Vale has completed the expansion stages of the railroad branch within the port. With its completion, TMPM will have its nominal capacity increased to 230 million tonnes per year. This production level will not be reached at once, however. That is because port works depend on the other stages of the S11D Project, such as the duplication of EFC and the end of the mine and plant ramp-up.

The TMPM works included onshore and offshore expansions, in addition to the expansion of the railroad branch, located within the port. In the offshore area, the project included the construction of a new berth on Pier IV, the North Berth, plus a ship loader, replicating the same design already existing in the South berth. In October, Pier IV's North berth began loaded commissioning tests.

The advantage of Pier IV in relation to other Brazilian ports is the capacity to receive large-size ships such as Valemax, the largest ore carrier in the world, with a capacity of 400,000 tons, 362 meters long and 65 meters wide. Since it is in open sea - that is, with no seawalls or jetties -, the pier required extra safety precautions from Vale, since the construction was performed over the sea. Its mooring system is unique in the world for ships with a capacity of 400,000 tons. It is comprised of onshore lines that aid the mooring of the ships to the berths. At Valemax, 16 onshore lines and 20 ship lines are used, to a total of 36 lines. The system enables giant vessels to operate without restrictions at the pier.

The onshore works comprised the expansion of the port's dry area, where four new ore stockyards have been built, with a capacity for 600,000 tons each. They are added to the nine existing stockyards. The new yards have two rotary car dumpers, one stacker, two reclaimers and two stacker-reclaimers. Finally, the works at Ponta da Madeira have also included the expansion of the railroad branch, delivered in late July. The Ponta da Madeira Maritime Terminal is comprised of the Locomotive Inspection and Filling Station (Pial) and a rail car workshop, which includes a Wheel Exchange Center (CTR) and a Wheel Maintenance Center (CMR). Both use brand new technologies, which are able to exponentially increase the productivity cycle in these routine operations. Today, almost 15,000 wagons are used to transport iron ore over the EFC and, in 2020, when the S11D is in full production, these will be 19,000. The increase in the number of wagons in circulation will make the part replacement process an even more complex task. This is when the new wagons workshop and the new locomotive filling station will be able to show all their importance to ensure EFC's capacity grows.

The process works as follows: the 330-car trains coming from Carajás, in southeast Pará, are broken down into 110-car blocks to facilitate unloading. While the ore is removed, the locomotives move on to being reviewed at Pial, with a capacity to service up to 12 locomotives at once. Pial resembles a F-1 pitstop, since it is completely integrated with the railroad circuit. Before, the locomotive would have to leave the circuit and be brought into a workshop to be supplied and submitted to corrective and preventive maintenance. Now, in addition to a greater integration of processes, the main benefit was the reduction in the preparation time of the locomotives for a new trip, which may last up to 90 minutes.

After being unloaded, the cars are pulled by the locomotives already revised and loaded to the Wheel Exchange Center. The axle comprises the wheels, the bearings and the shaft and enables the movement of the car over the tracks. At the CTR, any axles that require maintenance are removed and replaced by others in perfect working conditions. The Center has a capacity to service up to 2,000 cars a day. In this new method, which lasts up to 15 minutes, there is no longer need to separate the car with the damaged axle from the block, as was done before. The exchange made with the integrated block reduces maintenance downtime.

Any axles requiring maintenance are sent to the Wheel Maintenance Center. At this other large workshop in the complex, state-of-the-art equipment is used to perform the necessary repairs, leaving the axle apt to be used in new trips. Once the locomotive is supplied and revised, and the axles are replaced, it is time to assemble the train to go back to Carajás.

More information



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