deugro

Case Study

Belo Monte Power Project

Industry
Power

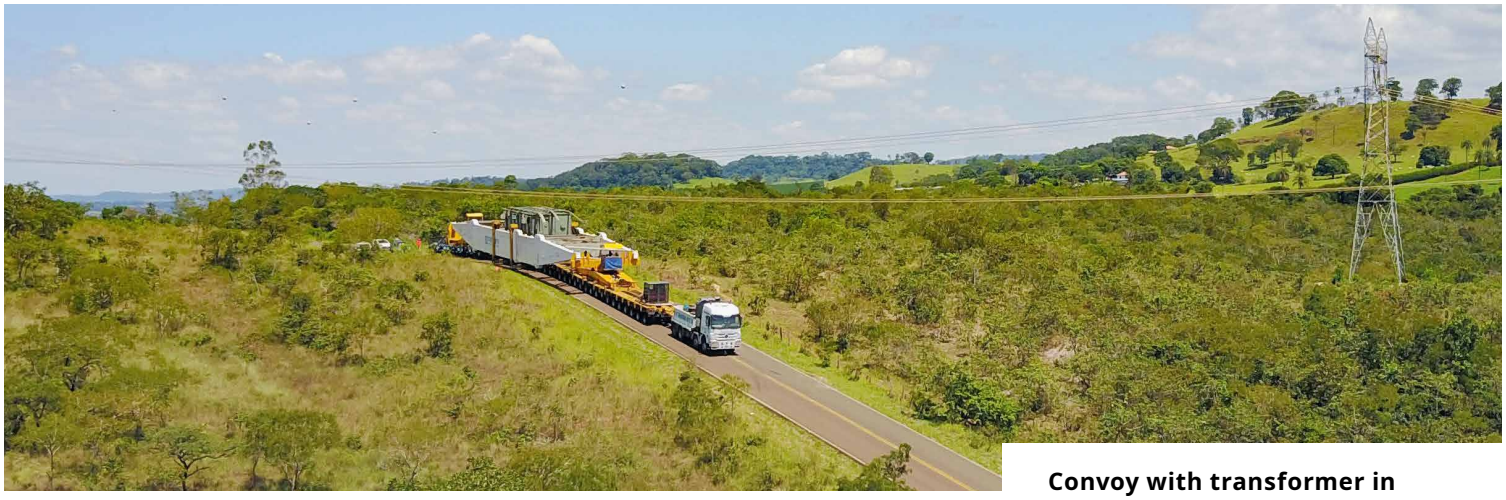
Significant tide changes, winds, currents and busy ferry traffic on the Amazon River

Steep 14% incline at discharge in Xingu

Vast distance - routes spanning half the Earth's circumference

Difficult and complex Brazilian terrain

Roads affected by cargo weight and size



Convoy with transformer in side girder bridge in Cristais Paulista, Brazil

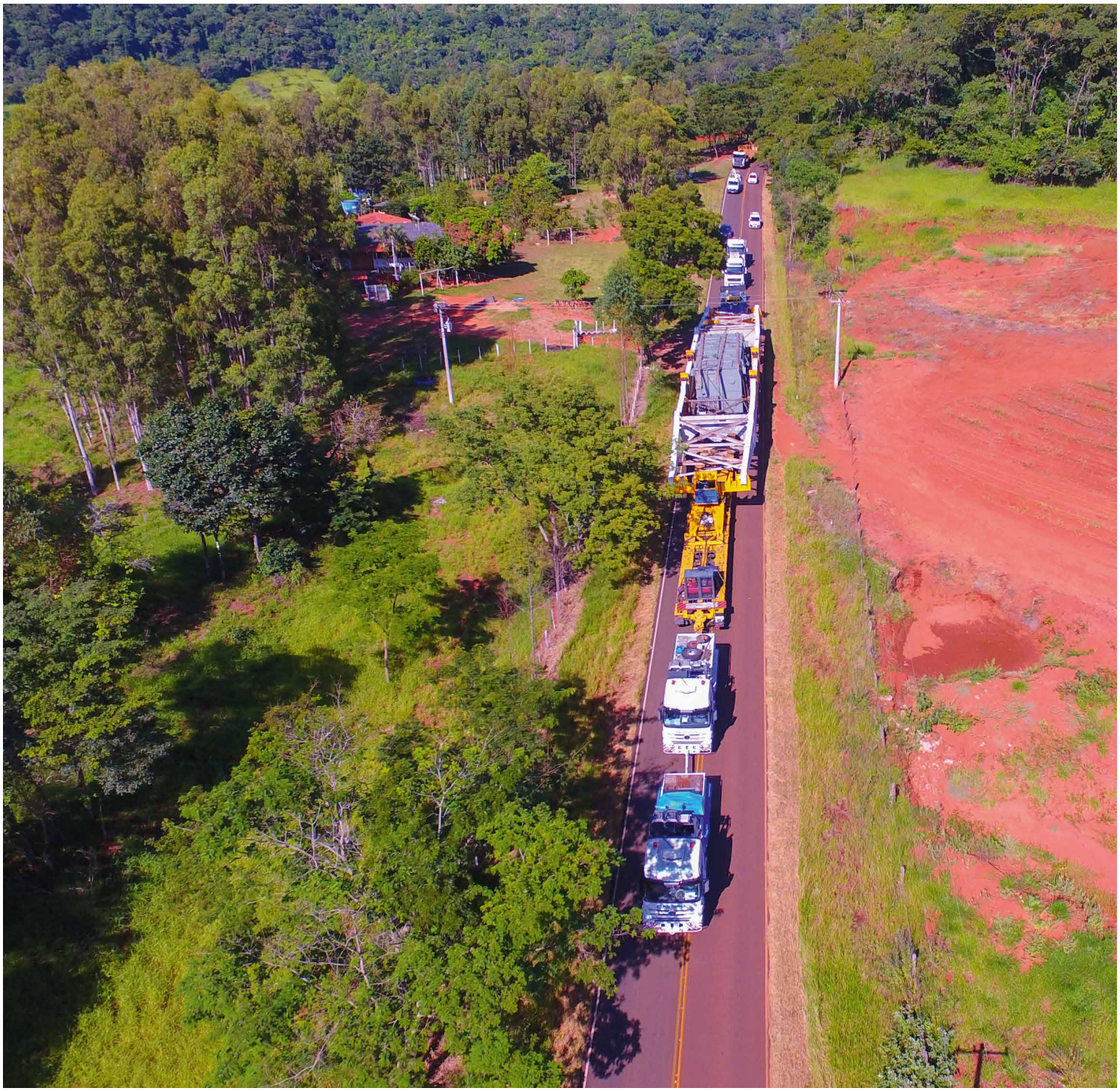
Case Study: Belo Monte Power Project

The government of Brazil set up a growth acceleration program aimed at developing the infrastructure of roads and dams, mainly in the Amazon area in order to boost economic growth in the region. When finally up and running, Belo Monte will be the third-largest dam in the world, behind Three Gorges (20,300 MW), China, and Itaipú (14,000 MW), partly in Brazil and Paraguay. The dam will be the main Brazilian hydroelectric plant, generating more than 11,000 megawatts of power at full capacity. The power generated will be transmitted over a 2,000-kilometer-long transmission line, able to provide sustainable energy for 17 entire Brazilian states and hence 60 million people. This amount of energy would replace the output of about eight nuclear power plants.

deugro was awarded the project for executing the transportation of the project's phase one, which encompasses two subsequent projects. The first project, UHE Belo Monte (hydro power plant), a consortium formed by the market leaders of this segment, includes the transportation of transformers and equipment (turbine rotor and turbine shaft) from Brazilian factories to the Belo Monte complex. The second project, High Voltage Direct Current (HVDC), likewise contains the transportation of transformers and equipment but from worldwide origins to two corresponding converter stations located in Xingu (state of Pará) and Estreito (state of Minas Gerais), Brazil.

Location

The Belo Monte power plant is located on the Xingu River, a main side river of the Amazon River in the state of Pará, near the city of Altamira, North of Brazil. While the hydroelectric plant complex is based in Xingu, and a first converter station right on the other side of the river, the town of Estreito is home to the Belo Monte's endpoint converter station. Estreito is located about 2,000 km south of Xingu, close to Belo Horizonte. Due to the difficult and complex terrain, deugro faced various challenges during the planning phase and execution of this project.



Project execution: High Voltage Direct Current (HVDC)

The transformers manufactured in Germany, China and Brazil were shipped by heavy lift vessels to the ports of delivery in Santos and Belém, where parts of the cargo were transshipped on locally sourced deck barges with special grillages. This allowed the self-propelled modular trailer (SPMT) to enter underneath the transformer at the final discharge location in Xingu, Pará for further transportation. The other part of the cargo was transported by road with specialized heavy haulage equipment.

After a five-day voyage through the Bay of Guajara, Marajo, Pará River, Straight of Breves, and Amazonas River before finally heading into the Xingu River, the deck barge arrived at the discharge location at Xingu, where a custom-made mobile jetty was waiting to discharge the valuable cargo. This jetty had been constructed in cooperation with a subcontractor especially for this project, in order to be able to adjust to the local tide variations. In addition, using the custom jetty allowed the team to minimize community impact and to avoid disruption of the vital ferry service of the Trans-Amazonian Highway.

» The custom jetty allowed the team to minimize community impact and to avoid disruption. «

The discharge at Xingu was one of the major challenges of the project and had to be planned and executed carefully in cooperation with a team of engineers from dteq Transport Engineering Solutions, a company of the deugro group.

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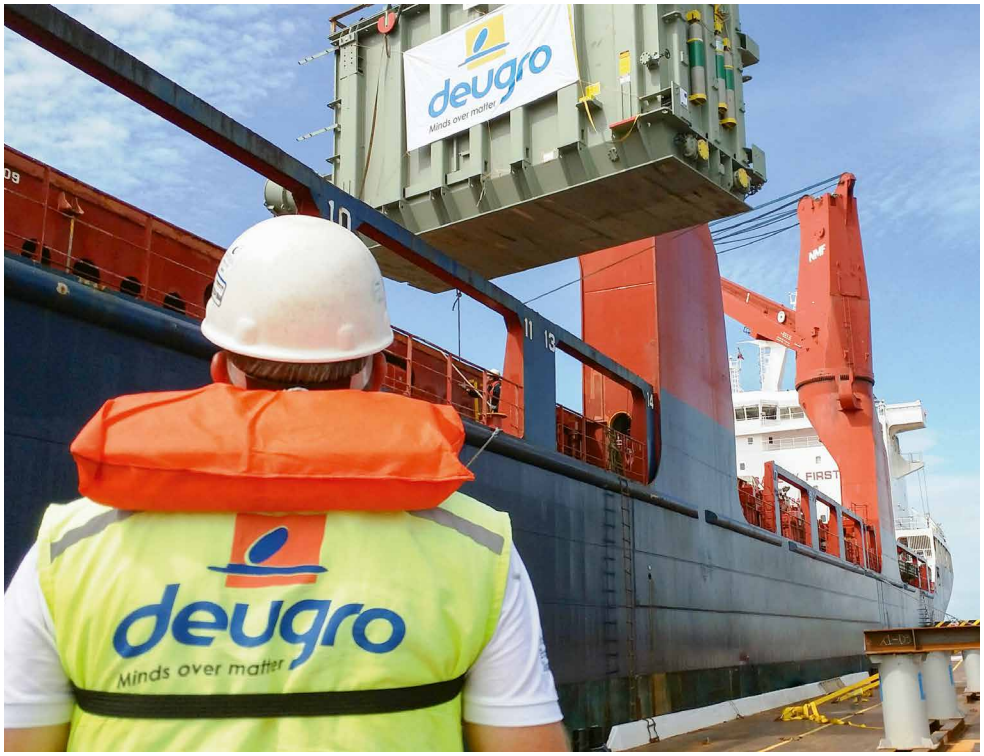
Project Data

- Cargo: 28 transformers
- (14 x 400 kV, 219 MT each; 14 x 800 kV, 332 MT each)
- Max. dimensions: 1,070 x 480 x 510 cm
- Origins: Germany, China and Brazil
- Places of delivery: Vitória do Xingu (Belo Monte jobsite) and Estreito (substation), Brazil
- Volume: 68,343 FRT



While docking, the barge had very few contact areas available and specific mooring points had to be built. Once the barge was safely placed for the roll-off operation, the cargo needed to overcome a 14% incline on the gravel path of the Xingu riverbed. The solution to secure this crucial move was a special surface on the jetty to prevent a slide backwards. The whole jetty was fixed on steel beams built into the ground. This precise move was only effective due to great teamwork of all project parties involved.

From here on, deugro successfully managed the transportation via SPMT up to the final job site, the HVDC converter station in Xingu. This station is able to receive energy from the Belo Monte complex and to convert it into alternating current to transport the energy to the town of Estreito, which is 2,000 kilometers away.

» This precise move was only effective due to great teamwork. «

At the same time in Estreito, multiple axle line trailer and girder bridge units delivered the remaining transformers. The sheer size of each transformer meant that roads would be affected. In cooperation with the local authorities, deugro minded all weight limits and other regulations. Various measurements were taken, such as allowing the roads to “breathe” between each massive cargo move or bridge inspections after each load.

One particular road section was so uneven that it required the height of the hanging cargo on the girder bridge to be raised. The cargo would otherwise have been hung up on the hilly parts of this challenging route.

Experience the complete transportation and watch the HVDC project video on YouTube: deugro group – Belo Monte Project.

Point of View:

Teamwork Was a Key to Success

Meet Cristiani Gomes, one of the dedicated logistics experts who played a significant role within the Belo Monte project team. She attended the project on site in Brazil, which faced various obstacles. Discover insights into the local project operations and gain a personal impression in the following interview.

Cristiani Gomes, Operations Manager

Given the rather poor infrastructure of the remote location, how did deugro manage to have all specialized equipment in place?

deugro started working on this project way in advance and had studied road conditions in detail for this project before deciding on the equipment. By working on this very closely with our trusted subcontractor, we managed to choose the suitable girder bridges, barges and self-propellers axle lines, matching the quantity with the high demand of transport frequency.

In your opinion, what is the main factor that led to success in regard to the Belo Monte project?

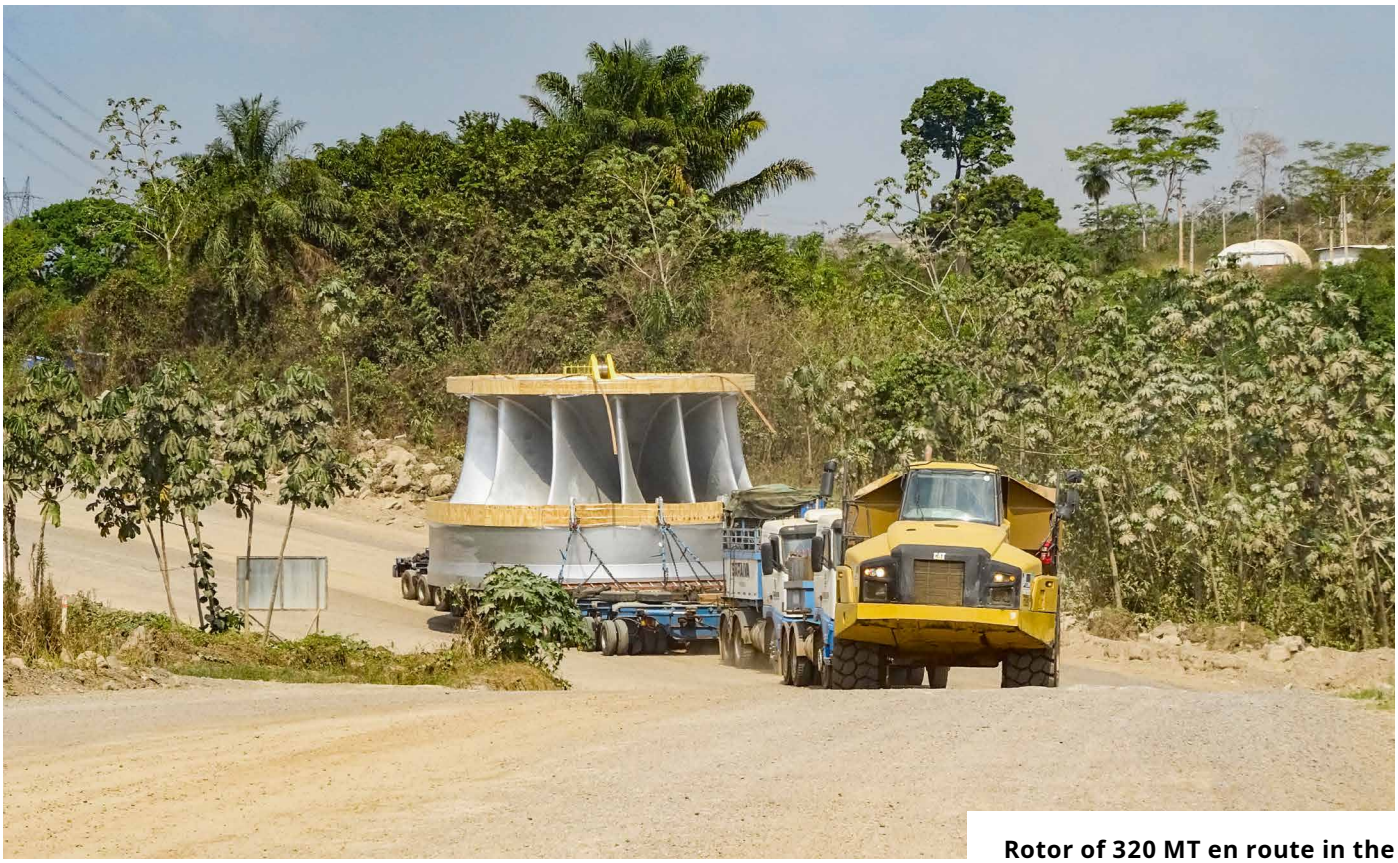
I would say that besides technical expertise, months of thorough preparation and the teamwork between the parties involved were most important. deugro managed to join the best minds for this project, which resulted in smooth and safe operations.

Do you think this project will cause sustainable change for the local economy?

We sincerely believe that this project will have a long-term positive effect on the local community and strength Brazil's economy by avoiding blackouts and providing clean and reliable energy.

Which action did deugro take to minimize the environmental impact of the project?

Given the remote location of both converter stations and the proximity to local communities, special care was taken to minimize social impact by the transports. For example, when transporting, the convoy was stopped at strategic areas in order to let the local traffic pass.



Rotor of 320 MT en route in the remote area of Xingu, Brazil

Project execution: UHE Belo Monte (hydro power plant)

The scope of work awarded to deugro not only included transportation by road and ocean, but also discharge and storage. From the factories in Taubaté, Jundia, Araraquara and Canoas, the cargo was trucked to the ports in Santos and Porto Alegre, where they were subsequently stored while awaiting further transport.

The next leg of transportation involved ocean freight from Santos and Porto Alegre to the Port of Outeiros in Belém, Pará. Here, the cargo was discharged from vessel to barge and set off on its voyage to the port in Belo Monte.

Using a gantry crane with a total capacity of 420 metric tons, the cargo was discharged onto truck for further transportation by road to the storage area. The crane was provided by Norte Energia, the company responsible for the site and construction as well as the end client. The final movement involved the trucking of transformers from the storage area to the final foundation, while the remaining equipment was taken to the power house.

Project Data:

- Cargo: 40 heavy lifts (14 transformers up to 218 MT, 6 transformers up to 265 MT, 10 rotors up to 320 MT, 10 turbine shafts up to 125 MT)
- Max. dimensions: 8.83 x 8.83 x 5.04 m
- Origins: Araraquara, Taubate, Canoas and Santos, Brazil
- Place of delivery: Vitória do Xingu, Brazil (Belo Monte job site)
- Scope: Ex works from factory to job site
- Volume: 10,241 FRT