

## SITE REPORTS

## PARAISO, GUACA, BETANIA

# 100% REDUNDANCY

**COLOMBIA** – EMGESA S.A.E.S.P from the ENEL Group has granted a contract to supply seven out of nine governors for the Paraiso, Guaca and Betania hydropower plants to ANDRITZ Hydro Colombia

The three hydropower plants are located in the center and south-east of Colombia and are strategically important for the generation capacity of the customer. HPP Paraiso and HPP Guaca have three vertical Pelton turbines each with a total capacity of 276.6 MW and 324.6 MW, respectively. HPP Betania has three vertical Francis units with a total capacity of 540.9 MW.

For ANDRITZ Hydro the contractual scope is to rehabilitate the governor system, including new governors for the seven units, replacement of hydraulic power unit instrumentation, and speed measuring devices. The contract also includes integration with the existing SCADA system, as well as installation, commissioning, and training. A major objective of this project is to accomplish primary regulation according to the CREG 25 code of Colombia.

Due to the high concentrations of hydrogen sulfide at HPP Paraiso and HPP Guaca, a high efficiency air filtration system has been considered for each electrical cabinet to keep the electronics safe.

Unit #1 of both HPP Betania and HPP Paraiso have been successfully installed.

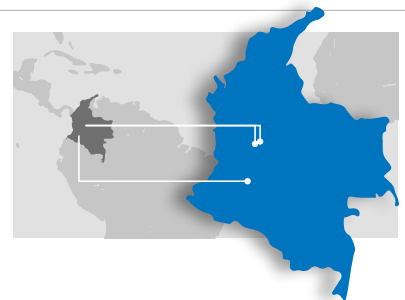
During commissioning, complete redundancy tests were carried out, verifying that the system has 100% redundancy. Integration of the new hydraulic system surpassed the expectations of the client after new hydraulic blocks for the distributor valve and the deflectors for the Pelton units were installed. The original lever-driven feedback governors were replaced by state-of-the-art electronic governors. During the fingerprint vibration measurement, the maximum over speed for load-rejection in the Pelton unit was 106% after the new implementation. This compares with 112% prior to the upgrade.

Currently, the assembly of unit #2 at HPP Paraiso and unit #3 at HPP Guaca is ongoing. Commissioning of unit #2 of HPP Guaca and units #2 and #3 at HPP Betania are scheduled for 2018.

With the successful execution this project ANDRITZ Hydro Colombia strengthens its market position for governor modernization in Colombia.

## AUTHOR

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Paraiso, Guaca, Betania | Colombia

#### Technical data HPP Paraiso:

Output:	3 × 92.2 MW
Head:	865 m
Voltage:	13.8 kV
Speed:	514 rpm

#### Technical data HPP Guaca:

Output:	3 × 108.2 MW
Head:	1,015 m
Voltage:	13.8 kV
Speed:	514 rpm

#### Technical data HPP Betania:

Output:	3 × 180.3 MW
Head:	72 m
Voltage:	13.8 kV
Speed:	128 rpm