

Design, manufacture, and supervision the installation of 4 MGS custom gearboxes for the cooling towers of the Miravalles Geothermal Power Plant in Costa Rica



ICE, Instituto Costarricense de Electricidad, is a pioneer in the exploration of geothermal fields. ICE initiated in the 1960s the first studies on Costa Rica's geothermal potential for electricity generation. These concluded with the discovery of nine vast deposits in the northern province of **Guanacaste**. In 1988, construction began on the Miravalles Geothermal Project on the southern slopes of the Miravalles volcano. After seven years, on March 25, 1994, the first unit with 55 megawatts (MW) capacity started operations. In the following ten years, four more teams came into operation, constituting the Miravalles Geothermal Field, with an installed capacity of 165.5 MW and a monthly production of 84.8 gigawatt-hours (GWh) operating at its maximum capacity. **Miravalles I** was inaugurated in 1994 and **Miravalles II** in 1998. Each plant has a 55 MW unit and the technology is "condensing".

← A crane lifts the MGS Gearboxes into the tower for installation.

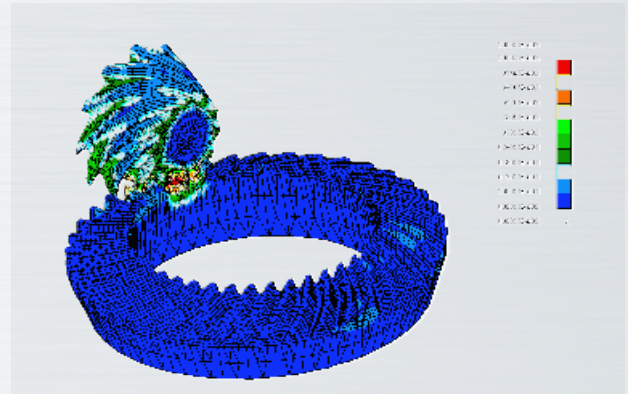
The case ICE requested that **ABS Costa Rica** implement a customized mechanical drive system in the cooling towers of the Miravalles I and II geothermal project cells. The previously installed gearboxes were starting to show some signs of failure. An in-depth review was needed to explain their behavior and propose a long-term solution that would extend the life of the equipment, improve its performance and optimize its maintenance.

Technical Solution After a first analysis, ABS Costa Rica detected failures originated in the high-speed bevel gear-pair, probably due to wear, which is common in 90° or bevel right angle catalog gearboxes as the ones initially installed, and proposed their replacement by new gearboxes custom designed and manufactured by its brand MGS based on the technical specifications of the ICE with the following criteria and objectives:



Standardize the gearboxes so that they can be installed in two types of cooling tower cells (Miravalles I and Miravalles II cells) and can be **interchangeable between the different towers** of the plant. This has a positive impact on maintenance cost savings, as it eliminates the duplication of spare parts, reduces inventory, and allows a more efficient assessment of overall performance.

Increase the Service Factor of the new gearboxes. ABS Costa Rica designed and manufactured four custom-made gearboxes, through its brand MGS Gears, with the highest manufacturing quality criteria. A case-hardened and tempered steel alloy was used for the bevel gears to achieve high wear resistance and very high gearing precision, which is essential for reliable operation at 1750 rpm. In addition, **its geometry was considerably improved** by using a globally recognized manufacturing profile that contributes to standardization and ensures component quality. Stronger, closer to the theoretical and ideal rolling tooth shape, and much smoother and efficient than catalog gearboxes.



“ABS standardized the MGS gearboxes so that they could be installed in two types of cooling tower cells (Miravalles I and Miravalles II) and could be interchanged between the different towers in the plant.”

To improve the reliability and maintenance of the equipment, it was also decided to incorporate **monitoring sensors to remotely control** its condition about the temperatures of all its bearings to analyze vibrations, oil level, and a series of other conditioning factors that allow establishing complete and real-time control of the condition of the gearbox and all its components. In addition, to achieve greater efficiency in the reception and sharing of data, the monitoring was **integrated with the SCADA** (Supervisory Control and Data Acquisition) system, which is currently used by ICE to receive and manage all the information generated in the process for supervision, quality control, data storage, etc.

Currently, the custom-made MGS gearboxes are installed and fully operational at the Miravalles geothermal power plant I and II.



Gearboxes prepared in the MGS workshop in Italy.



Local technicians during the installation of the MGS gearbox in one of the cooling towers.