

GEOHERMAL RETROFIT



WHY CHOOSE A GEOTHERMAL RETROFIT?

Geothermal power plants provide a unique answer to many of the needs and challenges of the current energy landscape and the energy transition objectives. Far better than other types of renewable power plants in meeting the base load energy demand, they are fuelled by a locally available flow of resources.

Much less dependent on supply conditions than other power generation technologies, geothermal facilities enjoy all the benefits of running on freely available fuel.



However, by their own unique nature, geothermal plants are also very location specific. Geothermal fluids can display very aggressive chemical properties, creating a heavy-strain working environment for turbines that severely affects their components and leads to fast ageing.

Consequently, the retrofit of components with newly designed ones becomes more interesting to plant owners compared to carrying-out service activities or building a new plant.

Building a new geothermal plant implies solving a variety of complex site-dependent issues that may simply make it economically or technically unfeasible.

Ansaldo Energia offers retrofit options based on viable, tested solutions, proven to restore the optimal plant operation and able to fulfil geothermal field exploitation/utilization criteria that may have changed over time.

Our retrofit options enable geothermal plant operators to continue using what is currently believed to be one of the most advantageous sources of energy, making the most of their existing facilities with state-of-the-art technical solutions.

How you can benefit

Our experience in the geothermal power sector dates as far back as a century ago, when the first in the world steam-driven turbine-generator unit ever installed was put into operation at Larderello, Italy.

Over a hundred years later, Ansaldo Energia ranks among the world's leading manufacturers of geothermal turbines/generators, with a range of products that stand out for their reliability, efficiency and remarkable design flexibility.

Providing a viable, cost-effective and profitable option to revitalize existing facilities and successfully solving the issues that cannot be tackled through conventional overhaul, Ansaldo Energia's retrofit solutions empower geothermal plant operators to successfully respond to the new needs of their sector, and of the energy landscape at large.

We provide an attractive and effective alternative to building new installations, avoiding technical hurdles, lengthy construction schedules, and huge upfront costs.



Our solutions

Ansaldo Energia can design tailor-made turbine retrofits according to Customers' specifications with a minimum impact on the existing BOP equipment and civil works.

Our geothermal retrofits also provide an opportunity to increase unit efficiency thus responding to changes that may occur throughout the geothermal basin's utilization timespan, improve operational reliability by replacing obsolete protection/control systems with modern ones, and extend plant life by installing new equipment to substitute worn out components.

Ansaldo Energia's retrofits are proven to solve geothermal plant issues even in very complex scenarios, such as forced outages caused by severely damaged components or design-related issues arising after the warranty period has expired.

Landmark projects

A description of a few example projects related to our retrofit services is provided hereunder.

	Increase in unit efficiency	Improvement of operational reliability	Lifetime extension	Customized solutions
Serrazzano	■	■	■	■
Rancia 2	■	■	■	■
Kamojang	■	■	■	■



SERRAZZANO

(Italy)



A very unique case of upgrade to dual admission operation.

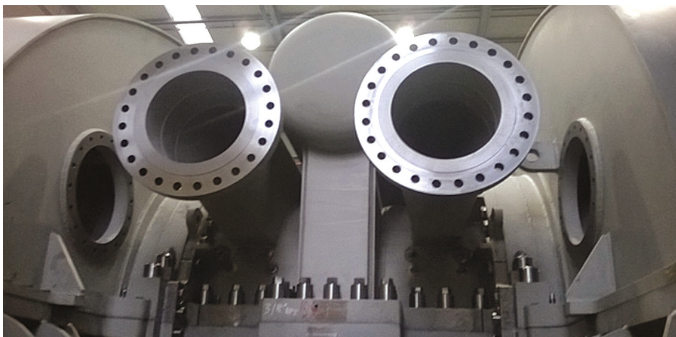
Customer	Enel Green Power
Scope of supply	Steam Turbine
Main goals achieved	Increased unit efficiency, Corrosion issues solved

Thanks to the retrofit, the plant's generation capacity reached 59 MW instead of the original 46 MW produced with the single admission solution, under the same boundary conditions.

The plant of Nuova Serrazzano is one of the geothermal plants owned by Enel Green Power and located in the geothermal area of Larderello, Tuscany (Italy). The plant consists of one turboset and it was built in 2000 to replace the existing smaller units of Serrazzano and Lago.

For 15 years, the plant's single admission turbine, originally manufactured by Ansaldo Energia, was fed with the steam from the area's major geothermal reservoirs. In 2016, Ansaldo Energia designed a retrofit for the existing turbine, based on revisitation of the concept of dual/triple flash plants. The project aimed to optimally harness energy from the local steam-dominated geothermal basin that feeds the plant with the steam extracted from multiple wells under different conditions.

The retrofit's main feature consisted in replacing the original turbine casing with a newly-designed one that allowed to feed the turbine with steam at two different pressure levels: the previous configuration required to throttle the steam from the Val di Cornia's deep wells in order to reach the same lower pressure levels as the steam from the shallow wells located near the plant.



The new turbine has been designed to avoid the remarkable corrosion issues that affected the original one. To withstand the extremely aggressive chemistry of the geothermal fluid from the local basin, the retrofit turbine casing's inner surfaces are made of highly corrosion resistant martensitic stainless steel instead of the carbon steel conventionally used for this type of applications.

Landmark projects

RANCIA 2

(Italy)

The third generation of 20 MW geothermal turbines



Customer	Enel Green Power
Scope of supply	Steam Turbine, Generator, Relevant Auxiliaries, Protection/Control System
Main goals achieved	Increased unit efficiency, Improved operational, Reliability

The newly designed unit features longer last stage blades than the original turbine, which increase the output of 1 MW (+5%) at full load under the same boundary conditions.

Rancia 2 is one of several Enel Green Power plants in Italy. It was fitted with the first generation of 20 MW turbine manufactured by Ansaldo Energia in the 1980s.

The retrofit took place in 2012 and it was the first of six similar projects targeting the replacement of outdated 20 MW turbogroups at different power plants, not all of which were originally manufactured by Ansaldo Energia.

The new turboset was designed to be of the same size as the original one. One of the Customer's key requirements was to preserve the existing interfaces with other parts of the plants, including the foundations, gas extractor and condenser, in order for turbine replacement to be carried out as rapidly as possible.

In addition, to capitalizing on past experiences with the first and second generation turbosets manufactured in the 1980s and 1990s respectively, the new unit's design incorporated several novel elements reflecting the experience acquired with extremely aggressive environments. Moreover, it fulfilled many Customer's requests related to operating issues.

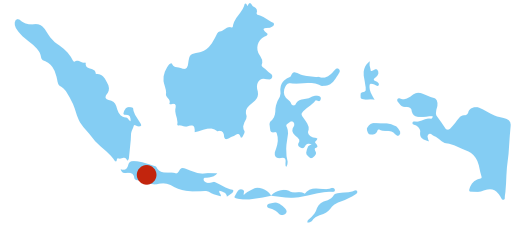
Despite the task of the new design development stage on the production schedule for the first of these six units, production was completed a month ahead of the contractual deadline and site works finished a week earlier than originally foreseen.

Landmark projects

KAMOJANG

(Indonesia)

Rehabilitation of a non-OEM power plant



Customer	Enel Green Power
Scope of supply	Steam Turbine, Generator, Mechanical/Electrical Plant, Equipment, Distributed Control System
Main goals achieved	Solved outage (replacement of severely damaged turboset), Increased unit efficiency, Improved operational Reliability, Extended lifetime of plant components

Ansaldo Energia's engineering and commissioning know-how specific to the geothermal sector was a major contributor to the successful project delivery.



Ansaldo Energia worked in consortium with local partner PP.PT for the rehabilitation of a 30 MW unit at the geothermal plant of Kamojang, near Bandung, Central Java. The plant is owned by Indonesia Power, a subsidiary of the state utility PLN.

Group 1 had previously faced a prolonged outage after a catastrophic accident involving the turbine. The construction and commissioning works were successfully completed in December 2017 on a tight schedule of 12 months.

This was an excellent result considering the scope of the retrofit project, which covered almost the entire set of mechanical and electrical equipment alongside the turbine, with only a few BOP items to be reconditioned (e.g. contact condenser). Maintenance of civil works was also included. This successful joint rehabilitation endeavour reflected the strong, efficient cooperation established among Ansaldo Energia, Indonesia Power and PT.PP, the local partner.

Effective project organization was key in solving several critical logistics and transportation issues. The turbine was designed as a drop-in solution based on the modified version of a standard product from the Ansaldo Energia range, able to fit within the original unit's footprint.


This made it possible to reuse the totality of existing turbine foundations and anchoring systems, which allowed for a substantial reduction of construction time. As compared to the original unit, the new turbine also features an optimized design that improved the Gross Heat Rate by 5.5%.

Thanks to this recently-awarded contract, Ansaldo Energia's geothermal presence in Indonesia has reached a total of 250 MW, including another four 55-60 MW geothermal steam turbines put in operation in the '90s.

The background of the entire page is a high-contrast, blue-toned photograph of a large industrial turbine. The image shows the complex, curved blades and stator vanes of the turbine, creating a sense of depth and mechanical precision. The lighting is dramatic, highlighting the metallic textures and the repetitive patterns of the turbine's components.

ansaldo | energia

For more information, please visit www.ansaldoenergia.com

Follow us on LinkedIn  www.linkedin.com/company/ansaldo-energia

Ansaldo Energia, all rights reserved. Trademarks mentioned in this document are the property of Ansaldo Energia, its affiliates, or their respective owners in the scope of registration. The information contained in this document is merely indicative. No representation or warranty is provided, nor should be relied on, that such information is complete or correct or will apply to any particular project. This will depend on the technical and commercial circumstances. Said information is provided without liability and is subject to change without notice. Reproduction, use or disclosure to third parties, without express written authority, is strictly prohibited.

Via N. Lorenzi, 8 - 16152 Genoa - Italy
Ph: +39 010 6551 - Fax: +39 010 655 3411
LinkedIn: www.linkedin.com/company/ansaldo-energia
ansaldoenergia.com