Services for thermal power plants

Alstom is dedicated to keeping thermal power plants competitive. Thanks to our OEM (Original Equipment Manufacturer) expertise and involvement in around 25% of the world’s power production capacity, we operate from a position of proven expertise. With 15,000 power industry professionals spread across 200 world-wide locations, Alstom Thermal Services supports our customers with extensive service solutions for daily operations and maintenance while helping to enhance lifecycle management.

In a changing competitive and regulatory environment, flexibility and expertise are key. Building on our global fleet and project execution experience, we partner with owners of Alstom and other OEM equipment to help maximise performance and lifetime profitability while keeping safety, reliability and environmental compatibility top priorities.

Alstom is a global organisation that cultivates cutting-edge expertise at the product/technology level while maintaining a strong local presence to meet site-specific needs and efficiently deliver tailored solutions in both established and emerging markets. Whether you require support in the areas of skills or systems, we have the technology, solutions and presence to meet your needs.
In today’s competitive markets, utilities, independent power producers and merchant power generators are all looking to maximise the reliability and availability of their generator assets. Plant ageing, performance concerns, grid compliance challenges and the need for operational flexibility are further issues that demand far-sighted solutions.

As a leading Original Equipment Manufacturer (OEM), Alstom has a long and diverse generator heritage, which results in an unrivalled range of technical expertise, fast solutions and equipment know-how. Furthermore, our global field service experience provides fast feedback and encompasses a large installed base of legacy equipment and state-of-the-art products.

Economic pressure and sustainability issues demand intelligent approaches to generator lifetime optimisation.

Services for generating excellence

**Optimising for reliability & availability**

With in-depth knowledge of all types of turbogenerators and generator auxiliary systems, covering the entire power range, Alstom has technologies and solutions for all your rotor and stator lifetime challenges. As a leading player in fast rewind solutions, our time-to-restart is excellent and we always harness the latest winding technologies to increase reliability and availability and boost the unit output.

**Local, global, universal**

By partnering with Alstom for your generator operations and maintenance, you get the best mix of local capabilities, regional hubs and global expertise. And we are not limited to serving Alstom equipment. Many of our customers have equipment from other manufacturers, but are drawn to Alstom by our unique portfolio of technologies and our ability to deliver solutions that match the customer’s goals.
Our power generation offering is based on a deep understanding of power markets and our customers’ needs. It is organised around three levers to maximise the return of assets over their entire lifecycle.

**Clean Power, Clear Solutions™**

**Reducing cost of electricity**

It takes competitive assets to keep electricity affordable. We enable power companies to compete successfully in the marketplace and provide affordable electricity to consumers. We help you reduce the cost of electricity through:

- Efficiency improvements
- CAPEX reduction/scaling up
- Capacity factor increase (renewable)
- Lead time reduction
- Competitive O&M
- Competitive financing

**Lowering environmental footprint**

Clean generation is one way of demonstrating environmental responsibility. Another is lowering resource usage, visual impact and noise pollution. In both cases, we can help you meet or exceed regulations and environmental standards. That is why Alstom innovates in the following areas:

- Renewable portfolio
- Natural resource optimisation
- Pollutants control (SO₂, NOₓ, PM, mercury)
- CO₂ emission reduction & CCS
- Land use, visual impact and noise
- Water intensity reduction & recyclability

**Increasing flexibility & reliability**

Intermittent power generation is a growing challenge of energy security, as is maintaining an aging installed base and adapting it to changing market conditions. We help you tackle both issues so that you can enjoy dependable operations with:

- Maintainability and outage time reduction
- Operational and fuel flexibility
- Designs and service for improved availability and reliability
- Climate packages
- Energy storage
Clear Solutions
meet the challenges of energy sustainability

Generating confidence
Local presence, global expertise and a strong heritage are the basis of Alstom’s universal portfolio of generator service solutions.

**REDUCING COST OF ELECTRICITY**
Alstom can help you lower capital expenditure and maintenance costs over the lifecycle by reducing the outage scope and thus optimising the Total Cost of Ownership.

**INCREASING FLEXIBILITY & RELIABILITY**
Alstom solutions enable you to increase generator reliability for shorter and less frequent repair outages and longer generator lifetimes.
Presence

With a network of 16,000 people, Alstom Thermal Services is close to customers all over the world. We have more than 300 generator engineers including more than 60 inspection and diagnostic specialists, so customers can always be assured of service excellence and rapid responses. Building on our three historical competence centres for generators, we now have a powerful and effective global presence.

Our capability
Matching your priorities

Monterrey, MX
Richmond, US
Sao Paulo, BR
Taubate, BR
Sao Paulo, BR
Taulate, BR
Johannesburg, SA
Vadodara, IN
Tianjin, CN
Vadodara, IN
Kuala Lumpur, MY
Maitland, AU

● 4 Product/Execution centres
● 7 Area centres
▲ 8 Service workshops
▲ 4 Service factories
▲ 1 Mobile workshop

*One combined product centre Belfort/Stafford
Technology

With a diverse OEM heritage and constant investment in service-focused R&D, Alstom has a cutting-edge portfolio of technology-driven solutions for generator operations, maintenance, outage management, performance improvements and lifecycle optimisation. Our key technologies focus on rapid responses that minimise downtime and optimise the scope for maximum value. Our key technologies include:

- Monitoring and diagnostics with ALSPA® Care
- Modular robotic inspection tools – DIRIS® Small for insitu inspection
- Online restoration of cooling system efficiency with CUPROPLEX®
- Stainless steel stator winding technology for large water-cooled generators
- Fast stator rewind technology for air-cooled generators

Solutions

By continuously improving our products and services we aim to deliver the most competitive and straightforward solutions. Taking every opportunity to increase reliability and availability and boost power output, we offer innovative solutions that cover the entire generator lifetime.

Alstom solutions cover the whole generator lifecycle and include:

- Condition assessments
- Field services, parts and repairs
- Rewinds, upgrades and renovations

pillars
priorities

>60 inspection and diagnostic specialists
>300 generator engineers
70 countries

9* generator workshops
15 fleets inherited
>6,000 generators built

* Including one mobile workshop
Condition assessments
Thanks to decades of experience in maintaining and improving the performance of one of the world’s largest installed fleets of turbogenerators, Alstom’s generator diagnostics, monitoring, assessment and consultancy solutions are reliable and far-sighted. We understand the challenges and priorities of plant owners and address your concerns with:

- Operational risk mitigation solutions
- Periodic and permanent online monitoring
- Condition-based maintenance
- Lifetime assessments of all turbogenerator technologies

Based on these solutions, generator availability is optimised by emergency response planning, spare parts pooling or preventive maintenance.

Parts, repairs and field services
To optimise generator availability, we make minimising the duration of outages our top priority. Leveraging the presence and competence of our global field service and workshop networks, Alstom offers time-saving solutions for the outage and repair of all types of generator:

- Outage management
- Spare parts solutions
- Fast and smart repairs on all generator components
Generator operators are looking for straightforward solutions from reliable partners for a fast return to service. That is why Alstom offers a range of availability and performance boosting solutions, covering all cooling technologies, all generator sizes, and all OEMs:

- Parts
- Repairs
- Field service
- Technical expertise and operational support

- Performance improvements
- Service contracts
- Services on other original equipment manufacturers’ generators

To address ageing and reliability issues, Alstom offers modernisation solutions built on our cutting-edge OEM technology and global installed base experience. However, it is not enough to restore the original performance: Alstom solutions aim to improve on the previous state, because our goal is to help our customers stay competitive.

**Rewinds, upgrades and renovations**

Using proven in-house technologies, we have solutions suitable for all types of installed technologies. And we can replace any component or generator within an existing plant. We offer the most rational solutions possible for:

- Stator and rotor rewinds
- Spare stators
- Spare rotors
- Renovation of auxiliary systems
- Excitation systems
- Replacement generators

Alstom generator replacement solutions are full-service answers to your plant lifetime challenges characterised by rapid delivery and fast site execution.

3 replacement stators or complete generators swapped per year

Up to 20% power increase after Alstom performance improvement projects

140 non-Alstom stator rewinds since 1999
Alstom’s generator legacy

**oOEM’s technology and design knowledge built historically in the business**

Thanks to the depth and diversity of our manufacturing heritage and operational feedback from one of the largest installed bases in power generation, Alstom’s capabilities cover the full range of generator technologies on the market today. We offer competence for any type of generator and cover the entire lifecycle.
depth and diversity
– your benefit
Robotic inspection tools

**DIRIS® robots**
Alstom’s DIRIS® robots (diagnostic inspection with rotor in situ) allow fast and reliable robotic inspections of the turbogenerator with the rotor in situ. Diagnostic engineers work outside the turbogenerator, controlling the robot that works in the air gap. Only one end of the machine needs to be opened\(^{(1)}\), which results in huge time savings.

The robot measurement sledge can rotate 360° around the rotor body. This gives access to every spot of the stator and rotor surface. Depending on the inspection scope, a stator wedge probe, a low flux probe, a camera system or a combination of sensors can be fitted.

**Retaining Ring Scanners**
Alstom’s scanners are ultrasonic, robotic inspection tools designed for detecting stress corrosion cracks in rotor retaining rings. They are used during outages and require minimum dismantling of the generator. The inspection is reliable and reproducible, which makes the comparison of results over time possible.

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ALSPA® Care Platform

**ALSPA® Care Platform**

ALSPA® Care platform is an online condition monitoring suite that provides a comprehensive service to easily assess the health of generators. Recommendations on maintenance to ensure proper equipment functionality are also part of the service.

ALSPA® Care platform supports a condition-based maintenance strategy for more reliable and available plant operations.

Stator bar cooling efficiency

**CUPROPLEX®**

Alstom’s CUPROPLEX® is a clean and cost-effective service that addresses the problem of copper oxide build-up in stator cooling circuits. Poor control of water chemistry leads to plugging. As the stator cooling efficiency drops, power output has to be limited to prevent overheating and component damage.

That is why Alstom has developed CUPROPLEX® which has now been applied effectively as an online emergency or offline preventive measure for more than 30 years.

Suitable for all types and OEM brands of water-cooled generators with hollow copper conductors, CUPROPLEX® increases availability and reliability and maximises component lifetime expectancy.

\(^{(1)}\) on selected fleets.
Stainless steel stator technology

Alstom’s stainless steel stator technology is an upgrade option for water-cooled generators that eliminates, at source, the risk of water leakage and the whole problem of losing cooling efficiency through copper oxide build-up.

This upgrade also contributes to simplifying the operation and maintenance of the generator, since the cooling system is no longer sensitive to imperfections in the water chemistry.

Benefits:
• Improves reliability and availability by eliminating winding leaks and blockages
• Extends the life of the stator
• Provides an opportunity to increase the power of the generator in the case of rehabilitation
• Simplifies maintenance of the stator winding

Stator rewind technology for any air-cooled generator

Alstom offers a rapid-response service for emergency rewinds and major outages. Our all-in-one offer employs Alstom advanced technologies for:
• measurement
• procurement
• re-engineering
• on-site rewinding

There is one standardised process and one technology for all types of air-cooled generators.

Auxiliary systems

Alstom also offers upgrades for generator auxiliary systems, including electrical systems from static excitation to brushless exciters.

From assessments to identify upgrade potentials, through partial modernisation, to the replacement of complete systems, we address parts obsolescence, safety regulations, redundancy or reliability requirements with our technology-driven solutions.

Clean Power Solutions™

Up to 40% time saving with DIRIS® inspection

Increasing Flexibility & Reliability

10% typical output MW gains with stainless steel stator upgrade
**PD monitoring to avoid major failures**

To reduce the risk of a costly emergency shutdown and repair, Alstom was asked to perform GOLD® Service measurements using a partial discharge online monitoring system.

**Solution**
Beginning in 2003, an Alstom expert took bi-annual measurements and provided a comprehensive report and trend analysis.

**Results**
In January 2009, online monitoring indicated a changing pattern of partial discharges, but no immediate shutdown was required. In June 2010, monitoring showed that partial discharges had reached critical levels and the unit was stopped for inspection. Partial discharges were located in the medium voltage platform, an area rarely affected by this type of degradation. After a minor repair the unit was returned to service and monitoring results normalised avoiding a major breakdown.

- Customer: Opel, Rüsselsheim, Germany
- Air-cooled 141 MVA generator, commissioned in 1999
- ALSPA® Care PD online monitoring installed 2003

**Robotic inspections to reduce outage time**

The customer was looking for a local diagnostic team able to provide planned inspection services while adhering to stringent outage time constraints.

**Solution**
Alstom offered its ‘DIRIS® Small’ robotic technology, allowing inspections to be performed with the rotor in situ to minimise the dismantling of parts. The inspection was performed by Alstom’s local, fully trained and certified diagnostic engineers.

**Results**
Thanks to Alstom’s robotic inspection technology, the maintenance costs and duration were minimised and the availability of this unit was maximised. The customer was satisfied with the process and findings – the results correlated with results obtained during an earlier classic rotor-out inspection.

- Customer: NTPC, Tanda, India
- OEM: SKODA
- H₂ indirectly cooled 110 MW generator
**Stator core emergency repair**

Serious damage to the stator magnetic core-end region resulted in an immediate shutdown. Given that a conventional repair would take 6-9 months, Alstom was asked to propose an emergency repair solution.

**Solution**

Alstom engineers designed a properly cooled prosthetic core that was able to withstand magnetic stresses in the end core region. The implementation of the solution required only 13 days of on-site work.

**Results**

Thanks to Alstom’s engineering capabilities, the generator was returned to service without operating restrictions and was fit for long-term operation only 13 days after the Alstom team arrived on site.

- **Customer:** Zhejiang Provincial Elec Power, Beilungang, China
- **OEM:** Alstom
- **600 MW coal**

**Online cleaning**

Thirty years of sub-optimal outage practices had led to plugging of a group of stator bars. As a result, temperatures had reached alarming levels during peak season production. Operations were under threat and Alstom was asked to perform emergency online cleaning.

**Solution**

Thanks to the capabilities of the local Alstom hub, a rapid response was possible. While the generator was running at full power, Alstom CUPROPLEX® online cleaning was conducted to safely restore cooling water flow back to normal.

**Results**

Despite double the typical oxide yield, the effective Alstom online cleaning process brought temperatures back to normal in only 48 hours.

- **Customer:** South Texas Project, Bay City, USA
- **OEM:** Siemens-Westinghouse
- **1,400 MW nuclear**
Stator upgrade for more power

At the invitation of customer E.ON, Alstom successfully bid against the generator OEM, Siemens, to solve technical issues relating to the magnetic core and increase the stator output of four units.

Solution
The Alstom solution, based on the stainless steel stator bar technology with axial core cooling, can be adapted to generators made by other manufacturers.

Results
Three units are already in operation following the successful Alstom upgrade and rewind. The performance guarantees have been met and power output is up from 558 to 635 MVA.

- Customer: E.ON, Ratcliffe, UK
- OEM: Siemens
- Coal 588 MVA
- Upgraded to 635 MVA

Exceeding expectations on stator rewinds

Alstom won the bid for a stator rewind against two competitors: OEM Ansaldo and NEC (National Electric Coils). The scope included the design, procurement and implementation of a stator rewind on two units.

Solution
Alstom’s solution included a fast stator rewind as the differentiating factor. Alstom’s stator bar removing tools (for the GVPI process) and fast rewind processes also contributed to the customer’s decision to award Alstom the contract.

Results
Alstom managed to complete each rewind significantly faster than the 44 days agreed: Unit 1 was completed in 32 days and Unit 2 in 28 days.

- Customer: Penderkar Energy, Meghnaghat, Bangladesh
- OEM: Ansaldo
- CCGT, 205 MVA air-cooled
Rotor rewind

Alstom was asked to bid for a rotor rewind and provide solutions to technical issues arising from two-shifting. The timeframe available for the implementation was a planned C inspection.

Solution
Alstom offered a rotor rewind and convinced the customer with evidence of proper planning, tight quality control and effective project management. Alstom technology was employed to address the two-shifting operational problems.

Results
The job was completed in 22 days – within the given time period – thanks to the effective implementation of the proposed solution and the appropriate technology employed. Alstom’s consolidated coil technology solved the two-shift issues satisfactorily.

Customer: Eskom, Majuba, South Africa
- OEM: Alstom
- 660 MW coal

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From online monitoring to offline solutions

Alinta Energy asked Alstom to supply five more generator condition monitoring systems. With this order, Alinta will have the system in operation on 14 generators.

Solution
Alstom’s ALSPA® Care PD systems give insight into the current generator state, allowing the customer to plan condition-based interventions based on concrete data captured while the machines are running.

Results
By using Alstom equipment and expertise, Alinta and other customers benefit from many years of knowledge over the widest range of air-cooled generators worldwide. This allows optimal decisions to be made with regard to overhauls, rehabilitation or upgrade solutions. The ongoing orders placed by Alinta Energy signify the high value attached to Alstom’s condition monitoring hardware and local diagnostic teams.

Customer: Alinta Energy, Port Hedland, Australia
- OEM: Alstom
- Air indirectly-cooled 40 MW TOPACK generators
Solutions for generating confidence
Alstom

Alstom is a global leader in the world of power generation, power transmission and rail infrastructure and sets the benchmark for innovative and environmentally friendly technologies.

Alstom builds the fastest train and the highest capacity automated metro in the world, provides turnkey integrated power plant solutions and associated services for a wide variety of energy sources, including hydro, nuclear, gas, coal, wind, solar thermal, geothermal and ocean energies. Alstom offers a wide range of solutions for power transmission, with a focus on smart grids.

Power generation

**Alstom Power** offers solutions which allow their customers to generate reliable, competitive and eco-friendly power.

Alstom has the industry’s most comprehensive portfolio of thermal technologies – coal, gas, oil and nuclear – and holds leading positions in turnkey power plants, power generation services and air quality control systems. It is also a pioneer in carbon capture technologies.

Alstom offers the most comprehensive range of renewable power generation solutions today: hydro power, wind power, geothermal, biomass and solar. With ocean energies, we are developing solutions for tomorrow. Alstom is one of the world leaders in hydro power, the largest source of renewable energy on the planet.