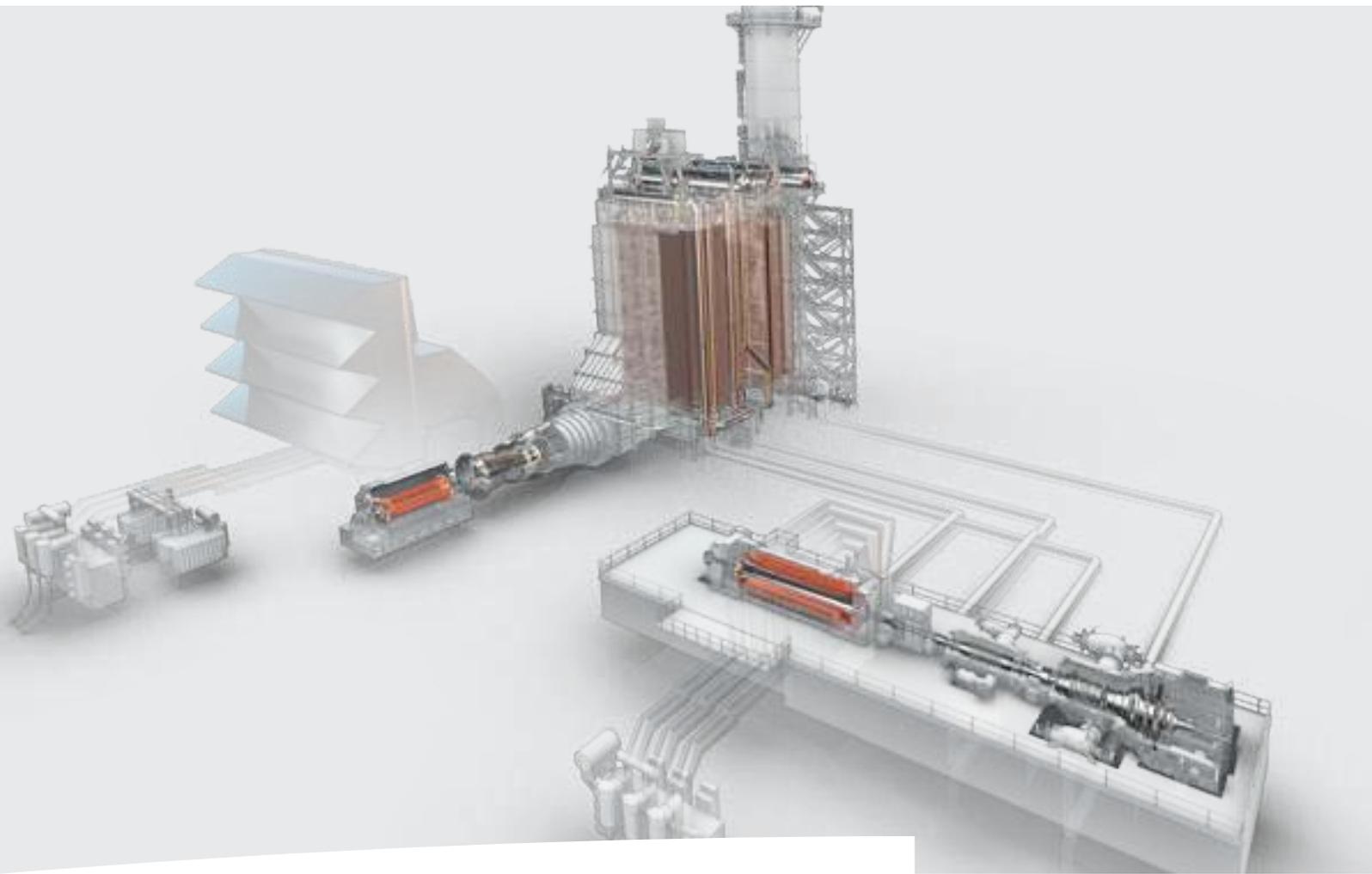


SERVICE SOLUTIONS FOR GAS TURBINES AND COMBINED-CYCLE PLANTS





Alstom is dedicated to keeping thermal power plants competitive. Having contributed technology to around 25% of the world's power production capacity, we operate from a position of proven expertise.

With 13,000 power industry professionals spread across 125 world-wide locations, Alstom Thermal Services supports its customers with competitive service solutions for daily operations and maintenance, while helping to enhance life cycle management.

In a dynamic 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, whilst maintaining the highest levels of safety, reliability and environmental compatibility.

Alstom is a global company 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.

Alstom combines a broad technology heritage with a commitment to maintaining and developing the installed base.



Everything for your **gas power plant**

Clean Power, Clear Solutions

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Clean Power, How Alstom is helping you

CLEAN POWER CLEAR SOLUTIONS™

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.



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 (SO_x, NO_x, PM, mercury)
- CO₂ emission reduction & CCS
- Land use, visual impact and noise
- Water intensity reduction & recyclability



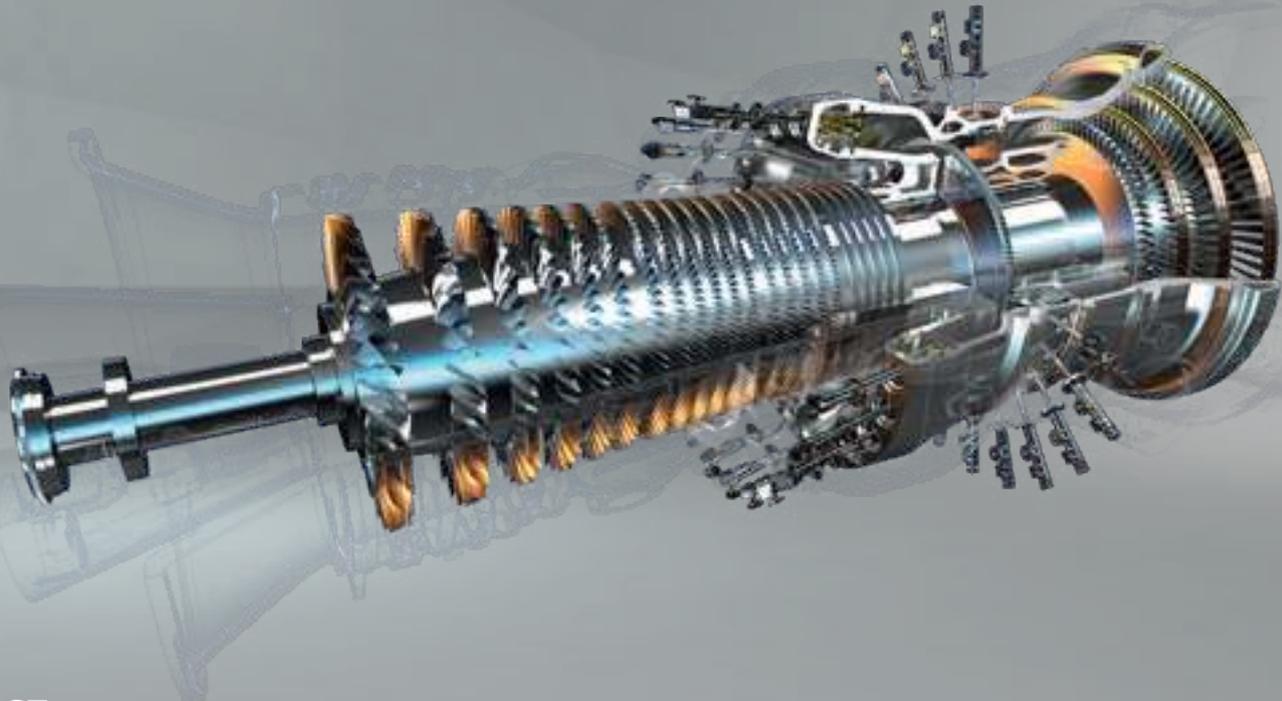
INCREASING FLEXIBILITY & RELIABILITY

Intermittent power generation is a growing challenge of energy security, as is maintaining an ageing 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



GT26

**INCREASING
FLEXIBILITY & RELIABILITY**



>98.5% reliability

Average equivalent reliability factor for the Alstom fleet with an O&M contract from 2012 to 2014

**INCREASING
FLEXIBILITY & RELIABILITY**



30%

Minimum environmental load achievable for E- and F-class machines, whilst maintaining emissions compliance and benchmarking efficiency

Support to secure your investment.

In an ever-changing environment, Alstom helps to keep your gas plant clean, compliant and competitive.

Thanks to our complete solutions portfolio, we can service the whole plant and unlock the potential of all your plant systems.

Building on service-focussed R&D and a global fleet perspective, Alstom has the presence, solutions and technology to help secure your investment.





The Alstom

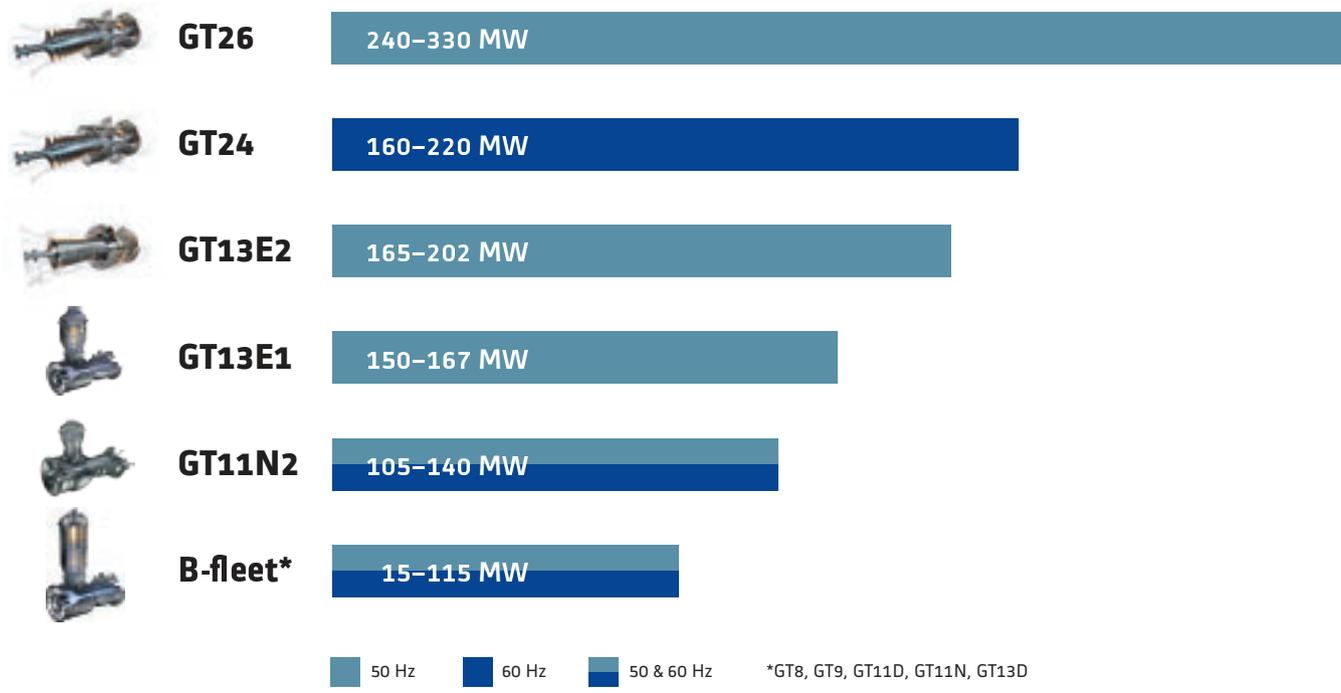
A never-ending



The Alstom gas turbine fleet

At Alstom Thermal Services, we serve Alstom’s whole installed base and ensure that every turbine can fulfil its full lifetime potential. Our fleet portfolio covers all markets and the full power range.

Output range



fleet

commitment to our customers



Our commitment to lifetime extension never ends: Some of the gas turbines that we service have been in commercial operation for over 45 years.

Capabilities

Presence, solutions



that count and technology

We address your priorities with evolutionary technology, proven solutions and a global-local presence to maximise the competitiveness of your plant.

65 countries
>125 locations

Presence Our organisation fosters expertise at the global level and customer proximity at the local level. We operate a fleet-focussed product centre, highly capable regional execution centres and a dense network of local service centres and workshops that coordinate parts, repairs, reconditioning and field services. This ensures that you always have quick access to the experts you need.

100 years of leading
industry experience

Solution With a comprehensive portfolio of solutions, Alstom addresses all the needs of gas plant owners and operators. From routine equipment maintenance to plant operation and management strategies, we are able to offer a unique integrative perspective that enhances plant performance and extends the competitive lifetime of components, systems and entire plants.

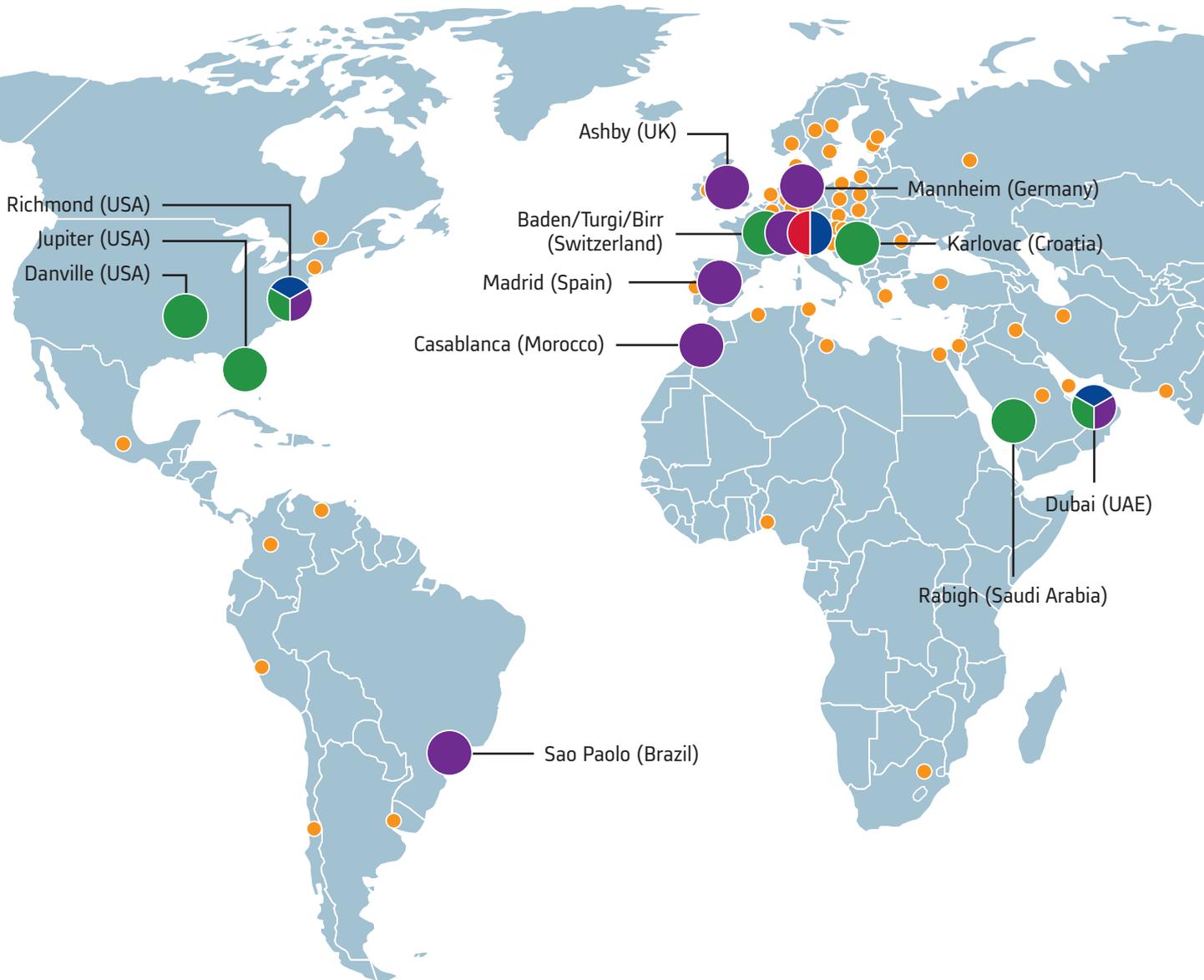
>740 gas units
producing >96 GW

Technology Through specific and dedicated investment in technology for the whole life cycle, we are increasing the competitiveness of the installed base with new and improved parts, spares, upgrades, retrofits and advanced plant operations and management systems. Our technologies boost reliability and flexibility, reduce the environmental footprint and cut the cost of production by increasing efficiency and the intervals between inspections.

The presence

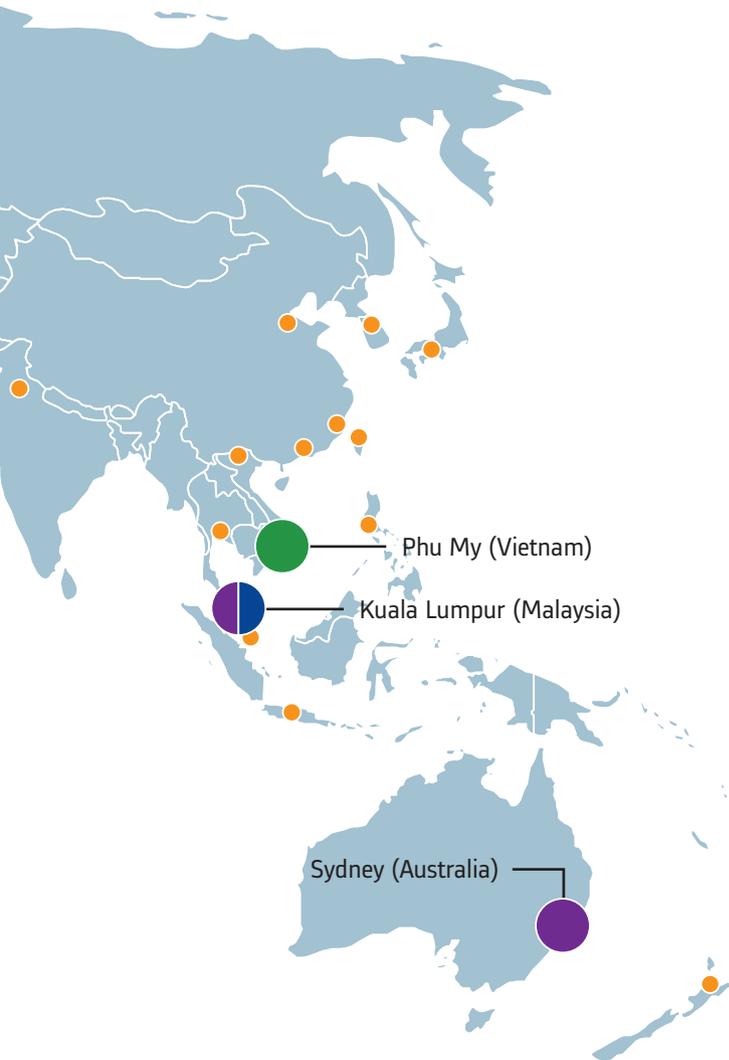
A footprint for

Thermal Services Gas OEM global footprint



With operations in over 60 countries, Alstom is close to customers all over the world, ensuring rapid responses and service excellence.

to perform plant productivity

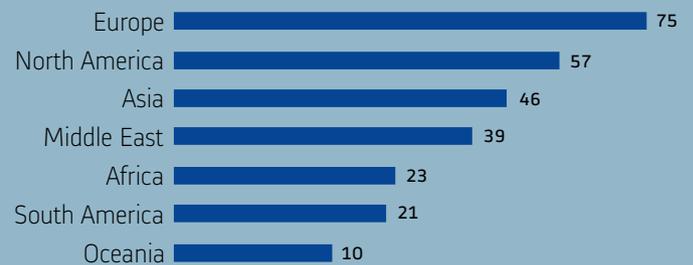


- Product centre
- Execution centres
- Local service centres
- Reconditioning workshops
- Field service network

Our customers

- Utilities, independent power producers and industrial plants
- A service fleet of more than 740 gas turbines in operation with over 96 GW installed capacity
- More than 150 service contracts covering over 330 gas turbines

Alstom units in operation



Our people

Alstom is dedicated to building strong, sustainable relationships based on trust and mutual understanding.

Our global team of experts offer tailor-made solutions for your needs. Our engineers are trained and certified to manage the most complex projects.

When you work with Alstom, you know where you stand in terms of business standards and ethics, no matter what country we are working in.

Our locations

To improve equipment productivity or total plant performance, competent, locally-based support is vital.

Alstom's global organisation and local reach allows us to leverage world-class technology, while adapting to the needs of customers in different regions.

Comprehensive solutions

For the entire



New plants and systems

A newly commissioned plant or system is a complex, state-of-the-art investment. To ensure reliable operation and high availability, plant management and operational staff need to rapidly establish reliable routines and patterns of teamwork as they gain experience with the new equipment.

To help customers through this delicate phase, Alstom offers expertise and skills in everything from troubleshooting and performance optimisation to solutions for:

- Training
- Field service
- Monitoring and support
- O&M services

Established operations

An established plant faces changing markets and evolving regulations that require a strong commitment to ongoing improvement. In many markets, the change in the energy mix also means that former base-load plants are increasingly switching to intermediate or cycling operations.

In addition to field service and parts solutions for regular maintenance, Alstom supports customers with innovative solutions to improve performance, flexibility and reduce costs:

- New and improved parts
- Parts reconditioning
- Expertise and operational support
- Plant assessments
- Performance improvements
 - Upgrades
 - Repowering
 - Conversions
 - Rehabilitations
- Flexibility improvements

Operations & Maintenance (O&M) contracts and Long-Term Agreements (LTAs) that allow plant owners to reduce the operational uncertainties are available throughout the plant life cycle.

portfolio

plant life cycle



Life-extension

To improve performance and extend the life of an existing plant is usually a more cost-effective and environmentally-friendly option than a new build.

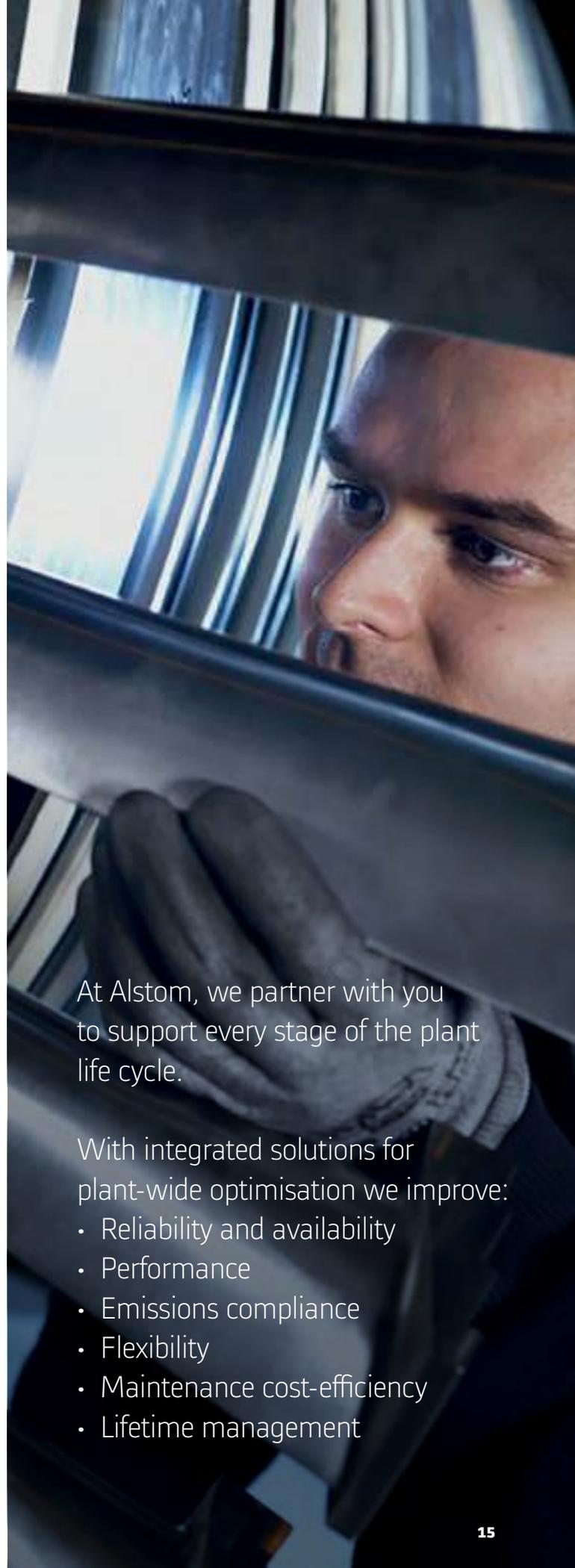
That is why Alstom has developed a portfolio of solutions for life extension, emissions improvement and cost reduction.

Many plants in this phase of the life cycle have a peak or backup function and so flexibility is paramount.

With Alstom's support, you can maintain safe and compliant operations to increase your return on assets well beyond the original design lifetime.

Solutions

- Parts reconditioning
- Plant assessments
- Extended service intervals
- Emissions compliance
- Plant rehabilitation
- Modernisation/deplacement of obsolete systems
- Lifetime monitoring



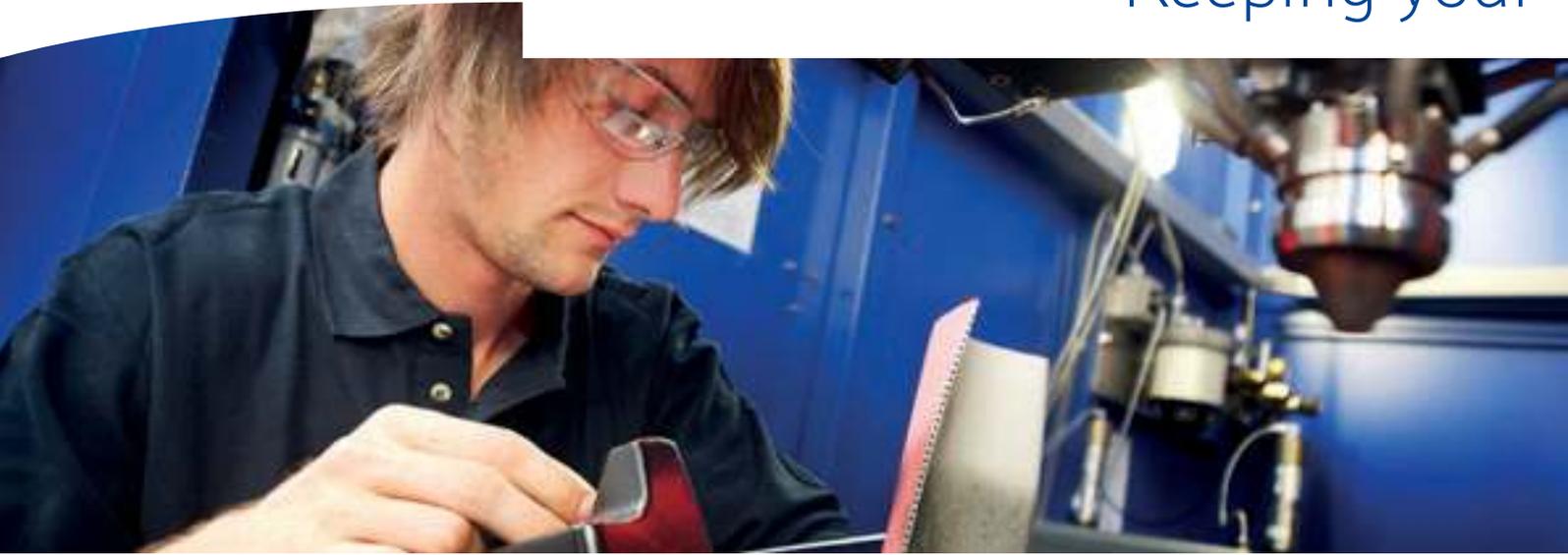
At Alstom, we partner with you to support every stage of the plant life cycle.

With integrated solutions for plant-wide optimisation we improve:

- Reliability and availability
- Performance
- Emissions compliance
- Flexibility
- Maintenance cost-efficiency
- Lifetime management

Comprehensive

Keeping your



Parts

New and improved – for performance

With state-of-the-art manufacturing technologies and dedicated R&D, Alstom parts services are also provided with field service experience to enhance quality and performance. We offer quality, standard parts, upgrades, customised components and emergency spares to maximise lifetime and minimise unscheduled downtime.

Parts life cycle management

Alstom helps customers with parts assessment and life planning. Considering extensions, repairs, reconditioning and parts replacement on a part by part basis, we help you get the best lifetime return on every part of the plant.

Reconditioning & repairs

Solutions for maintenance challenges

With over 30 years of experience in reconditioning and eight reconditioning workshops around the world, Alstom combines lifetime extension and performance recovery by integrating the latest design insights into the reconditioning process. Our reconditioning service covers the full range of noble parts – such as turbine and compressor components, structural parts and combustor components.

Replace, repair or recondition?

Standardised processes make every customer-specific reconditioning job efficient and accurate. We draw on fleet benchmarks backed by equipment inspections, metallurgical analysis and lifetime evaluations. By investing in cutting-edge technologies, processes and equipment, we are continuously reducing scrap rates and lead-times.

BENEFITS

- Performance recovery and a perfect fit thanks to detailed OEM know-how
- Highest reliability due to cutting-edge repair technologies and process control
- Delivery of full sets including replacement of deficient parts and assembly material
- Emergency stock for fast responses
- Component history tracking

solutions portfolio

plant competitive

Alstom offers a wide range of products and services:

- Parts
- Reconditioning & repairs
- Field service
- Expertise and operational support
- Performance improvements
- Flexibility solutions
- Service contracts
- Other OEM expertise

Field service

Global competence, local presence

Working with Alstom means you interact with fully-qualified, local teams who understand your market environment. But every job is backed by a global network of specialist problem-solvers who integrate experience from a huge installed base.

Our priority is to ensure reliable and efficient operations. So we leverage vast technical and outage management experience as we service, upgrade or repair customers' plants.

Our global field service engineers are experts in their field, trained and certified to effectively manage the most complex projects. As a flexible, competent service partner, our goal is to deliver service excellence.

Our field services portfolio includes:

- Inspection, repair and overhaul services
 - Type A and B visual inspections
 - Type C hot gas path inspections
- Recommissioning
- Outage planning
- Installation and erection
- Troubleshooting
- On-site testing, monitoring and diagnostics

Outage time reduction – A new way of working!

Alstom's outage excellence initiative applies standardised best practices and technical breakthroughs to systematically reduce the outage time.

Every detail is planned meticulously. From the positioning of parts and tools to the technician's movements – everything is analysed to eliminate waste of time and effort and deliver a fast return to service.

BENEFITS

- Applying LEAN methodology delivers sustainable results and leads to a new way of working
- The standard lead time for an F-Fleet hot gas path type C inspection has been reduced from 35 days to 25 days

Comprehensive

Holistic perspectives



Expertise and operational support

Thanks to systematic benchmarking across our global fleet and specialist experience and tools, Alstom offers engineering studies and component lifetime assessments to enhance your plant performance and management.

Alstom's Plant Support Center™ (PSC)

When you need direct access to world-class specialists, then Alstom's PSC is for you. We support troubleshooting, analyse equipment trends and provide support during assessment and recommissioning. The PSC also offers online support worldwide via Alstom's global plant operational support network.

Benefits

- **24/7 operation support**
Expert know-how from a single source for root cause analysis and other types of troubleshooting
- **Monitoring & Diagnostics (M&D)**
Early warning messages and assessments
Monitoring and diagnostic reports
- **Back-office support**
Alstom staff are fully supported during inspections, evaluations and re-commissioning site visits
- **Specialised M&D packages**
Gas turbine condition monitoring
Generator condition monitoring

Plant assessments

With Alstom's Plant Assessment Services, we help you identify specific measures to improve life cycle performance and profitability.

A total plant assessment enables you to align plant improvement measures with your business strategy and to identify and achieve synergies that would be missed using traditional component improvement approaches.

To optimise the interactions between components, operational processes and systems, Alstom's plant integration and assessment experts collaborate with your plant staff and the Alstom PSC to develop proposals for improvements based on our proven methodologies and best practices.

We offer plant assessments focussing on:

- Performance
- Reliability
- Asset condition
- Water and steam chemistry
- Operational flexibility

solutions portfolio

for a competitive advantage

Alstom offers expert support with a whole plant perspective to help you stay competitive in the face of natural degradation and evolving markets and regulatory challenges.

Training

Alstom's comprehensive set of courses and training programmes can be fully adapted to the needs of a particular customer or plant. Our training is designed to enhance reliability and availability over the plant life cycle, while upholding the highest environmental, health and safety standards.

Benefits

- Scheduled courses in our Alstom Training Centre or tailored courses at the customer's location
- Pedagogical training crews with high level of expertise
- Theory and hands-on experience with mobile simulators

Scope

- Plant operation and automation
- Mechanical maintenance
- Electrical systems
- Simulator-based training
- Soft skill training
- Refresher and upgrade training

CLEAN POWER
CLEAR SOLUTIONS™

INCREASING
FLEXIBILITY & RELIABILITY



100%
customer satisfaction rate in training in 2012
and 2013

1,553
people successfully trained in 2013



Comprehensive Performance



Performance improvements

Market expectations are set by the performance of new equipment: to keep older plants competitive, we offer performance upgrade packages that combine lifetime cost optimisation and extension, operational flexibility and emission reduction advantages.

Upgrades with a total plant perspective

One of Alstom's strengths is the ability to integrate upgrades with an integrated engineering view to make the most of your total plant potential.

We offer full or partial hot gas/steam path upgrades, LP last stage blade improvements, steam chests, valve internals and actuators, and control systems.

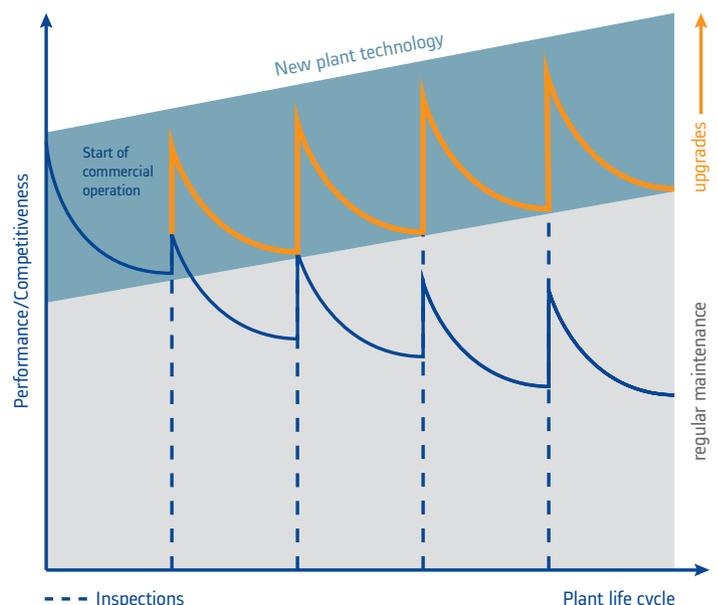
We can also replace the entire rotor for maximum competitive recovery: e.g. new gas/steam path, new inner cylinder with blading and layout changes, or complete replacement cylinders.

Alstom retrofit designs benefit from our experience in welded rotor design and the latest blading technology.

Competitive recovery

Our portfolio of solutions for competitive recovery helps you to update your equipment to meet market expectations in the face of natural degradation.

Rather than applying off-the-shelf products to the installed base, we develop custom applications of our new technologies. By maximising the benefits of each turbine upgrade or retrofit, we can help you recover your competitive edge and often even match the performance of current new equipment.



Competitive recovery with Alstom performance improvements

solutions portfolio

solutions

Alstom's upgrades and service solutions are designed not just to keep your plants running, but also to ensure maximum profitability for your business.

Upgrade with a total plant perspective – the MXL2

A good example of a technology package that is helping Alstom customers to make the most of market opportunities is the MXL2 upgrade series first introduced in 2012. With an MXL2 upgrade package, customers can operate to maximise profit and minimise maintenance costs.

Maximised performance & extended lifetime

The MXL2 upgrade is an evolutionary product that combines technological advances and operational experience in a single, attractive upgrade package for Alstom's GT24/GT26 and GT13E2 turbines.

M Mode

When market demand is high, plant operators can instantly switch to the M mode for maximum power and efficiency.

XL Mode

When demand is lower, operators can switch to the XL mode. Lifetime is thus extended and the C inspection interval is increased. This increases availability and reduces maintenance costs.

"We were very pleased with the performance of the GT24 with the MXL2 upgrade. And we saw very significant improvements in the overall output of electrical energy, coupled with a very substantial improvement in operating efficiency."

Archie Collins, VP of Operations
Emera Energy, Bayside Power Plant, Canada

MXL2 CONCEPT	MAINTENANCE INTERVAL EXTENSION	EFFICIENCY INCREASE (%-POINTS)	POWER OUTPUT INCREASE MW	SCOPE
GT26	up to +8,000 OH	M mode +0.7–0.8	+13–23	LP turbine upgrade, combustor improvements, new operation data counter
		XL mode +0.4–0.5	+4–12	
GT24	up to +8,000 OH	M mode +0.8	+17*	LP turbine upgrade, compressor upgrade, combustor improvements, new operation data counter
		XL mode +0.4%	+10*	
GT13E2	up to 48,000 EOH	1% combined-cycle	+3–15	Turbine upgrade, compressor upgrade, combustor improvements

Note: %-points = the additive increase in the percentage efficiency of the turbine
*CC performance figures based on reference GT in ICS plant. For indicative purpose only

Comprehensive Flexibility



Flexibility Suite

Plant operational flexibility and service flexibility are primary concerns in today's markets. With fluctuating renewable production, grid demands are becoming more stringent and base-load turbines are being forced to adopt new operational regimes.

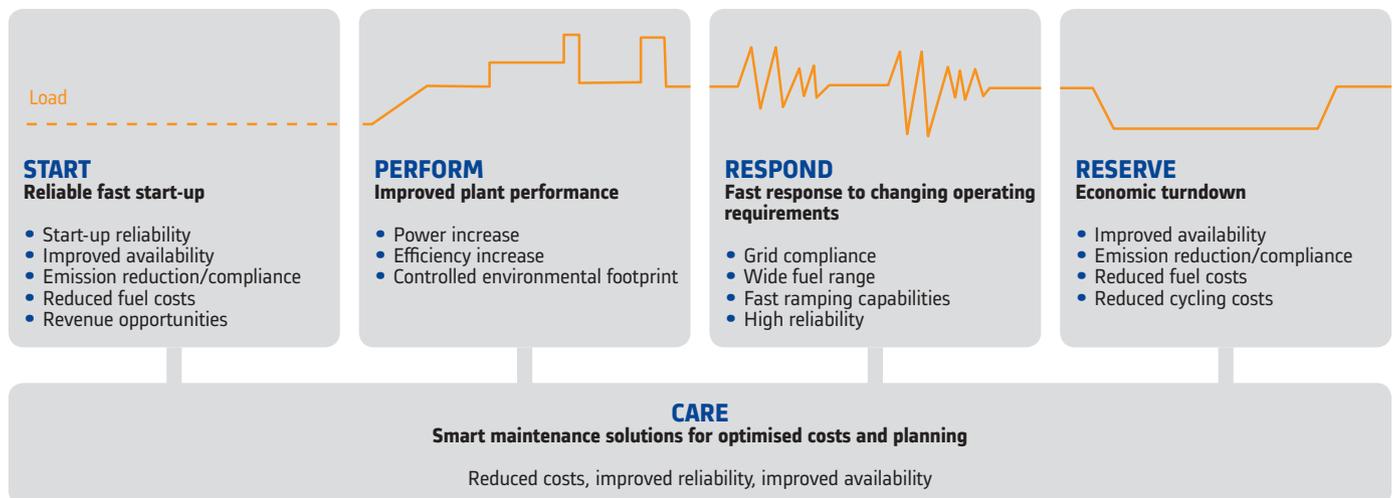
Today, being faster to grid, staying online longer and offering ancillary services can be decisive for commercial success.

New operational strategies are necessary and Alstom provides hardware and software optimisation solutions to enable new functionality – turning change into opportunity.

Alstom's Flexibility Suite spans from flexible service contracts to stand-still and preservation solutions, all customised to plant-specific requirements.

A portfolio for diverse needs

Alstom has a full portfolio of flexibility solutions, delivering value throughout the operation range.



solutions portfolio

solutions

Alstom offers a broad range of flexibility products, allowing customers to maximise their plants competitiveness whatever operating regime they have.

Low Part Load

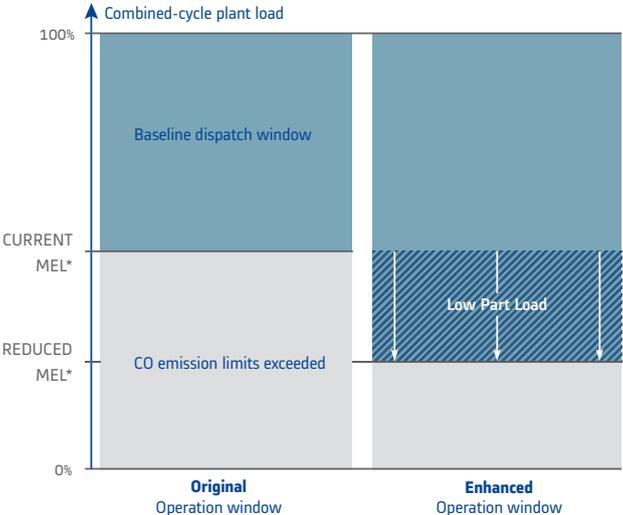
The low part load solution adds individual burner fuel control valves to the fuel distribution system and a switch-off control concept that keeps the combustion temperature elevated to limit CO production, while reducing the turbine output.

The result is a significantly extended load range that allows operators to save fuel costs and offer a larger spinning reserve and earn additional income with frequency response services.

GT13E2 low part-load capability with AEV burner

For the GT13E2 Alstom introduced a combustion solution that enhances its low part load capability even further.

The AEV burner employs a new, continuous fuel variation concept as the basis for more flexible and reliable operation. The burner also introduces emissions-compliant low part-load operation down to below 30% GT relative load. This allows the customer to react to demand changes rapidly and reduce maintenance costs by reducing the frequency of full shutdowns.



*MEL: Minimum Environmental Load



Comprehensive Customised service



Service contracts

Operation and Maintenance contracts

Fee-based contracts with risk sharing

Alstom Operation and Maintenance (O&M) contracts let plant owners devise completely new management strategies by outsourcing risks and responsibilities.

You can pick a standard agreement and tailor the service and equipment scope to suit your needs and thereby enjoy the following major advantages:

- Risks can be effectively mitigated and shared
- Leveraging of Alstom's extensive experience in plant asset management
- Flexible contract models to suit every business need

Long-Term Agreements

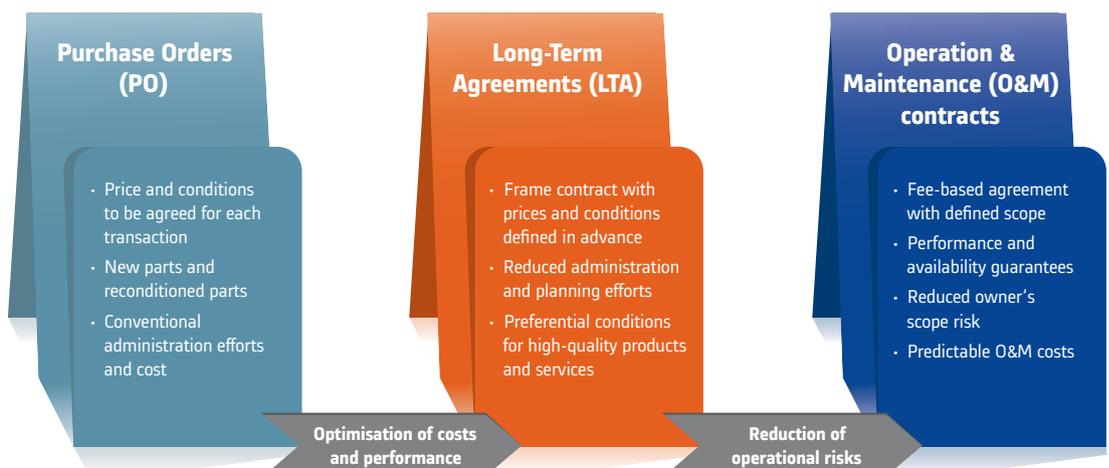
Efficient framework agreements

Alstom Long-Term Agreements (LTAs) provide you with all the benefits of a framework contract. Besides offering preferential conditions for high-quality parts and services, the LTA reduces your administrative overhead and simplifies planning.

LTAs offer many immediate advantages:

- Preferential prices for parts and services are agreed in advance
- Flexibility scope to suit your operative strategy
- Extendable to include almost any aspect of plant maintenance

From a simple purchase order to full plant operation, Alstom's Service Contracts can be tailored to perfectly match your business goals.



solutions portfolio

models and oOEM offerings

Alstom has the largest technology portfolio in the industry because of our commitment to integrating new knowledge into our service repertoire. This **has made us a popular address** for services and performance improvement across all brands of gas plant equipment.

Other OEM expertise

The Alstom company PSM (Power Systems Mfg, LLC) provides technologically advanced aftermarket gas turbine capital components, parts reconditioning services, field services, monitoring and Long-Term Agreements for non-Alstom machines in the 50 and 60 Hz markets.

7FA and 501F engines

- An entire range of fully-compatible compressor, combustion and hot gas path components
- Performance upgrade packages that increase power output and inspection intervals

B, D and E class engines

PSM's ultra-low emissions LEC-III® combustion system.

6B, 7E and 9E engines

PSM's ultra-low emissions LEC-III® combustion system with drop-in combustion and hot gas path replacement components. These products incorporate the latest engineering improvements, materials, coatings and aero-thermal designs. As a result, their performance, life cycle cost and durability equal, and often exceed all available alternatives.



Reconditioning workshops

Our PSM reconditioning facilities in Jupiter, Florida, USA and Dubai, UAE provide reliable and long-lasting repairs and reconditioning services, with the support of the entire Alstom network and extensive experience in the aero, thermal, mechanical and combustion aspects of gas turbine design.

Field service

PSM also offers a fully-integrated field service outage team capable of rapidly completing reliable overhauls on a wide range of non-Alstom power equipment including gas turbines, generators, steam turbines and auxiliary equipment.

Monitoring Centre

Our Monitoring Centre in Jupiter oversees turbines and overall plant performance 24/7. We use real-time data from the plants to track key performance indicators, provide early warnings of potential issues, analyse causes and recommend improvement solutions.

Service contracts

These are structured to meet the specific needs of each individual plant and account for changing market conditions. Our flexible agreements incorporate state-of-the-art PSM parts, reconditioning, field services and engineering support to optimise maintenance budgets and lower costs over the life of the agreement.



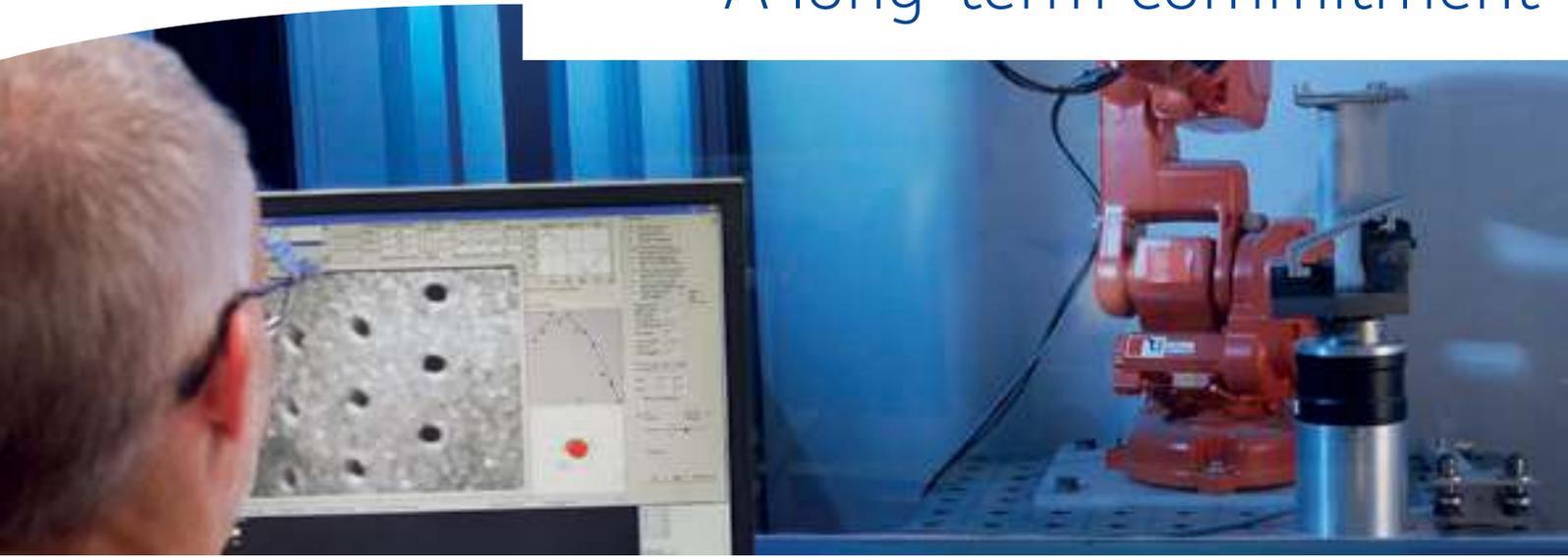
Keppel I + II – 1,300 MW combined-cycle power plant in the Tembusu sector of Jurong Island, Singapore.

Alstom's long-term service contracts for both the 2×KA26-1 and KA13E2-2 power plants allow the plant operator to reduce operational and maintenance risks by teaming up with a competent partner.



Technology

A long-term commitment



Alstom's Service R&D

Alstom's Service Research & Development (R&D) improves our existing range of products and technologies and continues to evolve and adapt our offering to changing market and customer needs.

Our skilled teams are part of a global R&D community leveraging the new equipment gas technology to develop the next generation of service products.

Our innovative solutions cover:

- Extension of the emission compliant load range for GT and CC
- Packages to enable shorter plant start-up times
- Fast and reliable in situ NDT technologies for lifetime management
- Versatile inspection robotics
- Improved component designs for higher cyclic capabilities
- New coatings to extend the useful life of hot gas components
- Application of new manufacturing technologies
- Sensor technologies to enable improved monitoring and diagnostics capabilities



for a lifetime

to developing new technologies

Each year, Alstom invests heavily in the development of new technologies to improve gas services like turbine and plant upgrades, reconditioning and inspection technologies. Through the application of improved materials, techniques and designs, we are deepening our expertise, improving our methods and creating the next generation of service solutions.



Selective Laser Melting (SLM)

Alstom is a leading the way in the development and application of additive manufacturing. SLM is used for complex repair and reconditioning technologies such as coupon repairs or tip build-up. It allows new design solutions and complex parts, like stator or rotor parts, to be customised, designed and manufactured on demand. Alstom operates multiple SLM cells, and significant breakthroughs are already being realised in pilot projects, both in terms of enhanced design solution, lead time reduction and weight saving.



Inspection robotics

Critical components such as turbines, generators, boilers and pressure lines have to undergo condition and risk assessments on a continuous basis in order to systematically ensure reliable component lifetime maximalisation. Alstom's inspection robots are high-tech NDT devices and are able to assess the condition of important components in a fraction of the time humans would need; they are much more precise and safe, and produce repeatable and reproducible results. Thanks to advances in miniaturisation, they are able to crawl into the tiniest structures and confined spaces to provide measurement data and video images or to treat surfaces in environments long inaccessible to humans.



Emission reduction technologies

The EV-alpha burner employs the latest state-of-the-art combustion technology and brings nitrous oxide (NO_x) performance down to single digit parts per million (ppm) under base-load conditions. All other parameters are unchanged or improved.

Key technology features

- NO_x emissions at base load down to <10 ppm
- NO_x emissions at upper part load reduced by 40%
- Significant emissions reductions down to gas turbine relative loads of 30%
- Improved pulsation behaviour during steady-state and transient operations
- Dry operation (no water / steam injection needed)



Steam Turbine

Comprehensive expertise

Alstom is the only OEM to cover both impulse and reaction technologies. This holistic approach for combined-cycle power plants ranging from single part replacement up to system level performance improvements.

Alstom's unique technical capabilities allow us to ensure that all solutions offered are seamlessly integrated into the wider plant, delivering maximum benefits coupled with optimum reliability.

Our technology leadership is also evident in our time-saving and quality-boosting tools and techniques for outage planning and execution.

Our condition assessment technologies allow more cost-effective life cycle management and enhance the planning and execution of all kinds of outages.

Automated ultrasonic inspection of last stage blades

Save time and boost reliability when checking blade roots and grooves with in-situ, phased-array, ultrasonic inspections. Thanks to Alstom's jig and specially shaped motorised probe, high-quality, repeatable data can be collected automatically and processed on a laptop for easy visual assessment. Data can also be stored for later comparisons or transmitted to Alstom for an expert opinion.

HRSG

100 years of experience

Our boiler heritage includes major manufacturers, such as Combustion Engineering (CE), EVT, Stein Industries and NEI. Building on over 100 years of experience, we now serve an installed base of more than 600 HRSGs all over the world.

At Alstom, this unrivalled design and technology experience is routinely applied to service the installed base.

Lifetime monitoring

To optimise reliability and lifetime, Alstom offers online condition monitoring and advanced NDE tools. For example, we can measure wall losses due to flow-accelerated corrosion with lasers, use a specific butt weld scanner to inspect boiler tubes, or employ a specific probe sled to examine headers.

Flexibility upgrade

To mitigate risks associated with flexible operation, Alstom offers a methodical assessment of the HRSG integrating the whole plant context, followed by the proposal of a customised flexibility upgrade solution.

Flexible single-row harp design

To improve the flexibility of non-Alstom HRSGs, we can upgrade pressure parts to the flexible Alstom single row harp design.

for the entire plant

for integration benefits



Generator

A portfolio for confidence

With Alstom's GOLD® and ALSPA® Care solutions for periodic or permanent online monitoring respectively, you can increase reliability and availability and optimise maintenance costs with conditions assessments based on data from pre-installed sensors (e.g. partial discharge or rotor flux monitoring).

Offline, robot-assisted inspections

Alstom's robotic inspection systems save outage time and support accurate trend analysis for optimal life cycle management. So you can conduct fast and reliable robotic inspections of the turbogenerator in situ with Alstom's DIRIS®, or detect stress corrosion cracking on the retaining rings with Alstom's Turborotoscan-S.

Renovation and rewind

We offer solutions for rewinds or the replacement of rotor and stator components that incorporate the latest technologies.

Fast Stator Rewind

Alstom's fast stator rewind is a single technology and process for any type of air-cooled generator. With proprietary processes and tools designed for rapid, quick and flexible manufacturing, customer benefits include rapid response, short downtimes, cost efficiency, quality and reliability.

Electrical and controls

Seamless control

Whilst the life cycle of the shaft line hardware components is measured in decades, digital control technology evolves at a much faster pace. This poses challenges for plant owners and operators with regard to the operation and maintenance of plant automation and control systems.

Obsolescence management of both the electrical and control systems is a very important aspect of ensuring the plants availability and reliability. Alstom offers full life cycle solutions for both of these mission-critical systems.

Generator and transformer protection system retrofit

A major part of Alstom's fleet is equipped with generator protection systems from other OEM's. For some of these products, spares and services are no longer guaranteed by the original supplier.

Alstom therefore offers a complete range of protective relays for all applications. New cubicles with state-of-the-art Alstom MiCOM relays protect your key equipment and ensure the highest plant availability.

Grid Compliance

With the influx of renewable power generation technologies, grid codes are changing and becoming even more stringent. Alstom provides solutions to ensure compliance can be met, both for existing plants and plants upgraded with flexibility suite solutions. These can range from control system modifications to hardware adaptations, depending on plant- and grid-specific requirements.

Success

Competitive recovery,



Outage excellence: C inspection executed in record time

Milford Power Company wanted to improve availability and cut maintenance costs with faster C inspections at this base-load plant that is covered by an Alstom LTSA contract.

Solution

Alstom's Outage Time Reduction initiative: Lean methods were applied to enhance the planning and execution of the outage. All sources of lost time were eliminated using value path mapping, laydown planning and specialised new tools.

Results

Alstom performed the turnkey outage, replacing HGP parts and installing an HP compressor, heat shields and new SEV lances. On the generator, partial discharge probes are installed.

- The total outage time was 23 days
- This represents a 34% saving on outage time

Specifications

- Milford Power Plant, USA
- 2 x KA24-1 ICS, 530 MW, Unit 2
- LTSA contract



Turbine upgrade: Competitive boost with MXL2

Centrica Energy wanted to extend the utilisation of their GT13E2 units. The key requirement was to increase plant efficiency and operational flexibility.

Solution

The first GT13E2 MXL2 upgrade was installed in March 2012.

Results

The validation was very successful, with a performance improvement achieved above specification. Centrica was highly satisfied with the upgrade and awarded Alstom the job to install the GT13E2 MXL2 in two other units at South Humber Bank to further reduce fuel costs and CO₂ emissions.

- 11.6 MW power output increase*
- +1.2% efficiency increase*

Specifications

- South Humber Bank, UK
- 5 x GT13E2 CC, 1,266 MW
- LTSA Contract

* Valid at site-rated ambient conditions

stories

flexibility and reliability



Service Contracts: First of a kind efficiency for Russia

To meet the high demand for power in Moscow, the Russian EM Alliance was looking for a high-efficiency, low-emissions plant design and a capable EPC and maintenance partner.

Solution

As the first ever foreign company to be awarded an EPC power plant contract in Russia, Alstom was awarded the turnkey construction of the combined heat and power plant that later led to a maintenance contract.

Results

The efficiency and emissions performance of the plant is unparalleled in Russia. Commercial operation began in 2009 and, in 2012, in recognition of the effective collaboration and the value of the partnership, Alstom was awarded a 14-year maintenance contract.

Specifications

- Mosenergo, Moscow, Russia
- 1 × KA26-1, 420 MW
- EPC 2006–2009
- O&M for 14 years commenced in 2012



Plant upgrade: Rejuvenation for relocated plant

To optimise asset utilisation and save capital investment costs, the state utility KOMIPO wanted to relocate an under-used power plant, upgrade it for power and efficiency, and convert it to a CHP configuration for district heating.

Solution

Alstom handled the feasibility studies and then supported the successful relocation. The upgrade included noble parts, a compressor upgrade, new burners for low emissions, ST upgrade and steam extraction for district heating. Alstom also provided the district heating equipment and a control system upgrade.

Results

The move addressed the potential shortfall in power supply to Seoul, without KOMIPO needing to build a new plant. Existing assets were utilised, lowering the cost of electricity and reducing the environmental footprint compared to a new build.

Specifications

- Poryong plant moved to Incheon, South Korea
- Korean Midland Power Company
- Before: KA24-2, 498 MW
- After: KA24-2, 535 MW and district heating capability

The customer voice

“In order to leverage reliability and heat rate performance, and the benefits associated with the reduced maintenance costs, we worked with Alstom to implement the GT26 MXL2 product upgrade, including the state-of-the-art low-pressure turbine.

It has allowed us to increase our production availability, which helps maintain our current market position, which is very important for us.”

Plant Manager
Dublin Bay Power Plant (Ringsend), Ireland



“The first GT13E2 MXL2 installation has successfully demonstrated that this upgrade delivers substantial benefits. The plant efficiency gain will allow us to reduce our fuel costs and CO₂ emissions, while the increased operational flexibility allows us to react quickly to changing demands from the grid.

We are very proud to operate the most advanced GT13E2 gas turbines in the world.”

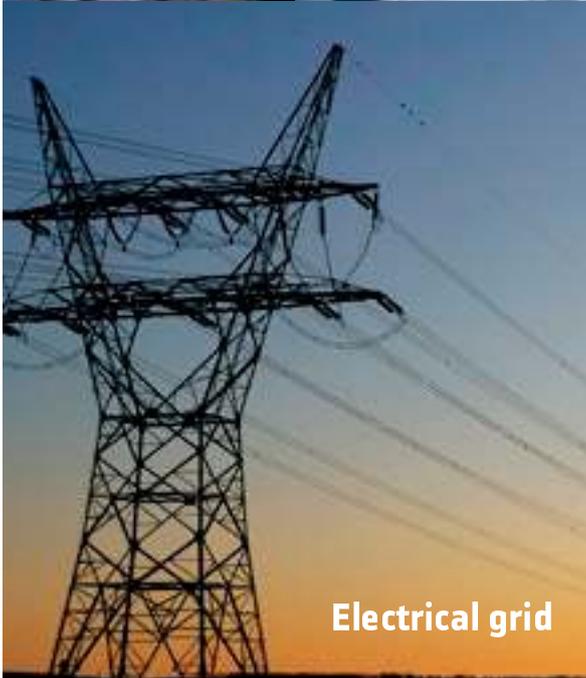
Station Manager
South Humber Bank, England



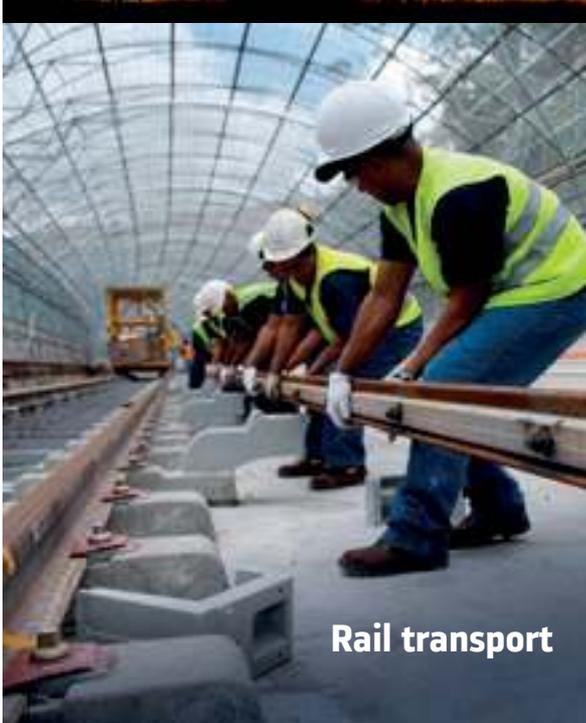
Strong technology and engineering capabilities combined with quick access to the relevant experts – these are the hallmarks of Alstom’s gas plant services.



Power generation



Electrical grid



Rail transport

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.

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