GAS POWER PLANTS
RELIABLE, VERSATILE AND ENVIRONMENTALLY FRIENDLY
Our world has an ever-growing appetite for energy – balanced by an increasing concern for the environment. **Alstom delivers the clean power and clear solutions that power producers and industries need to meet these increasing challenges.**

From advanced gas turbines to the design, construction and commissioning of gas power plants, Alstom is a **global leader** in the effort to **lower energy generation cost**, keep **emissions low** and provide unmatched operational **reliability and flexibility**.

**For more than 70 years, Alstom has established a track record** of quality, safety and responsiveness to versatile market needs. Alstom’s more than 1,500 gas power plant experts are committed to meet any gas power plant operator’s need – whether it’s designing and installing a plant from the ground up or retrofitting an existing facility.

**Key facts**

- **70** years of innovation
- **90** locations
- **200** turnkey power plants delivered
- **1,500** gas turbine experts worldwide
Increasingly complex power generation needs require solutions that meet today’s needs while remaining flexible enough to accommodate future demand. Alstom’s proven gas power plant solutions and dynamic approach to plant optimisation ensures that customers around the world gain maximum efficiency from their power generation effort.

**Proven technology**
For more than 70 years, power operators around the world have counted on Alstom to provide innovative gas power solutions. These solutions help leading operators gain maximum return on their investments.

From constructing the world’s first industrial gas turbine power plant in 1939 to the more than 200 gas power plants delivered to date, Alstom gas clean technologies have kept pace with power producers dynamically changing needs for increased production at lower cost and environmental impact.

**Innovative Plant Integrator™**
Alstom’s unique approach to power plant optimisation is based on a Net Present Value (NPV) model that considers six key factors across the plant’s entire lifecycle:
- Investment
- Lead time
- Performance
- Availability and operational flexibility
- Retrofit capability
- Life extension capability

This innovative approach tracks key business metrics to inform power producers of the revenue and profit potential of any power-related construction project. By synthesising this information, Alstom can make proactive recommendations to optimise operations in light of the power producer’s business goals and desired results.
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

**LOWERED 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

Our commitment to customers

Alstom’s gas-fired solutions are designed to deliver maximum performance to meet today’s challenging requirements and ultimate flexibility to address tomorrow’s needs. We know that success in today’s dynamic energy markets requires maintaining a delicate balance among the three clean power levers.

That’s why Alstom engineers focus on providing solutions that are state-of-the-art in both performance and efficiency. Our solutions offer you the highest levels of operational flexibility, quality and reliability and help you to meet your local market requirements for clean power at a cost efficient price.

LOWERING ENVIRONMENTAL FOOTPRINT

6 to 10 million tons
Reduced CO₂ emissions by an average of 6 to 10 million tons per year compared to coal-fired power stations*

INCREASING FLEXIBILITY & RELIABILITY

Able to run as efficiently at low load as at full capacity during peak hours*

*The figures refer to Pembroke KA26 power plant
Key benefits and operational improvements

**Highly efficient at both base and part load**
Alstom gas power plants attain excellent net plant efficiency at base load and offer the industry’s highest part-load efficiency. This is essential in today’s market, as gas power plants operate mostly at intermediate loads.

**Clean power generation**
Thanks to their high efficiency, Alstom gas power plants offer low CO₂ emissions. They also achieve low NOₓ emissions as a result of the unique combustion technologies used in Alstom gas turbines, such as sequential combustion and annular combustors with EV Burners (EnVironmental Burners).

**Outstanding operational flexibility**
Changing demand, variations in fuel availability and the need for operational efficiency require that gas power plant operators approach production with maximum flexibility. Alstom’s GT24/GT26 gas turbines can operate at relative load as low as 11% with low NOₓ emissions. However, when demand calls for maximum performance, Alstom gas solutions for increased power capabilities continue to keep emissions low. Technologies used include gas turbine air-inlet cooling features, gas turbine peak firing capabilities and duct firing for Alstom’s Heat-Recovery Steam Generators.

**Full turnkey Engineering, Procurement and Construction (EPC)**
Speaking with one voice to the customer, Alstom offers a complete range of Engineering, Procurement and Construction (EPC) services on a turnkey basis. To reduce risk for plant operators, Alstom draws upon its 70 years of gas power plant experience to apply proven designs, advanced technologies and operational expertise to keep new plant construction on budget and on time.

**Integrated power generation**
Using its Plant Integrator™ approach, Alstom creates tailor-made solutions that optimise each plant to local market conditions and specific business requirements. By systematically analysing, measuring and optimising the power producer’s desired end result, Alstom helps optimise the entire power plant across its entire lifecycle. This integrated approach helps to ensure that the plant not only meets today’s needs but is positioned to respond to the emerging requirements of tomorrow as well.

**Modularisation and standardisation**
Customers benefit from the modularity of Alstom systems, designed to ensure efficient erection with pre-assembled and led-tested modules before delivery to reduce field-required construction and testing.
Power plants with high reliability and efficiency

From simple- and combined-cycle gas power plants and cogeneration solutions to converting existing plants for improved efficiency, Alstom offers the industry’s broadest range of versatile and technologically advanced gas-fired options to meet power plant needs.

Alstom gas customers can expect outstanding operational flexibility, high plant efficiency at both full and part load, fuel gas composition adaptability and environmental excellence from every proven Alstom solution.

**SIMPLE-CYCLE**
- SC13E2 (50 Hz)

**COMBINED-CYCLE**
- KA13E2 (50 Hz)
- KA26 (50 Hz)
- KA24 (60 Hz)

**INDUSTRIAL SOLUTIONS**
Captive plants for
- Aluminium smelter operations
- Steel production

**CO-GENERATION**
Steam extraction for
- Desalination
- District heating
- Other industries requiring power and heat

**ADD-ON (OR STEAM TAIL)**
- Conversion of a simple-cycle power plant into a combined-cycle operation

**REPOWERING**
- Transforming an existing steam power plant into a combined-cycle power plant

**INTEGRATION WITH RENEWABLE POWER**
- Combining clean fuel and solar power

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**3D model of a combined-cycle power plant**

1. HRSG (Heat Recovery Steam Generator)
2. Air intake
3. Gas turbine
4. TOPAIR turbogenerator
5. Steam turbine
Key facts

Efficient operation and a high degree of customisation in a small footprint – that’s the stellar benefits that the GT13E2-based simple-cycle power plant delivers. Designed for cyclic as well as load operation, the GT13E2 gas turbine also provides operators extreme operational versatility.

Simple-cycle power plants are typically offered for peaking operations when:
• The value of the power produced is more critical than the cost of fuel
• Construction sites are very small

Configurations
• Single or multiple GT13E2 gas turbines with an Alstom air-cooled TOPAIR turbogenerator
• Co-generation with wide ranging steam production
• Inclusion of Alstom’s Heat Recovery Steam Generators

Additional options
• Augment power up to 15% of plant output through peak firing and/or air inlet cooling (evaporative cooling, fogging, high fogging) and/or water injection
• Supplementary firing for co-generation
• Indoor, semi-outdoor or outdoor installation
• Back-up fuel oil capability
The GT13E2 based simple-cycle power plant delivers **a high degree of customisation in a small plant profile** to meet wide ranging power provider needs, without sacrificing efficiency.

**Customer benefits**

**Operational flexibility**
- Designed for cyclic as well as base-load operation
- Unique dual operation mode with on-line switchover capability: Power optimised for higher performance or maintenance cost optimised for up to 50% more operation time between scheduled inspections
- Supporting small and/or industrial grids with proven frequency response
- GT island mode operation capability
- Fast startup capability and high startup reliability
- Excellent fuel flexibility to operate on a wide range of gas fuels with high hydrocarbon content and wide fluctuations of the Wobbe Index (±10%)
- Dual fuel capability, with on-line switchover

**Performance**
Highest efficiency in the conventional class, 50 Hz market

**Reliability and availability**
The GT13E2 outperforms the industry average on mean time between failures, mean time to repair, service factor and service hours per start, according to the Operational Reliability Analysis Program (ORAP).

**Low emissions**
Dry low NOx performance of <25 vppm (at 15% O2 dry) on fuel gas

**Proven experience**
Alstom's GT13E2 gas turbine serves as the core of the simple-cycle plant. This proven turbine, which has been installed over 150 times worldwide, can be customised to a broad range of applications, fuels and configurations. The GT13E2 has demonstrated high reliability and availability in over 9,360,000 operating hours (including more than 1,000,000 hours on fuel oil) with over 71,000 starts. The GT13E2 fleet leaders have amassed 140,000 operation hours on gas and 100,000 operation hours on fuel oil.
Key facts

Power plant operators faced with periods of peak demand and backup generation needs trust the versatile KA13E2 capability of meeting these challenges. The KA13E2 offers advanced class performance at conventional class temperatures and the highest availability and reliability, including faster power availability.

Based on the proven conventional class GT13E2 gas turbine, the KA13E2 offers a dual operating mode that makes it ideal for:
- Industrial and co-generation applications
- Regions where fuel costs do not require advanced-class turbines with higher investment and operation costs

In addition, the KA13E2 is the proven solution for:
- **Co-generation applications**: e.g. in industry, aluminium smelters, district heating and desalination with a wide range of steam extraction capabilities
- **Repowering**: the conversion of an existing steam power plant into a combined-cycle power plant

Configurations

Using a multi-shaft arrangement, the KA13E2 can accommodate up to three gas turbines with a dual pressure Alstom HRSG for each block and an Alstom COMAX non-reheat steam turbine. All of them are driving an Alstom air-cooled TOPAIR turbogenerator.

- KA13E2-1 1 GT / 1 ST
- KA13E2-2 2 GT / 1 ST
- KA13E2-3 3 GT / 1 ST

Options

- Augment power up to 10% of plant output through peak firing and/or air inlet cooling (evaporative cooling, fogging, high fogging) and/or water injection
- Supplementary firing
- Indoor, semi-outdoor or outdoor installation
- Phased construction with or without bypass stack
- Backup fuel oil capability
power plant KA13E2
and performance

Built around the GT13E2, proven by over 8.7 million operating hours, the KA13E2 offers exceptional class performance at conventional class temperatures.

Customer benefits

**Operational flexibility**
- Designed for cyclic as well as base load operation
- Unique dual operation mode with on-line switchover capability: Power optimised for higher performance or maintenance cost optimised for up to 50% more operation time between scheduled inspections
- Supporting small and/or industrial grids with proven frequency response
- GT island mode operation capability
- Fast startup capability and high startup reliability
- Excellent fuel flexibility to operate on a wide range of gas fuels with high hydrocarbon content and wide fluctuations of the Wobbe Index (±10%)
- Dual fuel capability, with on-line switchover

**Performance**
Up to 55.8% net efficiency in combined-cycle

**Reliability and availability**
The GT13E2 outperforms the industry average on mean time between failures, mean time to repair, service factor and service hours per start, according to the Operational Reliability Analysis Program (ORAP).

**Low emissions**
Dry low NOx performance with <25 vppm (at 15% O2 dry) on fuel gas

**Proven experience**
More than 40 KA13E2 combined-cycle blocks installed around the world, each customised to a range of applications, fuels and configurations, demonstrating very good reliability and availability on fuel gas and fuel oil.
Key facts

The KA24 and KA26 reference plants offer power producers leading operational flexibility, highly competitive base and part-load performance, proven reliability and low emissions. These combined-cycle plants have at their core either an Alstom GT24 (60 Hz) or an Alstom GT26 (50 Hz). Both of these advanced-class turbines feature Alstom’s innovative sequential combustion technology and dual operating modes. The latter enables plant operators to balance performance against plant maintenance costs.

Configurations

- **KA24-2 MS (Multi-Shaft arrangement)**, consisting of two GT24 gas turbines with two Alstom triple pressure reheat drum-type HRSGs and one Alstom STF30C steam turbine, each driving an Alstom air-cooled TOPAIR turbogenerator
- **KA26-1 SS (Single-Shaft arrangement)**, consisting of one GT26 gas turbine with one Alstom triple pressure reheat drum-type HRSG and one Alstom STF15C steam turbine, both driving one Alstom hydrogen cooled TOPGAS turbogenerator on a common shaft-line with a Self-Shifting Synchronous clutch (SSS-clutch)
- **KA26-2 MS (Multi-Shaft arrangement)**, consisting of two GT26 gas turbines with two Alstom triple pressure reheat drum – or once through-type HRSGs and one Alstom STF30C steam turbine, all of which drive to one Alstom air-cooled TOPAIR turbogenerator or optional hydrogen-cooled TOPGAS turbogenerator
- **Co-generation applications** e.g. in industry, aluminium smelters, district heating and desalination with a wide range of steam extraction capabilities
- **Repowering** conversion of an existing steam power plant into a combined-cycle power plant

Options

- Power augment up to 10% of plant output through air inlet cooling (evaporative cooling / fogging / high fogging)
- Supplementary firing in HRSG
- Indoor, semi-outdoor or outdoor installation
- Back-up fuel oil capability
- Low Load Operation Capability
power plant KA24/KA26
production in the advanced-class market

The KA24/KA26 plant provides unparalleled operational flexibility and efficiency across the entire load range.

Customer benefits

**Optimised reference plant design**
- Optimised topping and bottoming cycle for maximum all-round performance at base load and part load
- High cycling capability to support dynamic power generation needs
- Eliminates the need for an auxiliary boiler to assist in start-up of the power trains
- No loss of complete power train in the event of a steam turbine trip. In both single-shaft and multi-shaft configurations, the gas turbine generator unit continues to generate power, while the steam is directed to the steam bypass system until the steam turbine re-starts.

**Outstanding operational versatility**
- Unmatched operational versatility, with the innovative ability to switch online between two operational modes: Power optimisation for maximum output or maintenance cost-optimisation to extend operational time between inspections by up to 30%
- Sequential combustion technology for high all-round performance and flexibility

**Low emissions**
Dry low NOx performance (<25 vppm) over a wide load range – from 100% down to 50% or less – on fuel gas as well as in low load operation

**High base and part-load performance**
The unique sequential combustion gas turbine and Alstom’s expertise in designing optimised water-steam cycles combine to provide a highly efficient combined-cycle power plant across load ranges. This offers power producers higher Net Present Value (NPV) when operating in de-regulated markets that demands high levels of flexibility.

**Excellent fuel gas flexibility**
Because the GT24/GT26 gas turbines handle gas compositions with wide-ranging, high hydrocarbon content, they maintain an excellent Wobbe Index tolerance of up to ±15% without the need for hardware changes.

**Low Load Operation Capability (LLOC)**
- Capability to keep the entire combined-cycle plant running during low demand periods at very low load (20% or below)
- Option to “park” the plant during off-peak periods at a minimum combined-cycle power plant load, with low fuel consumption and rapid re-loading
KA13E2: perfectly matched to the aluminium industry

The unique dual operation mode capability of Alstom’s KA13E2 combined-cycle power plant makes it an ideal choice for use in the aluminium industry. Along with world-class efficiency, the KA13E2 offers you the option to dial up output to peak levels or extend the time between hot gas-path inspection intervals to 36,000 Equivalent Operating Hours (EOH).

Key facts
The power intensity of aluminium production makes the availability of low-cost electricity vital. The load of an aluminium smelter changes frequently, with load swings occurring as a result of anode effects or trips of pot lines. The power plant supplying the facility must be able to maintain a stable industrial grid frequency, independent of the electrical grid.

Today, the KA13E2, representing 14 GT13E2 gas turbines, anchors six dedicated plants powering aluminium smelters operated by leading aluminium producers like ALBA, DUBAL, SOHAR Aluminium and Rio Tinto Aluminium.

Customer benefits
Low cost of electricity
Based on the GT13E2, Alstom’s KA13E2 power plant maintains the highest efficiency in its class and, when used in the maintenance cost optimised mode, provides a possible hot gas-path inspection interval of 36,000 Equivalent Operating Hours (EOH).

Robust and reliable
- The stable EV (EnVironmental) combustion system and conventional firing temperatures of the GT13E2 support fast load changes up to 6 MW/s without compromising engine lifetime
- The block size of 250 MW provides high redundancy (N-1 and N-2), even in medium-size plants and retrofitted facilities

Operational flexibility
- When functioning in island operation mode, the GT controller easily accommodates rapid load changes. At the same time, the Plant Master controller distributes load between the different units to maximise efficiency.
- Use a wide variety of fuels, including natural gas, gas with high hydrocarbon content and fuel oil
- On-line changeover to fuel oil can be accomplished without changing hardware

Modularity
- Several augmentation options and peak firing capability are available to boost performance
- Phased construction capability allows rapid construction and plant start-up in simple-cycle operation
The power to produce specialty power efficiently and cost-effectively.

KA11N2 LBtu: a proven power plant designed for steel mills

The KA11N2 LBtu combined-cycle power plant, an ideal choice for industrial concerns with a need for additional power, has delivered optimal economic efficiency throughout its 15 years of operating history.

Key facts
To combat the increasing price of electricity, steel plants are leading the charge to optimise energy production by replacing boilers and using Blast Furnace Gas (BFG) in gas turbines. The KA11N2 LBtu has been specially adapted to burn steel making’s waste gases to efficiently generating power and steam. The Alstom gas turbines that power the KA11N2 offer consistent, stable operation at low- and part-load conditions, as well as reduced NOx and CO emissions.

Using Alstom’s innovative Plant Integrator™, each power plant is tailor-made to local business requirements and site-specific needs, providing maximum value to operators in the 50 Hz and 60 Hz markets.

Customer benefits
Fuel flexibility
- All waste gases from a steel plant can be utilised
- With a minimum LHV of 1,800 kJ/kg (660 kcal/Nm³), even pure Blast Furnace Gas (BFG) can be burned
- No need to use natural gas or expensively cleaned Coke Oven Gas (COG) for the gas turbine after start-up
- Low fuel costs – thanks to being independent of natural gas and COG
- Rugged combustor with fuel flexibility that can burn mixed gases even at ±15% calorific variation

Operational flexibility
Stable operation at low- and part-load conditions (operation of GT from 0 to 100% load on BFG)

High efficiency
- Higher efficiency than conventional BFG boiler/steam turbine solutions
- More power generated from the same amount of waste gas with lower CO emissions per MWh

Low emissions
Low NOx and CO values even at part-load

Proven track record
- First KA11N2 LBtu continues to operate since its installation in 1997
- 15 years of successful steel plant applications
- 21 similar applications using Alstom LBtu-burner technology with more than 2,000,000 fired hours
Key facts

Co-generation offers an extremely efficient way to combine the generation of electricity and heat (steam). Using waste heat from power generation can result in an extremely high fuel utilisation rate – often as high as 90%.

The demand for co-generation plants comes from industries requiring both power and steam:
- Desalination
- District heating
- Chemical and petrochemical production
- Oil and gas production and refining
- Pulp and paper processing
- Other industrial processes requiring heat (e.g., hot water production for Liquefied Natural Gas terminals)

Alstom’s combined-cycle gas power plants are well suited to co-generation.
Co-generation allows industries to achieve fuel utilisation of **up to 90%**.

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**Customer benefits**

**Higher efficiency**
- Use waste heat from power generation to achieve higher efficiency (up to 90% and above) than separate power and heat production
- Lower cost of electricity and heat

**Additional revenues**
- Gain revenue from two separate efforts: power and heat
- Lower risk for owner/operator, compared to dependence on either power or heat

**Optimised results**
- A large operational range of power plants from 100% load to below 40%
- Gas turbines with high efficiency, even at part load
- HRSGs especially designed for cyclic operation, as needed in co-generation applications
- Steam turbines with controlled steam extraction, providing flexibility between power and steam production
- Heating condensers especially designed for district heating or special condensers for warm water production to recover additional heat

**Green power**
Environmentally friendly power and heat production, with certificates of origin for produced power available in the European Union.

**Alstom ecoHEAT™ solutions**
ecoHEAT™ (ecological and economical heat production) combines high fuel utilisation and operational flexibility to derive separate revenue streams from power and heat. An expert in ecoHEAT™, Alstom can help power producers provide an appropriate amount of power and heat as needed to meet dynamic co-generation energy demands.

**KA26 ecoHEAT™**
- The KA26 has been specially adapted for district heating application
- The KA26 provides up to 300 MW for efficient district heating, even in a compact single-shaft arrangement with standard shaft height
Key facts

An add-on is the conversion of a simple-cycle plant into a combined-cycle plant. Two goals drive this conversion: to increase the power output and efficiency of the plant; and to maintain the previous low level of emissions and fuel utilisation.

Power producers integrate a “steam tail” into an open cycle GT plant using Heat Recovery Steam Generators (HRSG), steam turbines and related generators. Alstom’s long history of manufacturing customised steam turbines positions us as the ideal partner to offer steam turbines that fit optimally with gas turbines already in operation. Alstom can also integrate additional conversion-related equipment, as well as supply add-on retrofits of existing simple-cycle power plants from 10 MW upwards.

Alstom’s conversion expertise

Add-ons based on Alstom’s large steam turbine portfolio include:

Equipment
- Steam turbines: COMAX STF15C and STF30C, from 80 to 400 MW, and steam turbines GRT or MT, from 10 to 80 MW
- Associated Alstom turbogenerator and HRSG

Construction
Installation and commissioning, depending on local market needs and site-specific requirements

17 add-ons installed since 1990
lower NOx/CO/CO₂ emissions per kWh
Plant conversions lower the cost of electricity as performance improves.

Add-on concept – Az Zour, Kuwait

This plant, with its economic and environmental advantages, is just one example of Alstom’s capability to deliver clean integrated power solutions.

Customer .................. Alghanim International
Scope of supply ............ Add-on and 8-year Long Term Service Agreement including provision of spare parts, reconditioning services and technical field advisory services
Electrical output .......... 400 MW
Fuel .......................... Natural gas/diesel oil
Cooling system ............. Direct seawater
Application ................ Power generation
Key facts

Repowering involves the installation of new gas turbines, turbogenerators and Heat Recovery Steam Generators (HRSGs), while retaining the original steam turbine, cooling system and selected additional plant equipment and infrastructure.

Two types of repowering scenarios dominate:
- Hybrid repowering, which keeps the existing boiler in operation and adds a new HRSG
- Full repowering, which decommissions or removes the boiler to reallocate the space

Alstom specialises in repowering steam power plants with turbines above 50 MW (60 Hz) and 80 MW (50 Hz).

What we offer

Alstom offers a full range of equipment and expertise needed for repowering steam plants worldwide.

Equipment
- Gas turbine(s) based on Alstom portfolio (GT26, GT24, GT13E2, GT11N2)
- Associated turbogenerator and HRSG
- Retrofit of steam turbine from any OEM

Engineering
Integration of new equipment and existing steam plant components, process engineering and plant design

Construction
Installation and commissioning
Repowering allows steam power plants to operate longer at lower cost and with higher efficiency.

Customer benefits

**Significantly increase efficiency**
- Heat rate improvement up to 40%
- Decrease fuel-related operating cost by as much as 40%

**Increased power output**
Creating additional revenue (up to +200%)

**Keeping emissions low**
- Fuel change possible: From coal to natural gas
- Less NOx/CO2 emissions per kWh
- Lower CO2 emissions per kWh (down to 330–340 g/kWh) to satisfy emission standards

**Heightened flexibility**
- Expanded operational flexibility (wide operation range, fast load gradients)
- Fuel flexibility (in the case of hybrid repowering)

**Extended plant life**
- Existing plant can operate for a longer period of time once repowered
- Main equipment, such as the steam turbine, associated steam path and cooling system (cold end), can be reused

**More cost-efficient investment**
- Lower investment than a new plant
- Faster time-to-permit
- Opportunity to reuse space and plant infrastructure, while retaining experienced staff

**Proven experience**
- 15 repowered plants around the world in both the 50 Hz and 60 Hz markets
- Repowered capacity of 8,000 MW
- Recent repowered plants featured the GT26, GT24, GT13E2 and GT11N2 gas turbines
- Choose to install new gas turbines alongside existing Alstom and non-Alstom steam plant equipment
Key facts

Alstom and BrightSource have joined forces to pioneer a new frontier – the Integrated Solar Combined-Cycle power plant (ISCC). These two global leaders offer power producers turnkey solutions combining:

The two leaders in their field with their respective expertise can offer a plant with optimum performance, providing reliable and economical solar power, including:

- Alstom advanced-class gas turbine, steam turbine, generator and Solar Receiver Steam Generator (SRSG)
- Alstom Plant Integrator™
- BrightSource tower technology with higher steam temperature and higher efficiency than other Concentrated Solar Power (CSP) technologies
- O&M capabilities for the entire plant

Alstom’s ISCC solution places the combined-cycle power plant in the centre of the solar field and fully integrates the solar receiver into the Water Steam Cycle (WSC).

Solar power can be used to generate additional power or to save natural gas:

**Solar boost**

- **ISCC Power**
- **Additional power**

**Fuel saver**

- **ISCC Power**
- **CC power**
- **Fuel saving**
Customer benefits

**Reduce CO₂ emissions**
- Achieving ISCC efficiencies up to 80% with CO₂ emissions as low as 230–250 g/kWh
- Boost power production during the day
- Generate additional power from solar: up to 20% (KA26) and 12% (KA24)

**Save fuel**
- Up to 40% of the power can be produced from solar
- Up to 40% of natural gas is replaced by solar energy

**Improve solar operation mode**
Back-up from efficient combined-cycle power plant:
- No need for solar storage to smooth transients and to match evening consumption peak
- Solar electricity can be generated faster (ST already in operation, no start-up of solar WSC required)
- Ability to run in solar only mode (option)

**Lower cost of electricity**
- Use same equipment (steam turbine, generator, BOP, ACC) and same infrastructure (grid access, operation crew) for solar power as combined-cycle power plant
- Faster payback and significantly lower cost of electricity of solar power with ISCC configuration
Commitment to innovation

Alstom makes its unwavering commitment to innovation with the full commitment of 1,500 gas power plant engineering and R&D professionals located in 90 countries.

To supplement this deep internal expertise, Alstom also maintains working relationships with more than 30 universities around the world, including Oxford, Massachusetts Institute of Technology (MIT), Lausanne and engineering institutes in China, India and Russia.

This demonstrated commitment enables Alstom to deliver products featuring leading edge design and unmatched performance, and a complete set of services that enhance plant performance, reduce life-cycle costs and minimise environmental impact.

The Alstom power plant

Customers benefit from Alstom’s real-world validation and development facility in Birr, Switzerland.

This working gas power plant, which is connected to the Swiss power grid, gives Alstom the opportunity to validate technologies and components in a working environment, under real service conditions. The result is an assurance that customers receive the highest quality, most innovative, versatile and reliable products proven in real-world conditions.

Alstom’s evolutionary approach to R&D preserves customers’ investments, **while creating value across products’ lifecycles**.
More than 1,500 Alstom gas turbines anchor power production facilities worldwide, across a wide range of applications, fuels and configurations.

Creating revenue for power producers around the world

F’KIRINA (ALGERIA)
2 × GT13E2 – 292 MW

LAKE ROAD, CONNECTICUT (USA)
3 × GT24 – 792 MW

PELICAN POINT (AUSTRALIA)
1 × KA13E2-2 – 480 MW

DUBAL (UNITED ARAB EMIRATES)
1 × GT13E2 co-generation – 150 MW
1 × KA13E2-2 – 430 MW

SOHAR (OMAN)
2 × KA13E2-2 co-generation – 1,000 MW

LANGAGE (UK)
1 × KA26-2 MS – 885 MW

CLAUS C (THE NETHERLANDS)
1 × KA26-3 MS – 1,280 MW
Repowering of 640 MW steam power plant

FUJAIRAH (UNITED ARAB EMIRATES)
2 × KA26-2 and 1 × KA26-1 – 2,000 MW
Steam for desalination
Water: 590,000 m³/day

PHU-MY 2.1 EXT. (VIETNAM)
170 MW add-on for 2 × V94.2
In-depth service portfolio combined with broad experience

In today’s power generation and industrial markets, plant owners and operators seek to establish long-term cooperation with major Original Equipment Manufacturers (OEM). They look for partners who are willing and able to develop flexible solutions that will increase production efficiency and reduce emissions throughout the lifetime of their equipment.

As part of Alstom’s commitment to providing complete plant services for optimal performance, we are dedicated to supporting you to cost-effectively maintain your gas turbine and combined-cycle (GT/CC) power plants.

Our flexible and customised expert services cover solutions at all stages of the plant lifecycle or if requested simply on single components including:

- Parts
- Reconditioning and repairs
- Technical expertise and operational support
- Field service
- Performance improvements
- Service contracts
- Services on other OEM gas turbines

Service contracts

Alstom’s service contracts are tailored to meet all your operational, maintenance and support requirements. Whether you prefer a Long Term Agreement (LTA) or an Operation & Maintenance (O&M) contract, with Alstom’s comprehensive, yet flexible agreements, you can be sure of a win-win situation.

Partnerships for performance

Long-term agreements are based on framework contracts that define prices and conditions in advance. Besides offering preferential conditions for high quality parts and services, the LTA reduces administrative efforts and simplifies planning. The scope of services and equipment covered, as well as the contract duration and risk sharing, can be adapted perfectly to your needs.

LTAs offer many immediate advantages:
- Fixed preferential prices for parts and services
- Flexible scope to suit operative strategy
- Extendable scope to include almost any aspect of plant operations

Alstom’s operation and maintenance contracts let plant owners devise completely new management strategies by outsourcing risks and responsibilities.

Alstom’s O&M contracts are fee-based agreements that:
- Mitigate risks
- Leverage Alstom’s extensive experience in plant asset management
- Can be adapted to suit your business strategy

Partnership throughout the plant’s lifecycle

Plant Support Center™ – Expert support around-the-clock

Alstom’s Plant Support Center™ (PSC) offers fast and comprehensive technical support solutions to keep plants competitive. Besides remote monitoring and diagnostic services, the PSC provides 24/7 operation support and direct access to a global network of technical experts who assist in troubleshooting, assessment and re-commissioning and analyse equipment trends.

Besides practical experience, our plant operation experts rely on comprehensive and proprietary knowledge management tools. If required, they can also call in Alstom experts with specific engineering know-how and fleet-wide experience to assist with operational support or more detailed investigations.
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.