ALSTOM BOILERS
OUTSTANDING
OPERATIONAL FLEXIBILITY
Alstom is a global leader in power generation with a portfolio of products covering all fuel types. From fossil and biomass to nuclear and renewable energy sources, close to 25% of the world’s power production capacity depends on Alstom technology or services.

Alstom Power has more than 100 years of experience in the Engineering, Procurement and Construction (EPC) of new power plants. With operations in 70 countries, Alstom Power is close to its customers all over the world, ensuring rapid responses and service excellence at all times. With fossil power plants likely to continue to be the main component of world power generation, the efficient and reliable conversion of fuel into electricity remains of paramount importance.
We have also developed a range of Circulating Fluidised Bed (CFB) boilers firing low grade fuel, difficult-to-burn coals, waste coal and various opportunity fuels. We have developed a unique expertise in scaling utility size CFB boilers to 660 MW and larger with supercritical steam cycles.

Our expertise has produced a boiler design with very high reliability. This allows our customers to reduce outage time and maintenance expenses, thereby minimising lifecycle costs.

Proven fuel expertise

Alstom has been making boilers for over 100 years. Today, almost 30% of all boilers installed or under construction incorporate our technology.

We offer a wide range of boiler types including pulverised coal-fired boilers in both tower and two-pass configurations, advanced oil and gas fired boilers and circulating fluidised bed boilers.

We pioneered supercritical steam generation and today lead the industry in supercritical boiler technology. We have directly supplied more than 115,000 MW of supercritical boilers worldwide and trained and licensed other companies to install an additional 140,000 MW.

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Alstom has the largest installed boiler base in the world. Approximately 30% of all boilers installed or under construction use our technology.
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 (SO₂, NOₓ, PM, mercury)
- CO₂ emission reduction and CCS
- Land use, visual impact and noise
- Water intensity reduction and 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

Our commitment to customers

We are constantly driving new improvements in combustion technology and in material applications which allow our products to burn a wide range of fuels cleanly while meeting the most stringent environmental regulations on nitrogen and sulphur oxides, particulates and greenhouse gas emissions.

2.2 million tonnes of lignite saved per year as a result of Ultra-supercritical steam parameters*

≥50% NOx reduction
Achieved in our CFB boilers, using our in-house advanced SNCR**

Largest fuel spectrum
An extensive range of solutions for all types of fuels

* Savings for Neurath USC power plant vs. average German lignite plant fleet in 2012. Alstom calculations using ENERDATA figures
** SNCR: Selective Non-Catalytic Reduction system
An unrivalled choice of boiler products in a number of sizes and burning a wide variety of fuels

**Pulverised Coal (PC) boilers**

Pulverised coal-fired boilers are available in two alternative configurations. In a tower boiler, the heating surfaces are arranged directly above the furnace, resulting in a taller structure with a small footprint. In a two-pass boiler, the heating surfaces are located both above and adjacent to the furnace which means the structure is shorter but has a larger footprint.

Project requirements and customer preferences will determine which is selected with consideration being given to the fuel moisture content and ash characteristics as well as site restrictions.

**Oil and gas-fired boilers**

We manufacture advanced oil and natural gas-fired boilers, that are highly reliable and efficient in operation and which deliver outstanding environmental performance. To date, we have supplied 230 GW of subcritical and supercritical oil and gas-fired boilers, either directly or through global licenses.

**Circulating Fluidised Bed (CFB) boilers**

As one of the industry leaders in utility-class CFB boilers, we are scaling up our CFB boilers to 660+ MW Ultra-supercritical steam cycles. These boilers are able to burn a wide range of fuels, including a variety of low-grade opportunity fuels in an efficient way and, consequently, produce low emissions which conform to the strictest environmental standards.
Comprehensive portfolio based on proven designs

Our key combustion technologies enable our boilers to cover a large spectrum of fuel, from multiple grades of coal (including anthracite, bituminous, sub-bituminous and lignite) to oil and gas, heavy residues, biomass and opportunity fuels.

Ultra-supercritical technology – Our fifty years of expertise in advanced steam parameters and material testing, means we can provide state-of-the-art boilers that deliver impressive performance to maximum efficiency and flexibility and with the lowest possible emissions.
Understanding the concept

Supercritical conditions occur when boiler pressures increase above 3,208 psi / 221.2 bar. Beyond this point, water and steam cease to exist as a distinct liquid and gas and are replaced by a single supercritical fluid.

As the technology of supercritical steam generation emerged in the mid-20th century, we realised that it could deliver real benefits to plant owners and have pioneered its development ever since.

Increased efficiency equals less cost

Today, Alstom’s Ultra-supercritical boilers can operate at cycle efficiencies in excess of 42–45% HHV basis (44–47% LHV basis). Because they are more efficient in operation, they consume less fuel and produce less emissions per kilowatt-hour (kWh).

Supercritical boilers are designed for once-through operation at full load, avoiding the thick-walled steam drums common in subcritical boilers and so allowing quicker start-up. As a result of these efficiencies, the capital cost of supercritical plants is close to those of subcritical plants and overall lifecycle costs are often reduced.
The **higher pressures and temperatures** which are the hallmark of our once-through Ultra-supercritical technology deliver important benefits including **increased efficiency**, greater operating flexibility and **lower operating costs** and emissions levels.

**Supercritical means operational flexibility**
Our once-through supercritical boilers operate in a sliding pressure mode, where pressure is reduced with load. As such they can quickly adjust to changes in load demand while maintaining constant first-stage turbine temperature, lessening the thermal stress on components as the unit is cycled.

**Efficiency improvement with increasing steam conditions**

Steam conditions in bar/°C/°C (psi/°F/°F)

- **Mature technology**
  - 167/540/540 (2,400/1,000/1,000)

- **SUBCRITICAL**
  - 240/540/565 (3,500/1,000/1,050)

- **SUPERCRITICAL**
  - 270/580/600 (3,900/1,075/1,110)
  - 280/600/620 (4,050/1,110/1,150)
  - 350/700/720 (5,075/1,290/1,330)

- **R&D ongoing USA USC Materials Consortium & EC AD 700 project (Ni-base)**
  - 350/730/760 (5,075/1,350/1,400)

**CONTINUED ADVANCEMENTS**
- DDE USC material, DOE steam turbine material AD 700 project, COMTES 700
Furnace wall designs: benefits

There are advantages to both spiral furnace tube and vertical furnace tube arrangements. Which one is chosen depends, in part, on the type of project under construction.

**SPIRAL FURNACE TUBE**
- Benefits from the averaging of lateral heat absorption variation in each tube
- Simplified inlet header arrangement
- Use of smooth-bore tubing throughout entire furnace wall system
- No individual tube orifices
- Large number of operating references

**VERTICAL FURNACE TUBE**
- Simpler windbox openings
- Simpler furnace water wall support system
- No intermediate furnace wall transition header
- Lower construction and maintenance costs
- Easier to identify and repair tube leaks
Tangential firing systems

The tangential firing system built into our boilers offers several key advantages over other firing systems. Tangential firing delivers excellent fuel/air mixing and has a wider tolerance of fuel fluctuations.

The advanced burner design and staging ensure the use of the furnace volume is very effective which results in efficient combustion. As a result, low NOₓ and low slagging dramatically reduce cleaning and maintenance times allowing the system to work at maximum efficiency over a sustained period.

Tilting burners

Tilting burners deliver outstanding operational flexibility by allowing the highest cycle efficiency over the widest load range. They give the operator the ability to control reheat steam temperature by regulating the furnace outlet temperature.

As a result, there is no need for additional spray atemperation and therefore no associated reduction in the boiler’s overall efficiency.

Using advanced materials

Materials used for supercritical steam cycles need to combine high temperature strength with good resistance to oxidation. We use conventional and advanced ferritic steel, austenitic steel and nickel alloys and are constantly researching ways to improve the mechanical properties of the materials we use as well as our welding and manufacturing procedures.

Most material research is conducted under national or internationally coordinated programs and Alstom is an active member of many of them, including the AD 700/COMTES 700 programme funded by the European Commission and the US Ultra-Supercritical Materials Consortium sponsored by the US Department of Energy.
New equipment

We have centres in charge of project management and engineering in key locations around the world.

Our manufacturing sites are also spread around the globe, ensuring our capability to provide the product you need at the location you want.

Boiler services and retrofits

Boiler island rehabilitation: an integrated approach for boiler rehabilitation using process engineered solutions to improve steam parameters to boost plant efficiency and output.

- Field service includes boiler inspections, plant condition assessment, outage support & planning and commissioning and start up.
- Spare parts using genuine Original Equipment Manufacturer (OEM) replacements, plus product upgrades for OEM and other OEM (oOEM) equipment.
- Subsystem retrofits for biomass co-firing conversions and/or to reduce NOx or SOx emissions resulting from degraded fuel quality or compliance with new environmental regulations.
- Construction services for new construction, installation and maintenance service.
Project highlights worldwide

Each of our boilers is optimised for each customer’s needs and parameters to maximise efficiency, reliability and availability.

**COMANCHE 3 (USA)**
Sub-bituminous
1 × 815 MW two-pass PC boiler with vertical furnace tube walls and the latest low NOx firing system.

**BAIMA (CHINA)**
Anthracite coal with coarse particles
1 × 300 MW CFB boiler, commissioned in 2005 and the first utility scale CFB demonstration unit in China. Designed for an antracite-fired power plant, it produces clean, cost-effective power.

**NARVA (ESTONIA)**
A variety of fuels including oil shale, wood chips and peat
1 × 300 MW CFB boiler, making it the largest oil shale-fired boiler in the world. Commercial operation is scheduled for October, 2015.

**NEURATH (GERMANY)**
Lignite
2 × 1,100 MW tower PC boilers, the largest lignite-fired boilers in the world. These state-of-the-art Ultra-supercritical boilers are replacing older, less efficient units which will lead to a significant reduction in CO2 emissions.

**RDK8 (GERMANY)**
Bituminous
1 × 912 MW Ultra-supercritical tower PC boiler. This is one of the highest efficiency boilers in the world which considerably reduces CO2 emissions for each kWh generated.

**MANJUNG 4 (MALAYSIA)**
Sub-bituminous
1 × 1,000 MW two-pass PC boiler with vertical furnace tube wall. South East Asia’s first 1,000 MW Ultra-supercritical coal-fired power plant. Commercial operation is scheduled for 2015.
Alstom power mills

Best-in-class milling solutions

Proven design adapted to each site

Our products are designed to suit boilers up to 1,350 MW, covering a large spectrum of fuels and complying with the highest environmental regulations.

From HP and SM Bowl Mills to Beater Wheel Mills and Tube Mills, Alstom has advanced milling solutions tackling the most difficult fuel characteristics including high moisture coals as well as high or low moisture lignites.

Proven solutions to fit your needs

Alstom has extensive experience in grinding technology, having supplied grinding systems for a wide range of fossil fuels. For over 90 years, Alstom has maintained its position as the leading supplier and innovator of mills for utility and industrial boilers.

We combine our local presence with expert knowledge and global resources to deliver the technology and services to meet the highest customers expectations, all over the world.
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.