World Coal Association Leadership & Excellence Awards 2013

WORLD COAL ASSOCIATION

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Global

Alstom

Environmental initiatives reducing emissions

Alstom's WCA Leadership & Excellence Award-winning environmental initiatives are helping secure a future for coal in a low-carbon world.

By co-firing coal with biomass, the Drax power station in North Yorkshire, UK has reduced emissions by 2 million tCO_2 a year

By retrofitting new technology to existing plants and selecting the most efficient designs for new ones, Alstom saved 207 million tonnes of CO_2 (tCO_2) from being emitted every year between 2002 and 2011.

During this period, Alstom carried out 1,445 new build and retrofit projects in all areas of energy. The company monitored emissions at the affected sites for a year after completing each project. The results were then compared to the same plant's emissions before the project (in the case of retrofits) or to the emissions of the next most likely type of plant to be built on that site (in the case of new builds) to calculate the impact of its efforts. The results have been independently verified by PricewaterhouseCoopers.

Ultra-supercritical

The International Energy Agency (IEA) predicts that global coal consumption will rise by 65% by 2035. This trend is compatible with the global imperative to reduce CO2 emissions due to technological developments, such as high efficiency low emissions power plants and carbon capture and storage (CCS).

Alstom's emissions reduction strategy rests on three "levers":
1. Zero-carbon power generation
2. Making other forms of power generation more efficient
3. Carbon capture and storage.

Those "other forms of power generation" include coal. The drive for efficiency improvements includes using state-of-the-art designs when commissioning new plant. The Rheinhafen Dampfkraftwerk 8 (RDK 8) bituminous-fired power station in Karlsruhe, Germany is one of the first in a new generation of ultra-supercritical plants, generating steam at 600-620°C and 275 bar.

Ultra-supercritical conditions allow the 912MW plant to achieve 46% efficiency – or as much as 58%, when its district heating capabilities are considered. Commissioned in 2012, RDK 8 emits 740g of CO_2 per kWh. A 1980s-generation coal-fired power station emits 1,200gCO_2/kWh. That's a 40% improvement in 30 years.

> *"Alstom does not focus solely on running its own business, but is looking for solutions to multi-clean coal-based energy. Alstom is intensifying its efforts to increase the efficiency of existing power plants and of coal power plants under construction where CO2 capture and storage is a key technology to combat climate change."*
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> **Maciej Kaliski, Department of Mining, Ministry of Economy of Poland**
> **Judge, WCA Leadership & Excellence Awards 2013**

Co-firing and CCS

The Drax power plant in the UK opened in the 1970s, but since its conversion to co-firing coal with biomass, it has become the country's largest single producer of renewable energy. As of April 2013, one of its six 660MW units runs entirely on biomass, and plans are in place to convert two more by 2016.

Drax provides about 7% of the UK's total electricity supply. The biomass system accounts for 10% of that electricity, while reducing the site's CO_2 emissions by 2 million tCO_2 a year.

The expected increase in global coal consumption by 2035, according to the International Energy Agency

Drax also plays host to the White Rose CCS demonstration project: a proposed 450MWe plant using oxy-fuel combustion CCS, where coal is burned in pure oxygen instead of air. The system is expected to capture 90% of the plant's emissions for storage under the North Sea. The CO_2 transportation and storage infrastructure built for White Rose will likely prove instrumental in the growth of CCS in the UK.

In December 2013, the UK government's Department of Energy and Climate Change (DECC) awarded funding for White Rose's next essential stage: a front-end engineering and design (FEED) study. White Rose will also benefit from DECC's contracts for difference, an initiative designed to make low-carbon technology easier to finance by reducing risk for investors; and it is the only CCS project still in the running for Europe's NER 300 renewable energy funding programme.

Oxy-fuel combustion technology has already been proven in a 30MW pilot at Lacq in France, which achieved 90% carbon capture and 99% emissions purity.

Alstom has successfully piloted two other forms of CCS at Mountaineer and at a Dow Chemical site, both in the USA. Mountaineer, the world's largest ever CCS pilot project at 58MW, used chilled ammonia to capture CO_2 after combustion for storage in a saline aquifer. The chilled ammonia method can generate volatile nitrosamine emissions; but another form of CCS, the advanced amines process, was proven to address this in a pilot at the Dow Chemical site. Like Lacq, the Dow pilot achieved 90% capture and 99% purity.

In a series of smaller-scale, lab-based pilots in the USA and Germany, Alstom is developing the next generation of CCS technology: the chemical looping process and regenerative calcium cycle. Both techniques are expected to significantly reduce the energy penalty current CCS technology imposes on power plants.

Clean air

The company is also a world leader (by volume of equipment sold and deployed) in air quality control systems. Some of the technologies in Alstom's portfolio – which includes electrostatic precipitators, fabric filters, wet particulate scrubbers and hot gas filtration systems – are capable of reducing emissions of nitrogen oxides (NOx) by 90% and sulphur oxides (SOx) by 99%.

At the Kusile and Medupi supercritical coal power plants in South Africa, Alstom's wet flue gas desulphurisation system removes 90% of the SOx generated in the boilers. With six 800MW turbine islands each, Kusile and Medupi are the world's largest air-cooled coal power plants – as well as the most environmentally friendly power stations of any kind in sub-Saharan Africa.

Air cooling uses electricity, so it imposes an energy penalty on the plants. In a water-stressed area like South Africa, eliminating thermal power generation's significant demand for water is just another sensible sustainability measure.

Find out more

To find out more about the World Coal Association and our work, visit **www.worldcoal.org** or email **info@worldcoal.org**

To find out more about the WCA Leadership & Excellence Awards, visit **www.worldcoal.org/awards**

To find out more about Alstom visit **www.alstom.com**

207 Million

The number of tonnes of CO_2 Alstom successfully prevented from being emitted every year between 2002 and 2011 due to technological developments.