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Alstom takes the initiative on CO2 capture technologies and global warming challenge

Alstom has been carrying out an intensive research and development programme for the past years to meet the technological and economic challenges of capturing the CO2 created in fossil-fuel-based electricity production. As early as 2014, the company will be able to offer fossil-fuel-based power plants that respect the environmental constraints linked with climate change. Several technologies will be tested in six pilot projects already under way in Germany, the US, Norway, Sweden and France. Other projects are being studied and will be announced shortly.

Being aware of the urgency of the climate change problem and various regulations in preparation in the world, Alstom has launched, in parallel, the development of several technologies so that it can offer CO2 capture solutions that give the best energy efficiency for an acceptable cost of installation and maintenance for the operator.

Of the three main technology paths for the capture of CO2 emitted by a power station burning fossil fuels, Alstom Power is concentrating on post combustion technologies and oxy-combustion. The main reason for this choice is that capture technologies must be able to be used on existing power stations as well as the numerous power stations, mainly coal, that will be built by 2030 to meet the growing demand of developing countries. The solutions chosen by Alstom correspond to this.

Post-combustion technology is the most advanced technology today and can be adapted easily to the large installed base of coal-fired power stations. It consists of separating the CO2 from the exhaust gases using a solvent (amine or chilled ammonia). The latest results from our bench test show that the chilled ammonia capture method developed by Alstom can remove up to 90% of CO2 from the combustion gases. This technology can also be applied to both coal-fired power stations and to combined cycle gas-fired power stations. The various pilot projects and industrial demonstrations that will begin at the end of this year will verify the energy use of this technology and should confirm its economic advantages over other technologies.

The oxy-combustion method consists of burning a fuel in oxygen instead of air. The gases produced by this oxy-combustion are mainly water and CO2, which is easy to capture at the end of the process. The main challenge of oxy-combustion technology today is reducing the cost of large-scale oxygen production. This path has been chosen by Alstom because it presents the least technological risk.

The oxy-combustion should also be retrofittable to existing power stations and the conditions for doing so are currently being studied. Also, important technological breakthroughs are being prepared, such as chemical looping, a new and promising form of oxy-combustion currently undergoing bench tests at Alstom. This process will allow to avoid the costly use of cryogenic oxygen.

The third path, called pre-combustion, consists of transforming by gasification a fuel rich in carbon (coal or petrol derivatives) into a synthetic gas made up of carbon monoxide and hydrogen. Several stages of transformation and purification are then needed to transform the gas, remove the CO₂ and obtain a stream of pure hydrogen that can then be burned in a combined cycle power station. Although gasification is a well known industrial process, producing electricity from hydrogen on a large scale remains to be fully tested. Alstom has not gone down this technological road because it cannot be used in existing power stations, would be a costly investment and is difficult to put into operation to give reliable electricity production.

A programme well on its way

Alstom has already signed six deals with utilities and oil companies for the pilot CO₂ capture plants using both oxy-combustion and post-combustion methods.

Post-combustion:

- A 5 MWt post-combustion pilot plant (chilled ammonia) in association with Electric Power Research Institute (EPRI) for We Energies in the United States (coal)
- A 5 MWt post-combustion demonstration plant (chilled ammonia) for E.ON in Sweden (oil and gas)
- A 30 MWt post-combustion product validation unit (chilled ammonia) for American Electric Power (AEP) in the United States (coal) followed by the design, construction and commission a commercial scale of up to 200 MW CO₂ capture system in 2011
- A 40 MWt Post-Combustion test and product validation facility (chilled ammonia) for Statoil in Norway (gas)

Oxy-combustion:

- A 32 MWth oxy-firing demonstration (boiler retrofit) unit for Total in France (gas).
- A 30 MW oxy-firing demonstration plant for Vattenfall in Germany (lignite)

Other partnerships are also currently under discussion and will be announced in months to come. Alstom thus intends to take a worldwide leadership position in CO₂ capture, as is already the case in other “clean energy” areas. Regardless of the fuel source, the solutions offered by Alstom significantly reduce traditional pollutants and greenhouse gas emissions without sacrificing the profitability of power plants. World leader in air quality control systems, Alstom offers the world’s largest scale of solutions to eliminate dust and reduce traditional pollutants including mercury, nitrogen oxides and sulphur oxides by more than 90%.

While the development of CO₂ capture solutions is a priority, Alstom remains committed to the foundation of its business and the continued improvement of energy efficiency is chief among its

research and development efforts. Two main roads are being pursued. On the one hand, the improvement of plant efficiency, which translates into significantly more electricity for the same amount of fuel and a longer life span. This road translates into a large services offer, engineering and equipment for the rehabilitation of existing power plants with at stake important savings and CO2 emission reductions of up to 25%. On the other hand, the use of ever increasing steam cycle temperatures allows us to offer our clients the best available technology for new power plants. The next step of these advanced cycles will be at 700 degrees Celsius and will allow for an energy efficiency of around 50% by 2020, or 42% of CO2 emissions avoided compared to the average worldwide emissions of coal-fired power plants.

With electricity consumption rising worldwide, the protection of the environment, such as the control of CO2 emissions, is creating a new demand. Alstom, world leader in clean energy, offers the complete range of solutions, both for new equipment and for the retrofit of the installed base as well as in terms of services.

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