More efficient and economical capture of power plant carbon dioxide emissions

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A consortium led by VTT Technical Research Centre of Finland has developed a new technology that captures the carbon dioxide emissions of power plants more economically and ecologically. The International Energy Agency IEA regards carbon dioxide capture as essential if the emission reduction targets set for greenhouse gases are to be met. The new technology is based on a combination of traditional circulating fluidised bed combustion and oxyfuel combustion, enabling more extensive use of cheaper fuels and even biomass. Political decisions and legislative changes will be necessary before widespread implementation of this new technology.

Seeking to slow climate change and reduce greenhouse gas emissions is one of today's greatest environmental challenges. According to the intergovernmental climate change panel IPPC, carbon dioxide emissions should be reduced by 50–85% by 2050. Meeting this target would mean every year dozens of additional power plants implementing carbon dioxide capture systems. Until now, capture technologies has been at the trial stage and its implementation slowed by the prohibitive cost of the available methods.

The FLEXI BURN CFB project coordinated by VTT Technical Research Centre of Finland developed and successfully demonstrated an oxyfuel combustion concept based on circulating fluidised bed combustion. This new technology combines the oxyfuel based carbon dioxide capture with flexibility and financial benefits of circulating fluidized bed combustion. In addition, the same power plant can

continue operation also when capture is impossible, for example during temporary outages of the CO2 transport and storage facilities, thus reducing the investment risk.

The advantages of circulating fluidised bed combustion include high efficiency, fuel-flexibility and the option of using a large proportion of biomass in the fuel. The increased price of energy and exhaustion of good-quality fuel reserves mean it is currently more profitable to use lower-quality fuels. The fuel-flexibility enabled by this new technology will reduce dependency on imported coal and create cost savings, since cheaper options, including waste coal, can be used for fuel.

Equipping new and existing power plants with the carbon dioxide capture process will require further investments, since a part of the energy generated by power plants will inevitably be required for the production of oxygen and capture of carbon dioxide. This new technology nevertheless enables a smooth transition to carbon dioxide capture. The use of cheaper fuels can offset the costs that will inevitably be incurred through adopting the process.

The functionality of the technology was proven at a demonstration plant in Spain (30 MWth), the world's largest operational circulating fluidised bed oxyfuel combustion plant. The project also developed a commercial-scale concept for a 300MWe plant. The technology developed in the project enables the capture of the carbon dioxide generated by power plants, but its widespread commercial implementation will require political decisions and new legislation, particularly with regard to the storage and final disposal of carbon dioxide.

Provided by VTT Technical Research Centre of Finland