

Technology Platform Clean Power – Zero Emission Fossil Fuel Power Plants

Executive Summary for a Vision Paper

To drastically reduce the environmental impact of fossil fuel use, particularly coal, to save fuel resources to a maximum extent, to reduce CO₂-emissions and to enhance Europe's competitiveness. Technological pathways are the significant increase of efficiency of the conversion process as well as CO₂ capture and storage.

Advanced technologies for the generation of electricity based on fossil fuel use have been identified as a priority for the 7th Framework Programme. The Technology Platform shall give a significant impetus to R&D activities in this field. A common vision as described in the following text will create the basis for joint industry and research institute actions aimed at optimizing the time and funds needed for research activities.

New Technologies – the key for a sustainable energy system

Reduction of greenhouse gas emissions is one of the major drivers in European energy policy. With the implementation of the European CO₂ emission trading scheme, the framework for using fossil fuels for electricity generation has changed significantly. The overriding challenge for the power sector in Europe is to reach the target of massive CO₂ emission reduction without losing global competitiveness and long-term electricity supply security. There is a common belief among the participants of the Technology Platform that, with regard to a long-term use of fossil fuels, the key to combine environmental improvements, global competitiveness and securing supply of energy is the development of innovative technologies. With this goal in mind, two technical pathways were identified for electricity production from fossil fuels, specifically coal:

1. Enhancing the efficiency of the conversion process from fuel to electricity,
2. Developing technologies for CO₂ capture and storage.

Enhance efficiency – no-regret pathway

Increasing the efficiency of fossil power plants leads to both a reduction of CO₂ emissions and a decrease of fuel consumption. Therefore, enhancement of efficiency always aims at two targets with one arrow: improving the environmental impact and saving energy resources. As Europe's import dependency for energy is expected to increase up to 70% in 2030, energy resource saving has become a major macro-economic issue. Also, from an operator's point of view, less fuel consumption means a better competitive position as the marginal costs are reduced. Nevertheless, important limitations on efficiency increase are given by physical restrictions, in particular by the maximum process temperature achievable in real technical processes. Therefore, three key issues have to be pursued within this technical pathway:

1. Increase of maximum process temperatures for established processes,
2. Improvement of their technical components,
3. Development of new processes.

New technical solutions have to be found that allow a significant increase in efficiency by a limited rise in investment. The framework of the EU emission trading scheme supports technical designs that would not have been economically viable in the past. Anyway, as these new technologies are linked with technical risks a common commitment of industry partners and research institutes for joint actions is necessary. Intensive research work has to be done, specifically in the field of new materials; also, new technologies like combined cycle based on coal have to be optimized. But in the end, construction of a highly efficient full-scale demo plant must be achieved in due time. The common vision is to "pass the 50% threshold" for coal-fired power plants within the next decade.

CO₂ capture and storage - develop new opportunities

While increasing the efficiency can lead to significant emission reduction and fuel resource saving, it cannot bring CO₂ emissions close to zero. For very low CO₂ emissions, technical processes for capturing CO₂ within the conversion process shall be developed. To avoid the greenhouse gas effect, the captured CO₂ has to be separated from the atmosphere and stored for very long time periods. CCS requires major long-term research efforts on both elements:

1. Efficient capture technologies,
2. Reliable storage methods.

In a general approach, many promising capture technologies have to be developed and tested in experimental installations. By around 2012, all technical and economic data should be available. On this basis, a choice must then be made between all potential technologies. Parallel to this, long-term CO₂ storage has to be investigated with regard to technical, geological, ecological, economic as well as environmental/approval law aspects. The common vision is to achieve industrial-scale implementation by approximately 2020. Beside the technical challenges, public acceptance for CCS has to be ensured. This encompasses long-term storage as well as the unavoidable fact of higher fuel consumption and the resultant higher CO₂ production. Demonstration projects must be accompanied by open communication and sound development of a regulatory framework.

Conclusions

Fossil fuels will be a major part of Europe's power basis for the next decades. Massively increasing the efficiency of the conversion process can meet the targets of emission reduction and resource saving by simultaneously increasing the competitiveness of European industry. Further reductions of CO₂ shall be achievable by implementing CCS technology. Nevertheless, as additional energy will be necessary for capturing CO₂, CCS is not an alternative to efficiency increase, but highest efficiency of the energy conversion process is a precondition for CCS. There is no rivalry between both pathways - only an intelligent combination of both can lead to a sustainable solution. A sound evaluation of technical options and public acceptance requires installation of large-scale demo plants – for CCS as well as highly efficient processes.

A joint R&D-programme of industry and science on the generation of clean power based on fossil fuels opens up the opportunity for Europe to become the world leader in environmentally benign technology.