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| **Clean Coal Power Generation and Resource Utilization** |
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| **Research background:**The Alliancedevelops technologies for poly-generation of heat, oil, gas from coal, and ultra-low emission of pollutants from coal combustion power plant, which treats coal not only as an important source of energy but also as a precious resource. They make an important contribution to the key national strategic requirementfor developing clean coal-fired technology while protecting the atmosphere. The Alliance aims to be an international first-class technological innovation platform in coal power field by focusing on major issues in clean power generation from coal, reforming the systems, and developing innovativemechanism for promoting university-industry collaboration. The Alliance was accredited by the Ministry of Education and the Ministry of Finance in October 2014. |
| **Main research topics and progresses:****Main research topics:**1. Atmospheric pollutants treatment technology
2. Carbon dioxide capture and utilization technology
3. Solar thermal power generation technology
4. Biomass power generation technology
5. Liquid fuelsynthesis technology using biomass
6. Large-scale hydrogen production technology
7. Energy storage technology
8. Technology of converting waste into energy
9. Resource recovery power generation technology

**Achievements**Number of National Science & Technology Progress Awards (2013-2017): 4Number of National Technology Invention Awards (2013-2017): 2Scientific Research Funds (2013-2017): 652 million yuanNumber of National Natural Science Fund Projects (2013-2017): 89Number of Projects Sponsored by Ministry of Science and Technology (2013-2017): 80Number of SCI Publications (2013-2017): 1149Number of Patented Inventions (2013-2017): 301Number of Monographs (2013-2017): 19 |

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| **Members and institutes :**1. Zhejiang University
2. Tsinghua University
3. East China University of Science and Technology
4. China Huaneng Group
5. China Guodian Corporation
6. Dongfang Electric Corporation
7. Shenhua Group
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| **Representative achievements:****1. Circulating fluidized bed coal pyrolysis and combustion gas tar and steam poly-generation technology**A new poly-generation system combined coal combustion and pyrolysis has been developed forclean and high efficient utilization of coal. Coal is pyrolyzed in pyrolyzer and produces gas, then it is purified and used for industrial purpose or as gas turbine fuel.Tar is collected duringpurification and can be processed to extract monocyclic aromatic hydrocarbons (MAHs) andpolycyclic aromatic hydrocarbons (PAHs) etc., or to make liquid fuels by hydro-refining. Semi-coke from the pyrolyzeris burned in a circulating fluidized bed (CFB) boiler for heat or powergeneration.A300MW demonstration project using this technology designed byZhejiang University in cooperation with Guodian grouphas been erected and operated successfully.Operating and testing results show that the development of the dual fluidized bed material circulation system can effectively control the large-scale high temperature circulating material circulation and ensure the sealing performance between the two reactors, thus realize the grading conversion of lignite to gas, tar, heat, and power. Whilethe feeding rate of lignite was 40t/h, the gas yield of systemwas 8200Nm3/h, the gas (CO, and CH4) concentration wasmore than 75%, and the tar yield was about1.1t/h.The successfuloperation of 300MW circulating fluidized bed pyrolysis and combustion project provided a good choice for utilizing coalefficiently, and has a great potential for wild popularization and application.**2. Research and application of key technologies for ultra-low pollutant emission of flue gas from coal-fired power plant**Coal is the basic energy in China. The development of ultra-low emission technology for coal-fired power plants is of great importance to clean coal utilization and ensure energy security in China. However, China has a wide distribution of coal resources, complex components of coal, and large quantity of poor quality coal. The ultra-low emission technology for coal-fired flue gas with high adaptability to coal quality and power plant load is a difficult problem await breaking through.The key of this project is to develop anultra-low pollutant emission system with high efficiency, high reliability, high adaptability, low cost and high efficiency in removing multi pollutant,with which we can realize ultra-low pollutant emission from coal power plant usingcomplex quality coal of complex conditions. This technology can make coal much cleaner.The ultra-low emission technology of coal-fired power plant has promoted the green development of the energy industry. In the application of Jiahua coal-fired power plant, which hasa capacity of 1000MW, flue gas ‘runs’ in dozens of seconds in the ultra-low emission system.The concentration of pollutant emissions is far below the emission limits.With a high chimneyof more than 200m, the smoke can barely be seen, which means the clean utilization of coal in power plant was successfullyrealized.Now, cooperating with enterprises, ‘key technologies for ultra-low pollutant emission of flue gas from coal-fired power plant’ has been applied in more than 10 provinces and cities nationwide.Different grades of medium (1000MW, 600MW, 300MW etc.) and small power plant,with a total capacityof more than 100 million kilowatts were installed. At the same time, the team also promoted the standardization of key technology and equipment, led the formulation of 9 national and industry standards, and participated in the formulation of 6 national and industrial standards, which promoted the technological progress and industrial development, and supported the implementation of the national ultra-low emission strategy. The team was also invited to introduce this technology in the Davos forum as ‘China scheme’ for the controlling of coal fired pollutant emissions. |