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IMPROVING ENERGY EFFICIENCY AND REDUCING CARBON EMISSIONS

PROJECT REPORTED BY RWE

Fluidized-bed drying with internal waste heat utilization for lignite power stations – WTA*

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Project Description

WTA technology reduces the water content of run-of-mine lignite from 50-60 percent to 12 percent. The decisive advance: in contrast to the previous drying process using 1,000 degree Celsius flue gas, drying is carried out by WTA using significantly less energy at a temperature of 110 degrees. In addition, the heat used for drying the coal is now largely recovered and used again. The WTA-technology has been successfully trialled in a small plant at Frechen since 1993. At the Niederaußem power station the trial operation of a large WTA prototype plant started end 2008. Upstream of the BoA unit, its function is to pre-dry some 20 to 30 percent of the raw lignite and, in doing so, demonstrate the economic and technical benefit of fluidized-bed drying in continuous operation. In future lignite-fired power plants, the WTA process is expected to yield a further rise in efficiency by some four percentage points to 47 percent or more based on the lower heat value of the fuel.

The WTA, the most modern and biggest drying plant for lignite in the world, is a central integral element of RWE Power's coal innovation centre. Guided by the motto "The region does the research, the world reaps the benefits" the company drives forward research and development projects in a variety of areas at the Niederaußem power plant location. Projects such as CO_2 scrubbing, the REAplus high performance flue gas scrubbing and algae conversion have the common aim of making coal firing more environmentally friendly. RWE Power is investing a total of 70 million euros in the current four projects.

Project Reasons

Nature has given lignite up to 60 percent moisture, which is bound by capillaries, and the stored moisture aggravates lignite combustion. Before any industrial use, lignite must be dried. In view of the high moisture content, drying is an energy-intensive process, and that is why energy efficiency is a primary focus here. WTA technology is an important element in RWE's strategy to further reduce CO_2 emissions in lignite-based electricity generation. With the Niederaußem plant, RWE will show that WTA drying in continuous operations is technically and economically suitable for lignite-based electricity generation. Using the WTA method, the already achieved efficiency of BoA technology could be increased by some 1.4 percent points. WTA can be used in future power-plant new-builds. Thanks to better fuel utilization and the associated lower fuel needs per kilowatt hour produced, emissions and, hence, CO_2 values, too, can be cut again in the interest of climate protection. For future advanced lignite-based power plants – irrespective of the technique used, whether with or without CO_2 capture – pre-drying will be the basic precondition for achieving even higher efficiencies.

Project Appraisal and Estimation Methods

CO_2 emission savings of 240,000 t per year are calculated.

"The worldwide significance of coal for power generation will continue to increase. In Europe it is the energy source which offers the highest degree of security of supply and cost-effectiveness. At the same time ambitious goals to reduce carbon dioxide emissions have been agreed. The reduction of CO_2 emissions in coal-fired power generation is one of the biggest challenges of our time. RWE is leading the way by promoting Clean Coal Technologies such as the WTA. Fluidized-bed drying is an RWE Power proprietary development – a drying process that is more favourable in terms of energy in which less waste heat is left unused. This modern process for treating and drying lignite makes coal more climate-friendly: higher efficiency means more climate protection."

* WTA is the abbreviation of the German technical term.

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"The responsible use of resources and a considerable reduction in CO_2 – these are the cornerstones of our corporate philosophy. We are aware of our responsibility for a climate-friendly energy generation. Together with EURELECTRIC, RWE has committed itself to the objective of carbon-neutral electricity by 2050, this requires compensation measures. Research, development and innovation are crucial for a climate-friendly and secure energy supply, but even the best theory is of little use if not put into practice. Thus, we will invest over one billion Euros in R&D projects worldwide between 2009 and 2013. "More growth, less carbon" – this is our strategy for 2012. Increased efficiency of power plants, enhancement of low-carbon electricity generation, massive expansion of renewable energies and participation in international climate protection projects – these are our tools. Climate protection is a global challenge. It concerns every one of us and does not stop at national borders."

RWE is one of Europe's five leading electricity and gas companies. We are active in generation, trading, transmission and supply of electricity and gas. More than 70,000 employees supply over 16 million customers with electricity and approximately 8 million customers with gas.

RWE is the No. 1 power producer in Germany, No. 2 in the Netherlands, and No. 3 in the UK. We are continuously expanding our position in Central and South Eastern Europe. In fiscal 2009, we recorded about € 48 billion in revenue.

Our power plant portfolio and our investment programme for building new, environmentally friendly and flexible generation capacity are the main basis for future growth. Energy from renewables plays a key role. Our leading position in European energy trading helps us make optimal use of our power plants on the market. We react to changes in customer needs by offering new products for homes, commerce and industry. In this context, climate protection and energy efficiency are becoming increasingly important.

The RWE strategy: greener, more robust and more international. Our strategy has three focal points: profitable growth in Europe, reducing CO_2 emissions, and adapting our business activities to the challenges of the market.

The biggest investment programme in RWE history is planned. A main building block of our strategy is capital expenditure on power plants and networks. By the end of 2013, we want to have commissioned over 14 GW in new generation capacity. Two thirds of this will be based on CO_2-free and low-CO_2 technologies. Financing will come from the robust earnings of our current generation portfolio.

In Neurath/Germany the lignite-fired BoA 2&3 with a capacity of 2,200 MW and an efficiency of more than 43% are under construction. In comparison with existing plants, this will lead to a reduction in CO_2 emissions by 6 million tons. We are also forging ahead with plans for a dry-lignite power plant with an efficiency of more than 47%. The new hard-coal plants in Hamm/Germany and Eemshaven/Netherlands have an efficiency of 46%, meaning each of them needs some 20% less hard coal to generate the same amount of electricity and – compared with old systems – emits 2.5 million tons less CO_2. Combined cycle plants using natural gas, as they are currently being built in Lingen/Germany and in Staythorpe and Pembroke/UK, reach up to 58% efficiency. Another step towards making coal-fired power plants more climate-friendly is to develop clean coal technologies in the Coal Innovation Centre in Niederaußem.

RWE has a total of 2,370 MW installed power generation capacity in the field of renewables as of September 30, 2009. We mainly concentrate on wind on- and off-shore, hydro and biomass, but also invest in new applications such as biogas, geothermal or concentrated solar power. Several wind farms are under construction or in planning, as well as four biomass-cogen plants. The largest of these is planned for Stallingborough/UK, which will have an output of 65 MW and will run mainly on waste timber. The goal is to increase the generating capacity from renewables to 4,500 MW by 2012. With that portfolio in place, an electricity generation of at least 15,000 GWh should be reached. In the long term the installed capacity should be around 10,000 MW by 2020. This would lead to around 15% renewable production capacity by 2020 on the group level.

Another key element of our climate protection strategy is our participation in more than 130 international climate protection projects initiated as part of the United Nations' Joint Implementation (JI) and Clean Development Mechanism (CDM).

We associate goals such as climate protection and resource conservation not only with the production of energy, but also with its use. Information and awareness about efficient energy use helps to decrease costs and preserve the environment. With innovative approaches and new products designed for specific customer groups RWE wants to raise public awareness and set higher standards for energy efficiency. Our activities range from LPG for cars (Liquefied Petroleum Gas) to smart meters, from the "house of the future" to the promotion of electric vehicles. On the demand side we support our customers in efficient energy usage. In 2007 we launched our "150 million-euro energy efficiency programme" including services for residential, commercial and public entities.

RWE The energy to lead	GERMANY
Project Name	**Project Description**
RWE Innogy Wind Energy Projects	RWE Innogy invests 70 per cent of its available resources in wind power plants both offshore and onshore. Europe-wide, RWE Innogy operates an important onshore wind portfolio. There is still a growth potential in mature markets like Germany, the UK or Spain. Additionally, RWE Innogy is looking for very attractive options, e.g. in Italy, Poland and Romania. Offshore wind is one key technology for our capacity growth. Focus markets include the UK, Germany and The Netherlands.
RWE Innogy Hydropower Projects	Hydropower plays a major part in the electricity production portfolio of RWE Innogy. The main capacities are located in Germany, but there are also important assets in the UK, France, Switzerland, Portugal and Spain. Additionally, RWE Innogy sees particularly promising growth potential, primarily in Eastern and South-Eastern Europe, as well as in Turkey. We are determined to harness these opportunities.
RWE Innogy Biomass Energy Projects	RWE Innogy Cogen has been planning, building and operating biomass and co-fired CHP plants for many years in Germany and the Czech Republic. The focus lies on integrated biomass business based on diverse sources such as fresh and residual wood, energy crops and pellets. Key markets are Germany, the UK, Spain, Italy and CEE. Additionally, RWE Innogy has recently started biomass business activities in the USA, too.
RWE Power Modernisation Power Plant Ibbenbüren	In retrofit- and revision-measures the net-efficiency of the power-plant improves from 37.7% to more than 40%, thus decreasing the CO_2-emissions by 260,000 t p.a. The performance of the hard-coal power-plant rises from 752 to 808 megawatt. Overall, RWE Power invests just under 100 million Euros into the retrofit and revision of the plant.
RWE Power Modernisation Power Plant Niederaußem	Retrofit of turbines, capacitor and cooling tower, regeneration of electro- and dispatching technologies as well as high- and low-pressure-steam pipelines, further maintenance measures. Altogether RWE Power invests more than 150 million Euros, making them more efficient, enabling them for a more flexible operation and leading to a capacity rise from 600 MW up to 645 MW.
RWE npower Didcot B Replanting	Installation of new gas turbines to improve the efficiency and reliability of Didcot B 1,400 MW CCGT power station completed at the end August 2009.
RWE npower Biomass Co-firing with Coal	As part of our commitment to investing in new renewable technologies and providing clean affordable energy, we have developed co-firing capability across all RWE npower coal-fired plants.

RWE npower CERT/CESP	The Carbon Emissions Reduction Target is a Government obligation on UK energy suppliers. It sets energy-savings targets for each energy supplier based on the number of customers it has. The new Community Energy Savings Programme is a new obligation placed on energy suppliers and electricity generators and focuses on community-based energy efficiency solutions. Targets are given for individual companies as lifetime savings of CO_2 for the measures implemented.
RWE npower Climate Cops	The npower Climate Cops programme helps schools across the UK to become greener and more sustainable and shows young people how they can take a lead in being greener at home and school. It follows the Government's National Framework for Sustainable Schools by focusing on the child, curriculum, campus and community.
RWE Effizienz Media Cooperation "Stern"	Jointly with the magazine "Stern", RWE offered 500 home owners comprehensive energy audits for their housing, including detailed retrofit recommendations. The audits were paid by RWE. An external evaluation arrives at the conclusion that on average a CO_2-reduction of more than 80 t CO_2 per building is possible and, within less than one year, approximately one quarter of this potential (respectively 20 t CO_2) was realized.
RWE Power Algae Project	Micro-algae are single-cell or multi-cellular plant-like beings which absorb CO_2 via photosynthesis but in doing so grow about 10 times faster than land-based plants. To test this technology in depth before building a large scale plant, RWE Power, in cooperation with experienced partners, erected at the Niederaussem power plant location a pilot facility for binding CO_2 from the power station's flue gases. The algae can be harvested and used for other purposes. In this way, the algae- production plant in Niederaussem can process up to 6 tons of algae (dry matter) per year, binding 12 tons of CO_2.

Electricity Generation - Electricity Transmission & Distribution - End-use Energy Efficiency - CO_2 Capture & Storage + Carbon Sequestration - Other Projects

RWE The energy to lead	GERMANY	
Project Name	**Project Description**	**Country**
RWE Power CDM/JI Renewable Energy Project Activities	The renewable energy portfolio of RWE's CDM/JI projects includes hydropower, solar, solarthermal, wind, biomass as well as fuel switch (to renewable source) and geothermal. By purchasing CERs from these projects RWE contributes to the development and finance of such projects.	Worldwide
RWE Power CDM/JI Energy Efficiency Project Activities in the Industry	The efficient use of primary energy in the power-generation process makes a decisive contribution toward lowering CO_2 emissions. The energy efficiency CDM/JI portfolio includes waste heat recovery, waste gas recovery, fuel switch (to non-renewable source such as natural gas), process improvements, energy distribution and the cement industry.	Worldwide
RWE Power CDM/JI Energy Efficiency Project Activities in Households	Energy efficiency projects in households in CDM and JI regions combine climate protection targets and an improvement to the quality of life, especially in developing countries. Such projects are particularly sustainable, since they contribute to a permanent and environmentally friendly change in consumer behaviour. The portfolio includes CFL and cooking stove projects.	Worldwide
RWE Power Mountaineering Project	At New Haven, West Virginia, a first integrated CCS demonstration plant of 20 MW capacity was formally commissioned in October 2009. The plant separates out more than 100,000 tons of carbon per year which are transported via pipeline to deep saline formations for storage on site. American Electric Power (AEP), the USA's leading electricity generating company, Alstom and RWE are jointly developing the project.	USA
RWE Power CDM/JI N_2O Avoidance Activities	RWE Power develops, finances and operates CDM/JI project activities together with its affiliated companies Carbon Egypt (CE), Carbon Climate Korea (CCK) and Carbon Climate Protection (CCP) in which nitrous oxide (N_2O, laughing gas) in the waste-gas stream of nitric-acid plants is catalytically degraded.	Worldwide
RWE Power CDM/JI HFC-23 Avoidance Activities	HFC-23 (trifluoromethane) has a global warming potential 11,700 times greater than that of carbon dioxide (CO_2). Within refrigerant-producing factories, HFC23 is generated as a by-product. By purchasing CERs from these projects, RWE contributes to the development and finance of such projects.	China
RWE Power CDM/JI Methane Avoidance Activities	RWE participates in activities to avoid coal-mine-methane (CMM), coal-bed-methane (CBM) and landfill-gas emissions. Furthermore, we are involved in composting projects and biogas generation. In all these projects, methane – 21 times more harmful than CO_2 – is used to produce electricity and heat, converted into the less detrimental CO_2 by flaring or avoided process-related.	Worldwide

Electricity Generation - Electricity Transmission & Distribution - End-use Energy Efficiency - CO_2 Capture & Storage + Carbon Sequestration - Other Projects

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Project Name	Project Description	Country
RWE Power New-build BoA 2&3	RWE Power is continuing the renewal of its power plant portfolio with ultra-modern and more environmentally sparing technology, investing € 2.2 billion. The two new power plant units BoA 2&3 will have a gross capacity of 1,100 MW each, and an efficiency of over 43 % compared to 31% for old systems.	Germany
RWE npower Staythorpe	RWE npower is constructing a new combined cycle gas turbine (CCGT) power station at Staythorpe, Nottinghamshire. The station will have four generating units capable of producing a total of 1,650MW. Commissioning is expected to be completed by the end of 2010.	United Kingdom
RWE npower Pembroke Power Station	RWE npower is currently constructing a new combined cycle gas turbine (CCGT) power station at Pembroke, Wales. The station will have five generating units capable of producing a total of 2000MW.	United Kingdom
RWE Power WTA	WTA technology (fluidized-bed drying with internal waste heat utilization) is a proprietary development of RWE Power and is the biggest lignite-drying plant in the world. Located upstream of the Niederaussem BoA unit, its function is to pre-dry some 20 to 30% of the raw lignite destined for the unit in order to furnish evidence of the economic and technical benefit of fluidized-bed drying in continious operations. The result is a CO_2-reduction of over 250.000 tons annually.	Germany
RWE Power CO_2-Scrubbing pilot plant	CO_2-scrubbing kicks in at the end of the power-plant process. At the core of a CO_2-scrubbing facility is an absorber containing a scrubbing liquid. The cooled down flue gas flows through the absorber bottom-up and there encounters the scrubbing liquid which flows top-down, taking up the CO_2 in the process. The pilot plant is capable of capturing roughly 300 kilograms of CO_2 per hour from a partial flow of power station flue gases.	Germany