THE HEALY CLEAN COAL PROJECT
AN OVERVIEW

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ABSTRACT

The Healy Clean Coal Project, selected by the U.S. Department of Energy under Round III of the Clean Coal Technology Program is currently in construction. The project is owned and financed by the Alaska Industrial Development and Export Authority (AIDEA), and is cofunded by the U.S. Department of Energy. Construction is scheduled to be completed in August of 1997, with startup activity concluding in December of 1997. Demonstration, testing and reporting of the results will take place in 1998, followed by commercial operation of the facility. The emission levels of NOx, SO_2 and particulates from this 50 megawatt plant are expected to be significantly lower than current standards. The project status, its participants, a description of the technology to be demonstrated, and the operational and performance goals of this project are presented herein.

BACKGROUND

In September 1988, Congress provided $575 million to conduct cost-shared Clean Coal Technology (CCT) projects to demonstrate technologies that are capable of retrofitting or repowering existing facilities. To that end, a Program Opportunity Notice (PON) was issued by the Department of Energy (DOE) in May 1989, soliciting proposals to demonstrate innovative energy efficient technologies that were capable of being commercialized in the 1990's, and were capable of (1) achieving significant reductions in the emissions of sulfur dioxide and/or the oxides of nitrogen from existing facilities to minimize environmental impacts such as transboundary and interstate pollution and/or (2) providing for future energy needs in an environmentally acceptable manner.

In response to the PON, DOE received 48 proposals in August 1989. After evaluation, 13 projects were selected in December 1989 as best furthering the goals and objectives of the PON. The projects were located in ten states and represented a variety of technologies.

One of the 13 projects selected for funding is the Healy Clean Coal Project proposed by the Alaska Industrial Development and Export Authority (AIDEA). The project will demonstrate the combined removal of SO_2, NO_X, and particulates from a new 50 megawatt electric coal-fired power plant using both innovative combustion and flue gas cleanup technologies. AIDEA will own the Project, perform as DOE grant recipient, administer state funds, obtain financing through sale of bonds, and manage the Project. The architect/engineer for the project is Stone & Webster Engineering Corporation. Fairbanks utility Golden Valley Electric Association (GVEA) will operate the facility and pay for power generated under terms of a power sales agreement.

TECHNOLOGY TO BE DEMONSTRATED

Coal provided by the Usibelli Coal Mine, adjacent to the project site, will be pulverized and burned at the new facility to generate high-pressure steam. The high-pressure steam will be supplied to a steam turbine generator to produce electricity. Emissions of SO_2 and NO_X from the plant will be controlled using TRW's Entrained Combustor with limestone injection in conjunction with a boiler designed by Foster Wheeler. Further SO_2 and particulate removal will be accomplished using the Activated Recycle Spray Dryer Absorber System and Bag Filter developed by Joy Environmental Equipment, Inc.

The TRW Entrained Combustor is designed to operate under fuel-rich conditions, utilizing two staged combustion to minimize NO_x formation. These conditions are obtained using a precombustor for heating the fuel-rich main combustor for partial combustion with combustion completion occurring in the boiler. The first and second stages of combustion produce a temperature high enough to generate a slag (liquid ash) while reducing the fuel-bond nitrogen to molecular nitrogen (N_2). The third and final stage of combustion in the boiler occurs at a combustion temperature maintained below the temperature that will cause thermal NO_x formation.

The combustor is also used to reduce SO_2 emissions by the injection of pulverized limestone into the hot gases as they leave the combustor and enter the furnace. This technique changes the limestone into lime (flash calcination), which reacts with the sulfur compounds in the exhaust gas to form calcium sulfate. SO_2 is removed with combustor and boiler bottom ash. The flue gas, which contains the remaining sulfur compounds, calcium sulfate, and other solid particles leaves the boiler and passes through a spray dryer absorber and a bag filter for further SO_2 and particulate removal prior to exiting through the stack.

The innovative concept to be demonstrated in SO_2 removal is the reuse of the unreacted lime, which contains minimal fly ash, in the second-stage spray dryer SO_2 removal. The majority of fuel ash is removed in the combustor in the form of slag. A portion of the ash collected from the spray dry absorber vessel and the bag filter are first slurried with water, chemically and physically activated, and then atomized in the spray dryer absorber vessel for second-stage SO_2 removal. Third stage SO_2 and particulate removal occurs in the bag filter as the flue gas passes through the reactive filter cake in the bags.

The use of limestone in the combustor, combined with the recycle system, replaces the more expensive lime required by commercial spray dryer absorbers, reduces plant wastes, and increases SO_2 removal efficiency when burning high- and low-sulfur coals.

The integrated process is expected to achieve SO_2 removal greater than 90%, a reduction in NOx emissions to 0.2 pounds per million Btu. The integrated process is suited for new facilities or for repowering or retrofitting existing facilities. It provides an alternative technology to conventional pulverized coal-fired boiler flue gas desulfurization (FGD) and NO_x reduction processes, while lowering overall operating costs and reducing the quantity of solid wastes.

The demonstration project is under construction adjacent to the Golden Valley Electric Association (GVEA) existing Healy No. 1 pulverized coal-fired power plant near Healy, Alaska. Subbituminous coals from the adjacent Usibelli Coal Mine (UCM) will be the fuels. The primary fuel to be fired is a blend of run-of-mine (ROM) and waste coals. ROM coal is a subbituminous coal with a higher heating value (HHV) range of 7500-8200 Btu/lb, a low average sulfur content of 0.2 percent, and an average ash content of 8 percent. The waste coal

is either a lower grade seam coal or ROM contaminated with overburden material having an HHV range, average sulfur content, and average ash content of approximately 5,000-9,000 Btu/lb, 0.15 percent, and 20 percent respectively. The project will demonstrate the ability of slagging combustors to utilize low quality coals effectively. It is anticipated that coal consumption will average 330,000 tons annually over the 40 year plant life.

PROJECT STATUS

The projected project cost is about $267 million with $117.3 being a grant from the U.S. Department of Energy, and the remainder a combination of state grant, interest earnings, contributions from project participants, AIDEA bonds, and power sales. Construction of the HCCP began in the Spring of 1995 and is scheduled for completion in late 1997. The construction is on schedule, with startup activities planned for the fall of 1997. Demonstration testing and reporting of the results, scheduled to commence upon completion of construction, will take place in 1998. Following completion of the demonstration test program, the plant will be operated and maintained as a commercial electric generation plant.