DRAFT

Efficient Operators

Option Type:

This is a set-aside approach designed specifically as an incentive package for those entities that wish develop highly efficient and cleaner power generation projects in Illinois. Acceptable project types include cogeneration, combined heat and power (CHP), fluidized bed combustion, and other clean emerging technologies. Of note, integrated gasification combined cycle (IGCC) projects are separately classified. To promote these goals, the Illinois EPA is considering giving entities that undertake efficient operating projects in Illinois NOx allowances that can held, sold, or traded.

Issues:

Combustion technologies have significantly advanced in terms of thermal efficiency and pollution reduction, yet the vast majority of our power generation needs are still meet using older combustion techniques. To date, Illinois continues to rely heavily on our boiler fleet that includes several units constructed in the mid 1940s and many from the 1950s. It is only a matter of time before newer, more efficient, and economical plants replace the older plants. Acceptable efficient operator projects could include:

Fluidized bed combustion:
Fluidized bed combustion (FBC) evolved from efforts to find a combustion process able to control pollutant emissions without external emission controls (such as scrubbers), and is considered a cleaner type of solid fuel power plant. FBC is primarily used with coal, however it can also be used with other solid fuel types. During combustion, the boiler creates a fluidized bed with upward-blowing jets of air that suspends the solid fuel. The result is a turbulent mixing of gas and solids, much like a bubbling fluid. This action provides more effective chemical reactions and heat transfer. Modern commercial FBC units operate at competitive efficiencies, can cost less than today's pulverized coal (PC) units, and can have low NOx and SO2 emission levels.

Cogeneration & Combined Heat and Power (CHP):
Cogeneration or combined heat and power (CHP), is the simultaneous use of a fossil fuel fired power plant to generate both heat and electricity. Conventional power plants emit the heat created as a byproduct of electricity generation into the environment through cooling towers, as flue gas, or by other means. CHP attempts to capture the excess heat for domestic or industrial heating purposes. The majority of heating applications are found within relative close proximity to the plant to maintain higher efficiencies through minimizing heat losses.

Conventional power plants effectively do not convert all of their available energy into electricity, and thus waste a significant portion as excess heat. By capturing the excess heat, CHP allows a more efficient use of energy than conventional generation, potentially reaching an efficiency of 70-85%, compared with approximately 45% for the best conventional plants (super and ultra critical steam plants), and significantly better than Illinois' existing coal-fired boiler fleet with an efficiency of roughly 30-36%. Since more energy could be extracted from the same amount of fuel, less fuel would need to be consumed to produce the same amount of useful energy.

Combined cycle:
In a combined cycle power plant or combined cycle gas turbine plant, a gas turbine generator is combined with a steam turbine generator to increase the overall efficiency of electricity generation.

In a thermal power plant, high-temperature heat input is converted into two main outputs: electricity and a relatively low-temperature flue gas. A turbine, however, generates electricity and a relatively high output temperature flue gas that can be used in a second steam production cycle with a heat recovery steam generator (HRSG). Therefore, by combining both processes the combined cycle power plant efficiency can be increased. In some applications, the secondary steam cycle uses supplementary firing, sometimes called duct burners, to increase the quantity or temperature of the steam generated.

The efficiency of combined cycle power plants can achieve efficiencies up to 58%. As stated above, when used in combined heat and power generation, the efficiency could increase to about 85%.

Environmental Benefits:

Fluidized bed combustion:
FBC plants can reduce the amount of SOx emissions, by as much as 95%, through interactions with injected limestone. FBC plants also operate at cooler temperatures than a traditional pulverized coal boiler, which consequently creates less NOx. While efficiencies are comparable to those of traditional power plants, the reduced emission rates make them more attractive from an environmental standpoint.

Cogeneration & Combined Heat and Power (CHP) & Combined cycle:
Because of the increased efficiency of these types of power plants over a traditional power plant, they will be able to generate more useful energy and fewer emissions because less will fuel would need to be consumed. Therefore, environmental benefits include the longevity of limited natural fuel resources as well as potentially significant emissions reductions. Emissions savings per megawatt from a typical coal-fired unit are approximately 3.7 pounds of NOx and 7.6 pound of SO_2, while savings from the typical gas/oil-fired unit would be 0.8 pounds of NOx and 0.1 pounds of SO_2. Each thousand therms of natural gas consumption that could be saved would prevent a release of about 10 pounds of NOx and 0.06 pound of SO_2. Of course, a reduction in fuel usage would reduce all pollutant emissions.

Difference from model CAIR Rule:

The Model CAIR rule does not address Efficient Operators as an available option.