Illinois Environmental Protection Agency

Clean Air Interstate Rule (CAIR)
2006 Rulemaking

Outreach: February 7, 2006

NOTE: This document is provided by the Illinois EPA as a DRAFT discussion document for consideration and comment only. As such, all statements and views discussed are subject to change. All comments on this document should be provided via email to Rory Davis of the Bureau of Air at cair@epa.state.il.us by 02/20/06.

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Output-Based Allocations

Option Type:

An output-based allocation system is one in which NOx allocations distributed to EGUs would be determined by the amount of electric generation from the source.

Issues:

The USEPA model rule for CAIR allocates NOx allowances to pre-2001 units based on the historical heat input. This rewards plants that consume more fuel and rewards those that are *less* efficient. Illinois EPA is considering output-based allocations, where the allocations are based on electric output rather than heat input to reward more efficient plants.

Environmental Benefits:

An output-based allocation system rewards the power sector economically when it operates more efficient plants. This type of system encourages the reduction of fuel usage, and therefore, emissions of all pollutants. Output based allocations also benefit newer and more efficient sources. Increased efficiency is a form of pollution prevention, which reduces emissions of all pollutants, including non-regulated emissions such as carbon dioxide (CO_2).

Model CAIR Rule:

In the Model CAIR rule, allocations are determined by the heat input of the source. There is a provision for *new source* allocations to be determined by electric generation in the model rule. In a completely output-based allocation system, all NOx allowances in CAIR would be determined by their electric generation or a specified conversion to megawatt-hours. This system is not more stringent than CAIR because it does not reduce overall NOx emissions in Illinois due to trading, as the budget for NOx in CAIR remains the same. It is, however, a means for encouraging efficiency and newer, cleaner sources.

How would output be measured?

Gross electric output would be metered at the source. For any periods of time or situations where the source cannot meter its gross electric output, there are a number of possible alternative approaches including converting heat input data to an output equivalent.

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Updating Allocations & Reduced Lead Time

Option Type:

The Illinois EPA proposes to use output-based allocations using the average of the past two years for both annual and seasonal NOx for allocations three years ahead (e.g., in 2006 Illinois EPA would average outputs for years 2004 and 2005 to determine allocations for 2009; in 2007, average years 2005 and 2006 for allocations in 2010, etc.). The Illinois EPA believes that the three-year lead-time gives sufficient time for sources to plan for compliance.

Environmental Benefits:

Some of the environmental benefits under this scenario include:

- More accurate allocations for current use.
- New units are treated the same as older units after a shorter NSSA period.
- Existing plants will be encouraged to be more energy efficient sooner.
- Newer plants will be allowed into the allocation pool sooner.

Model CAIR Rule:

In the Model CAIR rule, the initial allocations, or baseline allocations, are determined using the average of the three highest heat inputs in years 2000 – 2004 for units that were operational prior to January 1, 2001. Under CAIR, the original baseline allocation stays the same throughout Phase I (control periods 2009 – 2014) of the program, whereas Illinois EPA's proposed rule uses more current data that may change unit specific allocations on a yearly basis.

In the Model CAIR rule, units that began operation after January 1, 2001, have to operate for more than five years before any allocations are given (other than new source set-asides). The units that began operation after January 1, 2001, are given allocations based on a modified output basis. New cogeneration units will also receive NOx allowances for their thermal energy portion. Under the Illinois EPA's proposed rule, newer units will be given NOx allocations based on gross energy output, in the same manner as existing units.

In 2015, the reduced allocations as stated in the existing Model CAIR rule for Phase II will be allocated the same as above.

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New Source Set-asides (NSSA)

Option Type:

A new source set-aside would be used to allocate NOx allowances to new sources whose emissions must be accounted for within the state's NOx budget, but have no associated heat input or electrical output data. The USEPA recommends that 5% of a state's CAIR NOx budget should be put in a new source set-aside.

Issues:

The prescribed method in the Model CAIR rule for a new source set-aside is to allocate to new sources from the set-aside on a first-come, first-serve basis. The new source will receive NOx allowances from the NSSA until the same criteria for data used for existing sources is available. This means in the Model CAIR rule, new sources must be operational for five years before they are able to establish their baseline, and the allocation for the first year that the data was available would take effect six years later. New sources would be receiving NOx allowances from the NSSA for 11 years.

Illinois, through a combination of shortening the length of time between allocation year and control period from six years to three years, and reducing the number of years to establish baseline values from five years to two years, plans to reduce the amount of time that new sources will receive NOx allowances from the NSSA, from eleven years to four, or possibly, five years.

Illinois EPA is also considering adjusting the baselines for plants each time allocations are made in order to use more current data, and avoid continuing allocations to shut down sources.

Environmental Benefits:

The benefit of reducing the amount of time that new sources will receive NOx allowances from the NSSA is in reducing demand for NSSA NOx allowances. Since the NSSA is a limited number of NOx allowances, there is the chance that it will become fully or over subscribed. This will discourage newer and cleaner sources from beginning operation in Illinois, if a significant number of NOx allowances have to be purchased for their operation over an extended period.

Likely Illinois Approach:

Illinois will most likely shorten the length of time between allocation year and control period, as well as shorten the length of time that is required to establish a baseline value for source allocations. Allocations will not be first come, first serve, and NOx allowances will be prorated among owners and operators that submit timely, complete, and correct applications.

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Compliance Supplemental Pool

Option Type:

In addition to a NOx Trading Budget USEPA also gave each state additional NOx annual allowances called the compliance supplement pool. Illinois was given a total of 11,299 NOx annual allowances. Under the Model CAIR rule, USEPA suggests that these NOx allowances may be used for early reduction credits or for power plants that cannot meet the control requirements by 2009 without undue risk to the electric power supply.

Issues:

Despite the Model CAIR rule, states are not restricted on how the Compliance Supplemental Pool allowances are used (see 70 FR 25285-6). The Illinois EPA proposes to retire the Compliance Supplemental Pool for public benefit (40 CFR 51.123(e)(4)(ii) and 96.143(a)).

Environmental Benefits:

Retiring the allowances from the compliance supplemental pool will reduce NOx emissions over the entire CAIR area.

Model CAIR rule:

The Model CAIR rule allows Illinois up to 11,299 NOx allowances. Two options were given for use of the CSP for NOx allowances in the proposed CAIR rule:

- Early reduction credits - one credit per ton of emissions of NOx reduced for CAIR sources subject to NOx trading in 2007 and 2008 that were not required by any other existing state or federal regulation. These credits are one for one and can be used or transferred to other units or sources.

- For electrical power plants that cannot meet the given allocations for 2009 without undue risk to electric power supply. This is due to needing more time to get proper controls installed to reduce emissions.

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Combined Heat and Power (CHP)

Option Type:

Combined Heat and Power (CHP) is the sequential or simultaneous generation of multiple forms of useful energy (usually mechanical and thermal) in a single, integrated system. Mechanical energy is used for electric generation and thermal energy is used by the plant or nearby customer facilities in process applications or to produce steam, hot water, hot air for drying, or chilled water for process cooling. CHP increases fuel efficiency, reduces electric demand, and reduces transfer inefficiency.

Issues:

Under the Model CAIR rule, CHP facilities receive credit for the useful thermal energy that is produced for use in-house or at customer facilities. Useful thermal energy in steam produced by a boiler is assumed to be produced with an efficiency of 80% from the heat input. This is then considered when NOx allowances are allocated to those sources.

Illinois EPA is considering improved treatment for CHP beyond what CAIR provides, in order to encourage further use of the practice in Illinois. Improved treatment of CHP, in conjunction with an output-based allocation methodology, would assume that all useful thermal energy produced displaces electric production at 100% efficiency.

Environmental Benefits:

CHP offers energy and environmental benefits over electric-only and thermal-only systems in both central and distributed power generation applications. Electric generation and emissions are reduced by both the displaced electric use and the efficiency gained by eliminating transmission and distribution inefficiencies.

CHP is not considered in the current trading program (35 IAC PART 217). There are few CHP operations in Illinois, so improved treatment of CHP plants beyond what the Model CAIR rule provides would be a bonus for operations that currently qualify, but mostly would provide an incentive to encourage CHP use in the design and location of new sources.

Model CAIR Rule:

In the Model CAIR rule, useful thermal energy in steam produced by a boiler is assumed to be produced with an efficiency of 80% from the heat input. For an output-based allocation methodology, the useful thermal energy that is metered would need to be converted into equivalent pounds of NOx at a rate in the neighborhood of 0.22-0.24 lbs/mmBtu. With improved treatment of CHP, the useful heat input would be divided by 3.4 mmBtu (the conversion rate from heat to electricity at 100% efficiency), and that figure, in mega watt-hours, for electric generation displaced by the useful thermal

energy would be added to the plant’s electric generation for purposes of NOx allocations.

In addition to sources that are regulated by CAIR, CHP operations that are not regulated by CAIR may be allowed to apply for CAIR NOx allowances taken from an energy efficiency set-aside.

Allowance Set-Aside in Brief

The set-aside is an attractive alternative to conventional emissions control options because energy efficiency and renewable energy have many benefits beyond reducing NOx. USEPA estimates that if all states in the NOx SIP Call area set-aside 5 percent of their NOx allowances for energy efficiency or renewable energy projects, the region could see annual savings of $5 billion in consumers' energy bills and $150 million in air quality compliance costs, along with the creation of approximately 20,000 new jobs. Emissions of hazardous air pollutants, greenhouse gases, and criteria air pollutants also would be reduced while also achieving economic goals simultaneously. By promoting the use of energy efficiency and renewable energy to help meet clean air objectives, states also can reduce hazardous air pollutants and greenhouse gas emissions cost-effectively. USEPA encourages states to use EE/RE set-asides.

Several states have moved forward in pursuing EE/RE set-asides: Massachusetts, New Hampshire, New Jersey, and New York have established EE/RE set-asides, and Indiana has a program under development. Maryland has created an analogous set-aside for "clean air projects."

The proposal for total allowance set-asides is between 25-30%.

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Demand Side Management (DSM)

Option Type:

This is a set-aside approach designed specifically as an incentive package for those entities that wish to undertake projects that downwardly affect their electric usage rates. Efforts of this kind are a form of energy efficiency and are commonly referred to as Demand Side Management (DSM). Consequently, a reduction in electricity usage would result in a decrease in the need for increased generating capacity and therefore a reduction in pollution; this concept is also commonly known as “negawatt” power since it is a negative need for power. To promote these goals, the Illinois EPA is considering giving entities that undertake energy efficiency projects that would offset a yet to be determined amount of emissions or save a yet to be determined amount of energy usage, NOx allowances that can held, sold, or traded.

Issues:

Unlike energy conservation, which is rooted in behavior, energy efficiency is technology based, therefore DSM usually implies actions that influence the quantity of energy consumed by users. The purpose of effectively implemented DSM is to:

- Reduce the power demand peaks, especially when power usage comes close to the limits of its availability.
- Shift the power loads between times of day, or even seasons.
- Fill the power demand valleys to better utilize existing power resources.
- Reduce overall power demand by using less energy without a reduction in service level.

Examples of DSM energy efficiency projects include the use of:

- Compact fluorescent lighting.
- High efficiency: air conditioners, refrigerators/ chillers, and boilers.
- High efficiency: motors, pumps, compressors, and steam systems.
- Smart building management software that regulates power flows.

The above listing is only a small list of potential projects where energy savings can be made. The U.S. Department of Energy estimates that motor driven equipment accounts for 64% of the electricity consumed by U.S. industries, and that switching to energy efficient motors could cut that energy usage by at least 12%. Similarly, over 45% of all fuel burned by U.S. manufactures is used to raise steam; improvements to the steam systems at a typical industrial facility could realize steam savings of 20%. Lastly, the optimization of compressed air systems could provide energy efficiency improvements between 20 and 50%.

The savings from energy efficiency are significantly greater than one might expect, because no energy is needed to generate, transmit,

distribute, or store energy before it reaches the end user. Energy savings from efficiency is also less expensive than building new power plants because utilities can plan for, invest in, and add up technology-based energy efficiency measures and, as a consequence, defer or avoid the need to build new power plants. A prime success story of this is Austin, Texas. Through DSM, Austin aggregated enough energy savings to offset the need for a planned 450 megawatt coal-fired power plant. Austin achieved these savings during a decade when the local economy grew by 46% and the population doubled.

Environmental Benefits:

Environmental benefits include the longevity of limited natural fuel resources as well as potentially large emissions reductions. Emissions savings per megawatt from a typical coal-fired unit are approximately 3.7 pounds of NOx and 7.6 pound of SO2, while savings from the typical gas/oil-fired unit would be 0.8 pounds of NOx and 0.1 pounds of SO2. For 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 SO2. Of course, a reduction in fuel usage would reduce all pollutant emissions.

Model CAIR Rule:

The Model CAIR rule does not directly address set-asides for DSM, it is however included under the broader umbrella of an “energy efficiency set-aside”.

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Energy Efficient New Construction (EENC)

Option Type:

This is a set-aside approach designed specifically as an incentive package for those entities that wish undertake energy efficient new construction (EENC) projects. Efforts of this kind are a form of energy efficiency and are commonly broadly categorized under demand side management (DSM). Consequently, a reduction in electricity usage would result in a decrease in the need for increased generating capacity and therefore a reduction in pollution; this concept is also commonly known as negawatt power since it is a negative need for power. To promote these goals, the Illinois EPA is considering giving entities that undertake these types of energy efficiency projects that would offset a yet to be determined amount of emissions or save a yet to be determined amount of energy usage, NOx allowances that can held, sold, or traded.

Issues:

A large part of our energy usage, as well as for potential energy savings, that is often overlooked are the various buildings (residential, commercial, other) in use. The table provided below, according to the Energy Information Administration (EIA), details the percentage breakdowns of the total U.S. energy and electricity consumption.

Category	Energy (%)	Electricity (%)
Residential buildings	21.5	34.8
Commercial buildings	17.9	33.1
Total buildings	39.4	67.9

As can be seen from the table, these energy usage areas are large. The Illinois EPA may proposes to allow all new building types, e.g., commercial, educational, governmental, industrial, medical, and residential, access to this set-aside option to maximize the potential environmental benefits of energy efficiency projects.

While the Illinois EPA may propos separate set-aside amounts for existing buildings under the Demand Side Management (DSM) set-aside, a better path forward is to encourage energy conservation right from the start of a building project. Rather than retrofitting efficiency into a design that is perhaps not ideal, building efficiency into the original design of the project will allow for much more efficient system as a whole.

Examples of potentially acceptable EENC projects include:

- ENERGY STAR qualified new home projects.
- Efforts beyond the Illinois Energy Conservation Code for Commercial Buildings (20 ILCS 687/6-3).
- New residential construction projects which would qualify under the Energy Efficient Tax Incentives under the Energy Policy Act of 2005

- Smart building management software that regulates power flows.
- High efficiency motors, pumps, compressors, and steam systems.

The above listing is only a small list of potential projects where energy savings can be made. The U.S. Department of Energy estimates that motor driven equipment accounts for 64% of the electricity consumed by U.S. industries, and that switching to energy efficient motors could cut that energy usage by at least 12%. Similarly, over 45% of all fuel burned by U.S. manufactures is used to raise steam; improvements to the steam systems at a typical industrial facility could realize steam savings of 20%. Lastly, the optimization of compressed air systems could provide energy efficiency improvements between 20 and 50%.

Environmental Benefits:

Environmental benefits include the longevity of limited natural fuel resources as well as potentially large emissions reductions. Emissions savings per megawatt from a typical coal-fired unit are approximately 3.7 pounds of NOx and 7.6 pound of SO2, while savings from the typical gas/oil-fired unit would be 0.8 pounds of NOx and 0.1 pounds of SO2. For 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 SO2. Of course, a reduction in fuel usage would reduce all pollutant emissions.

Model CAIR Rule:

The Model CAIR rule does not directly address set-asides for EENC, it is however included under the broader umbrella of a “energy efficiency set-aside”.

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Renewable Energy Emission Units (REEU)

Option Type:

This is a set-aside approach designed specifically as an incentive package for those entities that wish to specifically install renewable energy resources. The inclusion of these types of energy sources into Illinois' energy producing portfolio will reduce emissions while allowing for energy independence, simultaneously boosting our reliance on homegrown sources of energy. To promote these goals, the Illinois EPA is considering giving entities that undertake renewable energy emission units (REEU) projects that would offset a yet to be determined amount of emissions or generate a yet to be determined amount of energy usage, NOx allowances that can held, sold, or traded.

Issues:

Renewable Energy Emission Units (REEU), in the scope of set-asides for CAIR, are energy sources that ultimately convert the stored energy in biomass. Most renewable energy sources are those that are replaced rapidly by a natural process. For example, incident solar energy is captured in biomass and is accumulated over a period of months, as in straw, or through many years as in wood. Capturing renewable energy by plants and animals does not permanently deplete the resource. Fossil fuels, while theoretically renewable on a very, very lengthy time-scale, are utilized at rates that may deplete these resources in the foreseeable future. Of note, while power generated from the sun or the wind is also broadly considered a renewable energy source, for purposes of NOx allowance awarded through CAIR, these units are separately classified as "Zero Emissions Energy Units". An eligible project that can receive credits for being a renewable emission unit will generate some form of pollution during the extraction process, e.g., burning wood for heat releases pollutants to the atmosphere.

Types of renewable energy sources could include:

Biomass:
Biomass comprises the mass of all biological organisms, dead or alive, excluding biological mass that has been transformed by geological processes into substances such as coal or petroleum. The process itself is known as a carbon neutral process because the CO_2 that is released during the production of energy from biomass by combustion is offset by the CO_2 absorbed during the production of the fuel via photosynthesis.

Examples of biomass could include:

Distiller's dried grain	Maize
Jatropha	Rice hulls
Manure	Silage
Meat and bone meal	Stover
Miscanthus	Maiden Grass
Peat	Switchgrass

Plate waste	Whey
Landscaping waste	Sugarcane bagasse
Grass	Animal byproducts

Landfill Gas Recovery:
Landfill gas is generated as a byproduct of decomposition at a solid waste landfill. The gas is approximately equal parts methane and carbon dioxide, along with some measurable volatile organic compounds (VOCs). Because of the VOC pollutants that are known to be precursors of photochemical smog, the federal Clean Air Act (Part 40) requires that if the estimated VOC emissions exceed 50 metric tons, then the landfill owner is required to collect the landfill gas, and treat it to remove the VOCs. Because landfill gas has a sufficient heat content to produce power, a treatment option is by combustion in an engine or turbine that operates a power generator. Landfill sites are generally remotely located, which can make electricity production economically unviable; however it is a primary goal of this option to provide the availability for an additional revenue stream to increase the attractiveness of that type of project. The alternative for a landfill aside from power generation is to simply flare the gas stream, and essentially throw away the potential power value. Federal law requires the control of the landfill gas stream, and either method of control will create pollution as a byproduct.

Biofuel:
Biofuel is any fuel that is derived from biomass; unlike other natural resources such as petroleum, coal and nuclear fuels, it is considered to be renewable energy source. The material to make the fuel is from recently living organisms (e.g., corn to ethanol) or their metabolic byproducts (e.g., manure from cows or methane from anaerobic digestion). The carbon in biofuels was recently extracted from atmospheric carbon dioxide by growing plants; so burning it does not result in a net increase of carbon dioxide in the Earth's atmosphere. As a result, biofuels are seen by many as a way to reduce the amount of carbon dioxide released into the atmosphere by using them to replace non-renewable sources of energy.

Biodiesel:
Biodiesel is a fuel made from renewable resources such as vegetable oils or animal fats. It is biodegradable and non-toxic, and has significantly fewer emissions than traditional petroleum-based diesel. Biodiesel functions in current diesel engines, and is a possible candidate to replace fossil fuels as the world's primary transport energy source.

Ethanol:
The use of ethanol as a fuel for internal combustion engines, either alone or in combination with other fuels, has been given much attention mostly because of its possible environmental and long-term economical advantages over fossil fuel. Ethanol can be derived from corn, wheat, potato wastes, cheese whey, rice straw, sawdust, urban wastes, paper mill wastes, yard clippings, molasses, sugar cane, seaweed, surplus food crops, and other cellulose waste.

Excluded Activities:

Of note, NOx allowances would specifically not be awarded to projects that involve energy from the incineration, burning or heating of waste wood, tires, garbage, general household, institutional and commercial waste, industrial lunchroom or office waste, landscape waste, or construction or demolition debris.

Environmental Benefits:

Renewable energy sources are fundamentally different from fossil fuel power plants because they are renewable many times within a lifetime.

Recent studies have shown that the use of energies developed from renewable resources, e.g., biodiesel or ethanol, can have lower pollution emission rates.

Model CAIR Rule:

The Model CAIR rule does not directly address set-asides for REEU, they are however included under the broader umbrella of a “renewable energy set-aside”.

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Supply Side Energy Efficiency

Option Type:

This is a set-aside approach designed specifically as an incentive package for those coal fired utilities that wish to undertake efficiency improvements in generation, transmission, and distribution systems. To promote these goals, the Illinois EPA is considering giving entities that undertake supply side energy efficiency projects that would offset a yet to be determined amount of emissions or save a yet to be determined amount of energy usage, NOx allowances that can held, sold, or traded.

Issues:

Many of the coal fired utilities in Illinois could be considered aged with an average of 1960's era construction. Those plants, now using mature technologies, are now quite possibly no longer using the most efficient means available to generate power. Relatively small efficiency changes on the supply side of power generation can have considerable positive impacts for the environment as well as the power producer by being able to supply the same amount of electricity with a smaller amount of fuel input.

An example of this is the Southern Company, headquartered in Atlanta, Georgia, who delivers more than 39,000 megawatts to 4 million customers in Georgia, Alabama, Mississippi and Florida. Over a thirteen-year period, the Southern Company was able to reduce its heat rate by 5.8%, lowering it from approximately 10,300 Btu/kWh (in 1982) to less than 9,700 Btu/kWh (in 1994). This represents an improvement in the system efficiency from approximately 33.2% (in 1982) to 34.8% (in 1994). In addition to improving the company's system-wide heat rate, the Southern Company was able to increase its reliability from 88% (in 1982) to 96% (in 1994), and was able to increase its availability to approximately 86%.

These heat rate and availability improvements to the Southern company's electric system have provided benefits valued at $1.1 billion/year, including the deferral of 6,000 MW of new capacity. The cost of these heat rate and reliability improvements to the Southern Company is estimated at approximately $325 million/year. The operation and maintenance activities that comprise these costs include: establishing a heat rate improvement training program, creation of a plant heat rate review board and a system heat rate technical network, assignment of an efficiency engineer at each plant, instituting a program of heat rate monitoring, and investing in design upgrades. The Southern Company's experience is consistent with the OTA and EPRI estimate that a 5% heat rate improvement is technically feasible at a low cost or at no cost. Such an improvement would result in a concomitant emissions reduction from the utility.

Other than heat rate improvement projects as mentioned above, there are many other projects that can be undertaken to offset NOx emissions and qualify for NOx allowances. Examples of supply side

energy efficiency projects at the coal-fired utility that may offset NOx emissions could include:

- Turbine upgrades.
- Performance optimizations.
- Smart software management.
- High efficiency: motors, pumps, compressors, steam systems, fans, transformers, air pre-heaters, or condensers.
- Improved maintenance activities (e.g., more frequent refractory repairs or condenser decaling.)

Environmental Benefits:

Environmental benefits include the longevity of limited natural fuel resources as well as potentially large emissions reductions. Emissions savings per megawatt from a typical coal-fired unit are approximately 3.7 pounds of NOx and 7.6 pound of SO2, while savings from the typical gas/oil-fired unit would be 0.8 pounds of NOx and 0.1 pounds of SO2. For 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 SO2. Of course, a reduction in fuel usage would reduce all pollutant emissions.

Model CAIR Rule:

The Model CAIR rule does not directly address set-asides for supply side energy efficiency projects, they are however included under the broader umbrella of an “energy efficiency set-aside”.

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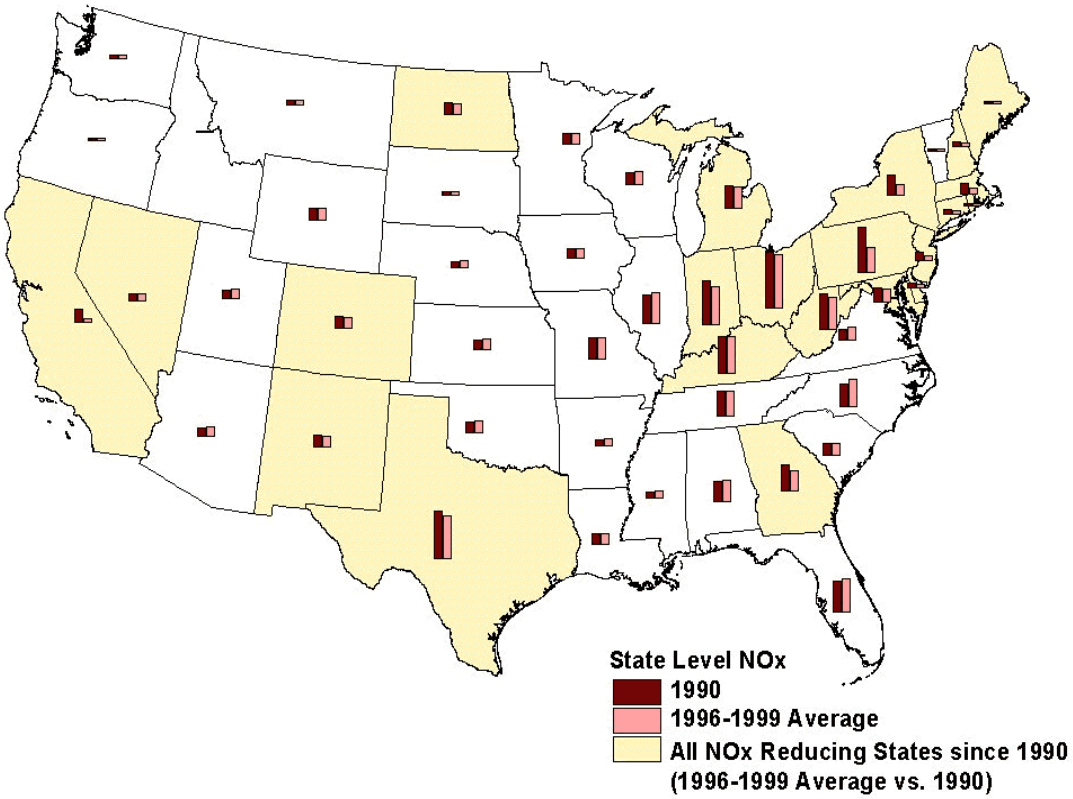
Upgraders

Option Type:

This is a set-aside approach designed specifically as an incentive package for existing coal fired electric generating units (EGU). Set-asides could be awarded to those entities that install a flue gas desulfurizer (FGD), selective catalytic reduction (SCR), non-selective catalytic reduction (NSCR), or other such Illinois EPA approved pollution control technologies (i.e. emergent NOx reduction technologies) within a specific time frame. To promote that goal, the Illinois EPA is considering giving entities that voluntarily install those devices a preferential amount of NOx allowances.

Issues:

The addition of these control devices to existing coal fired EGUs is one of the single most important areas for environmental benefit in Illinois. Illinois has among the largest utility NOx emissions (see graphic below from USEPA Clean Air Markets) and the fourth largest mercury emissions in the country based upon 1999 plant reported fuel use and mercury tests. The addition of these types of controls might also support the revitalization of the local coal industry and stimulate jobs in that sector.



Environmental Benefits:

Drastic reductions of air contaminants can be achieved by installing various pollution control devices. Major NOx reduction pollution control devices that would be eligible include:

Selective Catalytic Reduction (SCR) Systems:
A SCR system is a post-combustion NOX reduction method that reduces NOX by introducing gaseous or liquid reductant (most commonly ammonia or urea) to the flue gas stream and is absorbed onto a catalyst-impregnated bed. The reaction with NOx in the flue gas stream forms H2O and N2. The catalyst in the SCR can also oxidize a small percentage of mercury that can be captured in a downstream scrubber.

The NOx control efficiencies of SCR are 63-94%. Mercury control efficiencies when using a downstream scrubber can be appreciable with most boilers using about 30% or more bituminous coal; subbituminous coal can achieve small mercury reductions.

Selective Non-Catalytic Reduction (SNCR) Systems:
A SNCR system is a post-combustion NOX reduction method that reduces NOX through controlled injection of a urea solution into the combustion gas path. The resulting chemical reaction transforms NOX, urea, and oxygen into molecular nitrogen, CO2, and water. It is not known if a SNCR has any effect on mercury emissions.

The NOx control efficiencies of SNCR are 90%. Mercury control efficiencies are assumed to be zero.

Flue Gas Desulfurization (FGD) Systems:
FGD systems use a wet or dry spray to absorb SO2 gas and form dry particles, which are later collected in a particulate control device. Dry systems use a calcium based slurry/sorbent that reacts with the flue gas and dries into slurry. Wet FGD systems use a liquid absorbent to absorb SO2 gas. The liquid is typically an aqueous solution containing an alkaline chemical that reacts with the SO2 to form insoluble salts that are then removed from the scrubber effluent. Most wet FGD systems for SO2 control use either limestone or lime as the alkaline source. Mercury capture in FGD systems is species dependent. FGD systems in general have the potential to remove mercury to relatively high extents.

The NOx control efficiencies of FGD are 90%, and SO2 control efficiencies of 70-99%. Mercury control efficiencies are quite variable depending on the process; bituminous combustion can achieve much higher control efficiencies than sub-bituminous. Bituminous combustion with FGDs with fabric filters can achieve 98% control, while with ESPs achieve 46-81% depending on whether it is hot or cold sided. Sub-bituminous mercury control can range from 20-43%.

Model CAIR Rule:

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

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Zero Emission Energy Units (ZEEU)

Option Type:

This is a set-aside approach designed specifically as an incentive package for those entities that wish to specifically install zero emission energy generating units. The inclusion of these types of energy sources, specifically those that are electrical generating units (EGU), to Illinois' energy producing portfolio will reduce emissions and allow for energy independence. To promote these goals, the Illinois EPA is considering giving entities that undertake zero emission energy projects that would generate a yet to be determined amount of power, NOx allowances that can held, sold, or traded.

Issues:

Zero Emission Energy Units (ZEEU) are energy sources that capture and convert energy from natural flows of energy, eg. sunshine, wind, and flowing water without creating pollution. This set-aside is offered as a set of NOx allowances to those entities that are able to offset a given amount of NOx pollution, which they then may retain, sell, or trade. Acceptable types of ZEEU projects are:

Wind Power:
Wind power is the extraction of the kinetic energy from the wind, and is one of the oldest forms of renewable energy that man has used. Currently in Illinois there a number of projects being developed with considerable investment in wind-generated electricity.

Solar (solar thermal energy, photovoltaic cells and panels):
Zero Emission solar collection systems intercept the incident solar energy from the sun, which is then converted into thermal or electrical energy. There are several types and methods of solar collection systems that include:

- Passive solar collection systems that do not involve the input of any other forms of energy apart from the incoming sunlight. Passive solar water heaters, for instance, use a thermosiphon and have no pumps. Appropriate building design can also accommodate for space heating systems.

- Active solar collection systems use additional mechanisms such as circulation pumps, air blowers or tracking systems to direct the collectors at the sun. These mechanisms are typically powered by electricity and may have additional electronic or computerized automatic controls to more efficiently use the available energy.

- Focusing collection systems use a parabolic dish or a series of heliostats to concentrate light onto the solar cell.

An example of a conversion to thermal energy is a solar hot water heating system where the solar water heater uses the sun's energy to

heat a fluid, which is used to transfer the heat to a heat storage vessel.

An example of a electric energy conversion system is a solar photovoltaic panel. Solar photovoltaic panels contain arrays of solar cells that directly convert light into electricity.

Hydropower:
Hydropower energy is obtained from flowing water; today the majority of hydropower is converted to electricity. Most hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator, however hydroelectric power can also be developed from the kinetic energy of flowing water via a stream or river.

Environmental Benefits:

Environmental benefits include the longevity of limited natural fuel resources as well as potentially large emissions reductions. Emissions savings per megawatt from a typical coal-fired unit are approximately 3.7 pounds of NOx and 7.6 pound of SO2, while savings from the typical gas/oil-fired unit would be 0.8 pounds of NOx and 0.1 pounds of SO2. For 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 SO2. Of course, a reduction in fuel usage would reduce all pollutant emissions.

Model CAIR Rule:

The Model CAIR rule does not directly address set-asides for zero emission units, they are however included under the broader umbrella of a “renewable energy set-aside”.

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Early Adopters

Option Type:

This is a set-aside approach designed specifically as an incentive package for those entities that wish to undertake in the various other NOx allowance set-aside projects available in Illinois on a sooner rather than later basis. Earlier more environmentally friendly options will help the state in its efforts to attain the PM 2.5 and ozone air quality standards. To promote this goal, the Illinois EPA is considering giving entities that apply for qualifying projects within the set-aside categories established time frame, NOx allowances that can held, sold, or traded. The allotment method for this category is still under discussion.

Issues:

There are obvious environmental benefits related to the timing and use of cleaner and more efficient technologies and methods as well as more adequately using the renewable technologies available to us. Because emissions are aggregated over the years, the Illinois EPA would prefer to receive a certain amount of environmental benefit today rather than the same amount at some time in the future. The offset of pollutant emissions today, or in the nearer future, will allow for immediate benefit for all time forward and is therefore effectively more valuable. The Illinois EPA is proposing the cutoff date for entry into this set-aside category as December 31, 2012. Applications for allowances from this pool would need to be applied for, and approved, by that date to be eligible. Projects do not necessarily have to be completed within that timeframe to be eligible, however the project will need to be completed before any allowances will be issued. Upon approval, a reasonable project completion date will also be established to help ensure that only serious projects are slotted for available allowances.

Environmental Benefits:

By design, this set-aside option will encourage early participation in environmentally beneficial projects, and presumably there should follow a decrease in multi-pollutant emissions on an advanced timetable that perhaps would not have been achieved without such incentives available. This option is intended to be used in conjunction with the other available NOx set-aside categories previously mentioned.

Difference from model CAIR Rule:

The Model CAIR rule does not address early adopters as an available option.

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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 SO2, while savings from the typical gas/oil-fired unit would be 0.8 pounds of NOx and 0.1 pounds of SO2. 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 SO2. 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.

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Integrated Gasification
Combined Cycle (IGCC)

Option Type:

This is a set-aside approach designed specifically as an incentive package for those entities that wish to develop integrated gasification combined cycle (IGCC) projects in Illinois. IGCC allows the use of coal in a power plant that has approximately the same environmental benefits of a natural gas-fueled plant with the thermal performance of a combined cycle facility. To promote these goals, the Illinois EPA is considering giving entities that undertake IGCC projects in Illinois NOx allowances that can held, sold, or traded.

Note: This set-aside option is strictly available to IGCC plants, not coal gasification plants used to make synthetic gas that may have incidental generating capacity.

Issues:

IGCC is effectively a cleaner power plant by design, and is better described as a pollution prevention method rather than pollution control.

IGCC plants utilize a process that gasifies the energy content of the fuel into a synthesis gas, or syngas, that is then fired in a combined cycle power plant. Potential fuels include petroleum coke, high sulfur content coal, and even biomass. The term integrated refers to the secondary use of low-pressure steam in the gasification process that is then used to power the steam turbine. Today, there are only a few IGCC plants in operation for power generation, mainly due to the high capital cost of such a plant. Despite the high costs, IGCC by far provides the most environmentally friendly use for coal in a power plant.

Environmental Benefits:

IGCC provides several environmental benefits over traditional pulverized coal (PC) boilers. Since the gasification process takes place in a low-oxygen environment the sulfur in the fuel converts to hydrogen sulfide (H_2S) instead of SO_2, which is easier to capture and remove. In a PC boiler, the combustion zone is oxygen-rich and readily forms SO_2. SO_2 removal rates of 99% and higher are common using technologies proven in the petrochemical industry.

IGCC units can be configured to operate at very low NOx emissions without the need for a SCR by lowering the flame temperature. Flame temperature lowering techniques have been found to provide a significant reduction in NOx formation (15-20 ppmv) to just above the NOx emission rates from natural gas combined cycle units.

A PC plant with emission controls may approach IGCC's performance in one or two areas, but it cannot match the IGCC's overall environmental impact when including air, water, solids, and CO_2

emissions. A state of the art IGCC plant with enhanced sulfur removal technology can simultaneously achieve greater than 99.5% sulfur removal, essentially total volatile mercury removal (greater than 90- 95% removal), and very low PM levels of <0.004 lb/mmBtu. The state of the art IGCC plant will also produce only 40% as many solids byproducts as coal combustion processes, and will use almost 40% less total water. Importantly, CO2 emissions can also potentially be effectively captured and sequestered.

Difference from model CAIR Rule:

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