Advanced Coal Technology Development Can Be Supported Under Existing Clean Air Act Permitting Frameworks: Why IGCC, for example, is BACT for new coal-fueled EGUs

Prepared for U.S. EPA's Advanced Coal Technologies Working Group

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1. Introduction

There are existing opportunities under the current Clean Air Act and implementing federal regulations to promote the development of Advanced Coal Technologies[1] ("ACTs") for the generation of electricity. In particular, this paper presents the statutory and regulatory framework for federal air permitting for new units in clean air areas,[2] and notes that current perceived "barriers" to the selection of ACT for best available control technology ("BACT") based emissions limits in fact exist only in current EPA policy choices made under the top-down BACT framework. Because state air permitting processes are modeled on the federal requirements as a minimum or floor, any change in federal policy in the direction of promoting ACTs through the BACT process also will be highly influential on states.[3]

We assert that the Agency easily can, going forward, support ACT deployment by promoting and requiring the analysis of ACTs -- including technologies that have the potential to capture carbon emissions -- in the BACT determination for coal-fueled EGU air permitting. EPA can do so without undertaking any rulemaking or guidance development process, and indeed must do so to be consistent with the Act's requirements, and to avoid litigation. Evaluation of ACTs is required by the Clean Air Act's plain language and intent, and consistent with existing Agency rules and guidance – selection of ACTs as BACT is a likely result of their analysis. Selection of ACTs as BACT promotes their more widespread adoption. Such a change in direction by the Administrator therefore will promote the near-term, early development of a

[1] For the purposes of this white paper, an "Advanced Coal Technology" is a method for the production of electricity from coal, which is at the forefront of technological change, and which has the ability to capture carbon emissions.

[2] ACTs can be the basis for LAER for a coal-fired EGU where the particular ACT represents the lowest achievable emissions rate. The LAER analysis is in many ways more straightforward than the BACT analysis, as "lowest" means the more stringent of "the most stringent emission limitation which is contained in the implementation play of any State for such class or category of source… or … the most stringent emissions limitation achieved in practice by such class or category of source." 42 U.S.C. §7501(3). The statutory language furthermore does not allow for analysis of economic, energy or other environmental factors (apart from absolute cost prohibition), to be barriers to the selection of LAER, and existing EPA policy on LAER requires consideration of technology transfer and process changes. NSR Manual at G.3 ("If some other plant in the same *or comparable* industry uses that control technology, then such use constitutes evidence that the cost to industry is not prohibitive.").

[3] Under the Clean Air Act's framework of cooperative federalism, state agencies have ultimate responsibility for adopting policy and regulatory requirements respecting control or abatement of air pollution, provided that the federal Act's requirements are the minimum or "floor" for the state regulatory and policy frameworks. 42 U.S.C. §§7401(a)(3)&(4), 7416.

generation of very low emitting EGUs that also have the ability to at least partially capture their carbon dioxide (CO_2) output in the near term, whether for storage or for transportation and use in enhanced oil recovery operations. Additionally, at the very least, this practice would help avoid significant new financial commitments to large carbon dioxide sources (conventional or supercritical PCs) without consideration of the options for CO_2 capture and storage.

The following presents the statutory and regulatory background underlying the BACT determination, and the EPA "top-down" analysis for the selection of a BACT emissions rate. It discusses the implications of *Massachusetts v. EPA*, 127 S. Ct. 1438 (2007), the recent Supreme Court case recognizing that carbon dioxide is an "air pollutant" within the meaning of the Clean Air Act. The "top down analysis" for determining BACT for a coal-fueled EGU is presented to show why an ACT must be considered in the BACT determination, and how it can be selected as the basis for the BACT emissions limit.

2. The Federal Clean Air Act Requires Evaluation of ACTs in the BACT Determination as part of the Air Quality Permitting Process for a New Coal-Fueled Electricity Generating Unit in Clean Air Areas

The PSD permitting framework can support the choice to develop ACT technologies to the extent that they can achieve emissions rates consistent with the statutory definition of BACT.

A. Statutory and Regulatory Background.

The federal Clean Air Act mandates that "no major emitting facility on which construction is commenced after August 7, 1977, may be constructed in any [PSD] area[4] unless . . . the facility is subject to the best available control technology [BACT] for each pollutant subject to regulation under this chapter [ch. 85, *i.e.*, the Clean Air Act], emitted from, or which results from, such facility." 42 U.S.C. §7475(a)(4). Clean Air Act Section 169(3) further defines BACT as

> an emission limitation based on the maximum degree of reduction *of each pollutant subject to regulation under this chapter* emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for such facility *through application of production processes and available methods, systems, and techniques, including*

[4] The federal statute establishes the Prevention of Significant Deterioration or "PSD" program for areas of the country that meet currently applicable ambient air quality standards – i.e. those areas that are "in attainment" – as well as areas that cannot be classified as "attainment" or "non-attainment" areas. 42 U.S.C. §7407, 7470-7492.

> *fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques* for control of each such pollutant.

42 U.S.C. §7479(3). 40 C.F.R. § 52.21(b)(12) contains the regulatory definition of BACT which is substantively identical to that found in the Act.

BACT must be established for "each pollutant subject to regulation," and it is uncontroverted that this definition includes air pollutants for which National Ambient Air Quality Standards ("NAAQS") have been established. Additionally, the Supreme Court has recently declared, in *Massachusetts v. EPA*, 127 S. Ct. at 1459-60, that the definition of "air pollutant" contained in section 302(g), 42 U.S.C. §7602(g), "unambiguously" includes carbon dioxide and other greenhouse gases. *Massachusetts v. EPA*, 127 S. Ct. at 1459-60. The section 302(g) definition is relevant to all programs contained in the Act. 42 U.S.C. §7602 (first sentence). Section 52.21(j)(1) of the federal regulations implementing the Act's PSD provisions provides that "[a] new major stationary source shall apply [BACT] for each regulated NSR pollutant that it would have the potential to emit in significant amounts," and Section 52.21(b)(50) further defines "regulated NSR pollutant" as "any pollutant … subject to regulation under the Act."[5]

Because the Act obligates the Administrator to promulgate regulations for "air pollutants" under several different programs, greenhouse gas emissions are currently "subject to regulation under the Act."[6] For example, CAA sections 111(a)(1), (b)(1)(B), state that "the Administrator shall publish . . . regulations establishing standards of performance," for "emissions of air pollutants" from new stationary sources in listed industries. 42 U.S.C. §7411(a)(1), (b)(1)(B). Greenhouse gas emissions therefore are "regulated NSR pollutants" under the Act." U.S. EPA's recent pronouncements to the contrary are not based in the text of the Act, nor are they supported by the precedent cited by the Agency. *See, e.g., Christian County Generation, LLC*, PSD Appeal No. 07-01, Brief of the EPA Office of Air and Radiation

[5] Congress did provide in the Act certain express exemptions from PSD for specific pollutants, including all pollutants listed under CAA §112(b) (hazardous air pollutants). 42 U.S.C. §7412(b)(6). The regulations also include that express exemption in 40 C.F.R. §52.21(b)(50)(iv). Carbon dioxide and other greenhouse gases are not expressly exempted from PSD review.

[6] Merriam-Webster defines this use of "subject to" as "liable to" regulation. www.merriam-webster.com/dictionary/subject. Additionally, "subject to regulation" does not necessarily mean "subject to direct emissions control requirements" – regulations can impose monitoring or testing requirements. In that sense, CO_2 is already regulated, under CAA §821. 42 U.S.C. §7651k note. EPA rules requiring certain sources, including coal-fired power plants, to monitor CO_2 and report the monitoring data to EPA, are found at 40 C.F.R. Part 75.

(Sept. 24, 2007) (hereinafter "*Christian County* Brief") at 3, 7-8; U.S.EPA Response to Comments on Draft Air Pollution Control PSD Permit to Construct Deseret Bonanza, Permit No. PSD OU-0002-04.00 (Aug. 30, 2007)(hereinafter "Deseret Bonanza RTC") at 5-6. Instead, EPA's arguments are based in Agency policy established many years before the *Massachusetts v. EPA*, decision, and erroneously equate CO_2 and other greenhouse gases with air toxics –which are expressly exempted by the statute from PSD review.[7]

The statute and regulations further require the BACT emissions limit to be "based on" the "maximum" "achievable" reductions "through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques . . . ." 42 U.S.C. §7479(3); 40 C.F.R. § 52.21 (b)(12). The legislative history of the 1977 Act illustrates that Congress contemplated that what were at that time "advanced" technologies for generating electricity from coal would be evaluated as part of the process for setting BACT limits for new coal-fueled power plants. The congressional history of the BACT definition includes the following discussion:

> Mr. HUDDLESTON. Mr. President, I send to the desk an unprinted amendment.
>
> The PRESIDING OFFICER. The amendment will be stated.
>
> The legislative clerk read as follows:
>
> The Senator from Kentucky (Mr. HUDDLESTON) proposes an unprinted amendment numbered 387: On page 18, line 15, after "ment" insert "or innovative fuel combustion techniques."

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[7] In its *Christian County* Brief, EPA/OAR cites a case decided 8 years before the Supreme Court's decision in *Massachusetts v. EPA*, for the proposition that carbon dioxide is not a 'regulated NSR pollutant' within the "EPA's historic view and promulgated regulations." *Christian County* Brief at 8. But EPA ignores the substance of the case, which rejected attempts to impose PSD limits on air toxics listed in §112(b) and therefore expressly exempted from the PSD rules, as well as attempts to impose PSD limits on specific constituents of a pollutant already governed by the permit. *Knauf Fiber Glass, GMBH*, PSD Appeal No 98-3, et seq., 8 EAD 121 (EAB 1999), 1999 EPA App. LEXIS 2 at *97-*100. In its comments on the Deseret Bonanza permit, U.S. EPA cites *North County Resource Recovery Assoc.*, 2 EAD 229, 230 (EAB 1986) – decided 4 years before the 1990 Clean Air Act Amendments, and a full 21 years before the Supreme Court's 2007 ruling – for the proposition that CO_2 is "unregulated" by the CAA's PSD provisions. Deseret Bonanza RTC at 5-6. But *North County*, again, deals only with air toxic pollutants, which are expressly exempted, by Congress, from the PSD rules.

EPA also cites *Kawaihae Cogeneration Project*, 7 EAD 107, 132 (EAB 1997), and *InterPower of New York*, 5 EAD 130, 151 (EAB 1994) for the bald assertion that the Board has already "determined that CO_2 emissions are not regulated pollutants for PSD permitting purposes." *Christian County* Brief at 3. But these decisions predate *Massachusetts v. EPA* by a decade or more, and were reached during the same period of time when the Agency was arguing generally that CO_2 and other greenhouse gas emissions were not "air pollutants" under the Act, a perspective definitively overturned by the Supreme Court's decision.

Mr. HUDDLESTON. Mr. President, the proposed provisions for application of best available control technology to all new major emission sources, although having the admirable intent of achieving consistently clean air through the required use of best controls, if not properly interpreted may deter the use of some of the most effective controls.

The definition in the committee bill of best available control technology indicates a consideration for various control strategies by including the phrase "through application of production process and available methods, systems, and techniques, including fuel cleaning or treatment." And I believe it is likely that the concept of BACT is intended to include such technologies as low Btu gasification and fluidized bed combustion. But, this intention is not explicitly spelled out, and I am concerned that without clarification, the possibility of misinterpretation would remain.

It is the purpose of this amendment to leave no doubt that in determining best available control technology, all actions taken by the fuel user are to be taken into account- be they the purchasing or production of fuels which may have been cleaned or up-graded through chemical treatment, gasification, or liquification; use of combustion systems such as fluidized bed combustion which specifically reduce emissions and/or the post-combustion treatment of emissions with cleanup equipment like stack scrubbers.

The purpose, as I say, is just to be more explicit, to make sure there is no chance of misinterpretation.

Mr. President, I believe again that this amendment has been checked by the managers of the bill and that they are inclined to support it.

Mr. MUSKIE. Mr. President, I have also discussed this amendment with the distinguished Senator from Kentucky. I think it has been worked out in a form I can accept. I am happy to do so. I am willing to yield back the remainder of my time.

123 Cong. Rec. S9434-35 (June 10, 1977)(debate on P.L. 95-95)(emphasis added).

B. The Top-Down BACT Analysis

Since 1990, the EPA's New Source Review Manual[8] ("NSR Manual") has set forth the generally accepted framework for the case-by-case determination of BACT. Because the statute

[8] U.S. EPA Office of Air Quality Planning & Standards, New Source Review Workshop Manual (Oct. 1990)(DRAFT). The EAB does not consider the Manual "a binding Agency regulation," however the Board does "look[] to [the Manual] . . . as a statement of the Agency's thinking on certain PSD issues." *In re Prairie State Gen. Co*., PSD Appeal No. 05-05, slip op at 7 n. 2 (Aug. 24, 2006)(citing *In re RockGen Energy Ctr*., 8 EAD 536, 542 n.10 (EAB 1999), *In re Knauf Fiber Glass, GmbH*, 8 EAD 121, 129 n.13 (EAB 2000)).

specifically requires the permit issuing authority to determine BACT for a source on a case-by-case approach, any attempt to impose blanket restrictions on the analysis is contrary to the letter and spirit of the Act.[9] The NSR Manual sets forth a "top-down" analysis for setting a BACT emissions limit for any major emitting facility seeking an air permit under the PSD program. The "top-down" analysis includes five steps, beginning with the identification of all potentially available options, and ending with the selection of one option as the basis for the emissions limitation which will be written into the PSD permit for the facility as the "BACT limit." See NSR Manual Section B. " '[T]he strict application of the methodology described in the NSR Manual is not mandatory,' " however. " '[A] careful and detailed analysis of the criteria identified in the regulatory definition of BACT *is* required, and the methodology described in the NSR Manual provides a framework that assures adequate consideration of the regulatory criteria . . . .'" *In re Prairie State,* PSD Appeal No. 05-05, slip op. at 16, 13 EAD – (Aug. 24, 2006) (emphasis added), *aff'd, Sierra Club v. EPA, No. 06-3907 (7th Cir. 2007)*(quoting *In re Cardinal FG Co*., PSD Appeal No. 04-04, slip op. at 12 (EAB Mar. 22, 2005), 12 EAD --.

Step 1. If undertaken in a manner consistent with the statutory language, the first step of the EPA top-down policy must identify all technologies, including the "application of production processes, systems, techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques" for the control of each pollutant subject to regulation under the Act. 42 U.S.C. §7479(3). According to established EPA policy guidance, "[t]his includes technologies employed outside of the United States. . . . [and] should include not only existing controls for the source category in question, but also (through technology transfer) controls applied to similar source categories and gas streams, and innovative control technologies." NSR Manual at B.5.

The statutory language requires inclusion of an ACT on the step 1 list in a BACT determination for a proposed coal-fueled EGU, as a control option, where the ACT is a "production process," "system," or "technique" for producing electricity from coal with lower resulting emissions of air pollutants, including carbon. *See In re Knauf Fiber Glass, GmBH*, 8 EAD 121 at 129 (EAB, 1999)("control option" can be "an 'add-on' pollution control technology

[9] For example, in a December 2005 ruling, EPA asserted in response to a written question about all "proposed coal-fired power plants" generally, that "we would not require an applicant to consider IGCC in a BACT analysis for a SCPC unit." Final letter from Stephen D. Page, Director, US EPA Office of Air Quality, Planning and Standards, to Mr. Paul Plath, E3 Consulting, LLC (December 13, 2005).

that removes pollutants from a facility's emission stream, or an 'inherently low-polluting process/practice' that prevents emissions from being generated in the first instance"); *cf*. *Sierra Club v, EPA*, No. 06-3907, slip op. at 4 (7th Cir. Aug. 24, 2007) (contrasting the asserted unreasonableness of considering a nuclear-fueled power plant as a "control technology" for a proposed coal plant, with the reasonableness of considering another technique for generating electricity from the same source of coal as a "control technology" for the source).

The 1990 NSR Manual's language sets out EPA's policy-based limits on the potential reach of the statutory language, couched in terms of the degree to which consideration of the statutory mandate to set an emissions limit based on the maximum degree of reduction from best available control technologies can "redesign" or "redefine" an applicant's proposal. The NSR Manual states that

> … applicants proposing to construct a coal-fired electric generator, have not been required by EPA as part of a BACT analysis to consider building a natural gas-fired electric turbine although the turbine may be inherently less polluting per unit product (in this case electricity). However, this is an aspect of the PSD permitting process in which states have the discretion to engage in a broader analysis if they so desire. … [T]here may be instances where, in the permit authority's judgment, the consideration of alternative production processes is warranted and appropriate for consideration in the BACT analysis. A production process is defined in terms of its physical and chemical unit operations ued to produce the desired product from a specified set of raw materials. In such cases, the permit agency may require the applicant to include the inherently lower-polluting process in the list of BACT candidates.
>
> … [And where] a given production process or emissions unit can be made to be inherently less polluting . . . the ability of design considerations to make the process inherently less polluting must be considered as a control alternative for the source.

NSR Manual at B.13-B.14. The EAB, in its *Prairie State* decision (upheld by the 7th Circuit Court of Appeals on other grounds), confirmed the decision by the state of Illinois to consider one ACT, IGCC technology, at step one of the top-down analysis as an "inherently lower polluting process or method" that could achieve the applicants' "purpose or basic design for the facility," which was a mine-mouth pulverized coal-fired EGU.[10] *Prairie State*, slip op. at 35-36.

[10] There are significant inconsistencies in EPA's current approach to this question. EPA Region 8, included supercritical technology as a step one control option for a waste-coal fired power project, even though "[t]he use of supercritical pressure in a power plant affects the design of all components with the plant cycle, boiler, turbine, pumps, etc." – but the Agency flatly rejected IGCC on "redesigning the source" grounds. EPA Region 8, Final

The EAB further held that the "redesigning the source" policy "does not prevent the permit issuer from taking a "hard look" at whether the proposed facility may be improved to reduce its pollutant emissions,[11] *id.* at 33-34, and at whether the applicant's asserted "design requirements" were derived in a way calculated to avoid measures for limiting pollution. *Id*. & 30 n.23; *see also Sierra Club v. EPA*, No. 06-3907, slip op. at 3 (noting this aspect of the EAB ruling).

The EAB's decisions (and those of the Administrator before 1990) "reflect a central concern with preservation of the facility's basic purpose."[12] *In re Prairie State*, slip op. at 27 (citing Brief of Sierra Club in response to OAR, at 9); *see also In re Knauf Fiber Glass, GmbH*, 8 EAD at 136 ("EPA has not generally required a source to change (i.e. redefine) its basic design."). But "who is the appropriate authority to identify the facility's purpose or basic design," *Prairie State*, slip op. at 28, the applicant or the permit-issuing authority? The Seventh Circuit Court of Appeals recently asserted that this responsibility lies with the permit-issuing authority under the Act. *Sierra Club v. EPA*, No. 06-3907, slip op. at 5. According to the Court, because it is EPA that has established the underlying policy, framing the boundaries is also within EPA's purview, and is not under the control of the applicant. Of course, EPA is bound by the statute's language and history in drawing these lines, and the discussion above illustrates that including ACTs at the first step of the BACT determination is required by the statute's plain language.

Two earlier decisions by the EPA Administrator further explain the limited nature of the "redefining the source" policy. In *In re Pennsauken County, New Jersey, Resource Recovery Facility*, PSD Appeal No. 88-8 (Adm'r, Nov. 10, 1988), the petitioner asked the EPA Administrator to deny a PSD permit to a municipal waste combustor and, instead, require the county to dispose of its waste by co-firing it with coal in existing power plants. *See id*. at 10. In effect, the petitioner wanted the EPA to order the applicant to engage in what EPA characterized as a different type of activity: electricity generation, rather than waste disposal. The

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Statement of Basis for the Deseret Power Electric Cooperative Bonanza Power Plant, at 21, 10-18, 20-23 (August 30, 2007).

[11] Cleaner production processes must be evaluated even where they are proprietary or confidential. *See, In re Knauf Fiber Glass, GmbH*, 8 EAD 121(EAB 1999).

[12] EPA has recognized, in rulemakings establishing emissions limitations for coal-fueled EGUs, that IGCC is in the same source category as other technologies for generating electric power from coal. For example, in 1998 EPA adopted a nitrogen oxide limit as part of its new source performance standards that applied to all new electric generating units, whether pulverized coal or IGCC technologies. Revision of Standards of Performance for Nitrogen Oxide Emissions From New Fossil-Fuel Fired Steam Generating Units, 63 Fed. Reg. 49442 (September 16, 1998).

Administrator rejected this option because the petitioner's argument was based on his general opposition to a waste combustor, not to the amount of air pollution emitted by the proposed source, or the emissions limits that were conditions in the permit. Thus, the Administrator held, the petitioner was asking EPA to "redefine the source" from a waste combustor to a power plant:

> *Petitioner Filipczak's fundamental objections to the Pennsauken permit are not with the control technology, but rather, with the municipal waste combustor itself.* He urges rejection of the combustor in favor of co-firing a mixture of 20% refuse derived fuel and 80% coal at existing power plants. These objections are beyond the scope of this proceeding and therefore are not reviewable under 40 C.F.R. 124.19, which restricts review to "conditions" in the permit. Permit conditions are imposed for the purpose of ensuring *that the proposed source of pollutant emissions-- here, a municipal waste combustor--* uses emission control systems that represent BACT, thereby reducing the emissions to the maximum degree possible. These control systems, as stated in the definition of BACT, may require application of "production processes and available methods, systems, and techniques, including fuel cleaning as treatment or innovative fuel combustion techniques" to control the emissions. The permit conditions that define these systems are imposed on the source as the applicant has defined it… [T]he source itself is not a condition of the permit.

Id. at 10-11 (emphasis added). The Administrator subsequently reaffirmed the *Pennsauken County* decision and explained that "source," within the newly created "redefining the source" policy, refers to a *source category*.

> In *Pennsauken*, the petitioner was urging EPA to reject the proposed source (a municipal waste combustor) in favor of using existing power plants to co-fire a mixture of 20% refuse derived fuel and 80% coal. In other words, the *petitioner was seeking to substitute power plants (having as a fundamental purpose the generation of electricity) for a municipal waste combustor (having as a fundamental purpose the disposal of municipal waste)…*

In re Hibbing Taconite Company, 2 E.A.D. at n. 12 (Adm'r 1989) (parentheticals original, emphasis added). After clarifying the "redefining the source" policy as only preventing a change in the "fundamental purpose," *i.e.*, the source category, the Administrator further explained that the "redefining the source" policy did not allow the permitting agency to blindly accept the source design proposed by the applicant. *Id*. at 842-843. In *Hibbing*, the permit applicant wanted to burn petroleum coke at its taconite plant, but EPA required the applicant to consider burning natural gas (a lower-polluting process and cleaner fuel) as part of a BACT determination. *Id.* The Administrator specifically rejected the idea that requiring consideration

of cleaner fuel constitutes "redefining the source" because the fundamental purpose, or source category, remains the same.

> [O]ne argument that could be made is that the Region, by requiring the burning of natural gas to be an alternative to be considered in the BACT analysis [for a petroleum coke-fired plant], is seeking to "redefine the source." Traditionally, EPA has not required a PSD applicant to redefine the *fundamental scope* of its project… [The redefining the source] argument has no merit in this case.
>
> *EPA regulations define major stationary sources by their product or purpose (e.g., "steel mill," "municipal incinerator," "taconite ore processing plant," etc.), not by fuel choice. Here, Hibbing will continue to manufacture the same product (i.e., taconite pellets) regardless of whether it burns natural gas or petroleum coke*… The record here indicates that there are other taconite plants that burn natural gas, or a combination of natural gas and other fuels. Thus, it is reasonable for Hibbing to consider natural gas as an alternative in its BACT analysis.

Id. (parentheticals in original, emphasis added).

Under this legal framework, if an ACT (IGCC for example) is a "production process," "system," or "technique" for producing electricity from coal with lower resulting air pollutant emissions, then it must be considered at the first step of the top-down analysis.[13, 14] The EAB recognized this in *Prairie State*, slip op. at 35-36, holding that Illinois EPA was correct in

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[13] For information about IGCC in this regard, *see* Robert J. Wayland, U.S. EPA Office of Air and Radiation, OAQPS, "U.S. EPA's Clean Air Gasification Activities", Presentation to the Gasification Technologies Council Winter Meeting, January 26, 2006, slide 4; and "U.S. EPA's Clean Air Gasification Initiative," Presentation at the Platts IGCC Symposium, June 2, 2005, slide 11 (citing the "inherently lower emissions of nitrogen oxides, sulfur dioxides, and mercury," as among the "fundamental advantages" of IGCC).

[14] The definition of BACT also explicitly requires considering the application of "fuel cleaning … for control of each pollutant." 42 U.S.C. § 7479(3). The EAB has held that "[i]n deciding what constitutes BACT, the Agency must consider both the cleanliness of the fuel and the use of add-on pollution controls." *In re Inter-Power of New York*, 5 E.A.D. 130, 134 (EAB, 1994) (internal citation omitted). In addition, "the definition of BACT includes consideration of both clean fuels and use of air pollution control devices." *In re Hawaiian Commercial & Sugar Co.*, PSD Appeal No. 92-1 at 5 n.7 (EAB, July 20, 1992).

U.S. EPA's rules setting New Source Performance Standards for coal-fired electricity generating units state that IGCC is an available method for cleaning and treating coal to remove air pollutants prior to combustion:

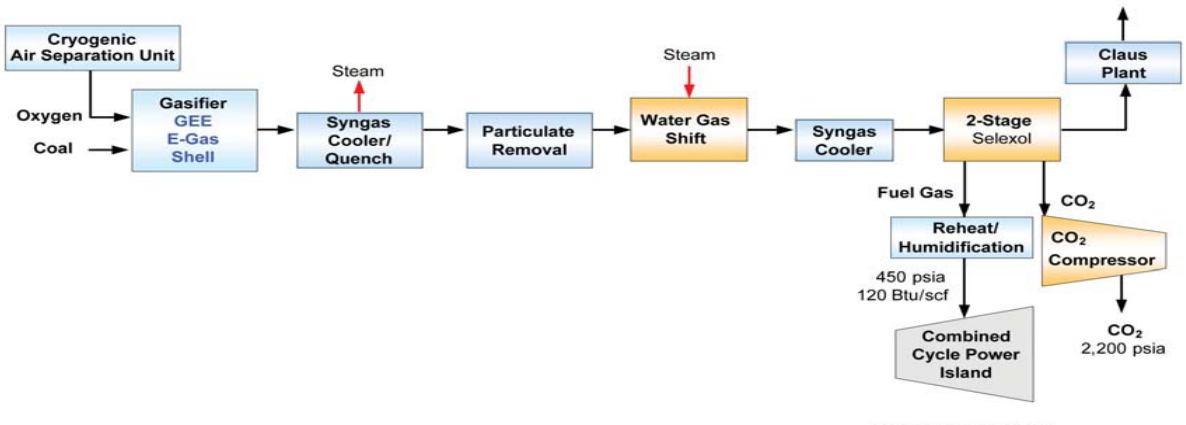
> One approach to controlling SO2 emissions from steam generating units is to limit the maximum sulfur content in the fuel. This can be accomplished by burning… a fuel that has been pre-treated to remove sulfur from the fuel… There are two ways to pre-treat coal before combustion to lower sulfur emissions: Physical coal cleaning and gasification… Coal gasification breaks coal apart into its chemical constituents (typically a mixture of carbon monoxide, hydrogen, and other gaseous compounds) prior to combustion. The product gas is then cleaned of contaminants prior to combustion. Gasification reduces SO2 emissions by over 99 percent.

U.S. EPA, Standards of Performance for Electric Utility Steam Generating Units for Which Construction is Commenced After September 18, 1978, 70 Fed. Reg. 9706, 9710-11 (February 28, 2005). As a result of this fuel cleaning, IGCC units "will inherently have only trace SO2 emissions because over 99 percent of the sulfur associated with the coal is removed by the coal gasification process." *Id.* at 9715.

including IGCC at step 1 of the BACT determination for a new pulverized coal plant. While CO_2 was not a consideration in the *Prairie State* review, IGCC also is the *only* currently available "control technology" allowing CO_2 capture from commercial-scale electricity generation using coal. As compared with conventional pulverized coal-based power plants ("PC plants"), IGCC technology is capable of vastly reduced emissions of criteria air pollutants, including sulfur dioxide ("SO_2"), nitrogen oxides ("NOx"), particulate matter ("PM"), and carbon monoxide ("CO").[15] IGCC with controls also can emit lower levels of mercury than PC units -- in excess of 90% mercury removal can be accomplished for less than a 1% increase in the cost of electricity generation.[16]

Furthermore, the case-by-case or incremental nature of BACT means that the existing permitting analysis can drive incremental steps towards carbon capture for all new coal-fueled EGUs. Because IGCC offers the immediate availability of capture-ready technology, when carbon is evaluated, the BACT limit for CO_2 for the new coal EGU can be set at the level at which capture would occur with an IGCC using today's technology. As compared with the availability of capture options for other coal-fueled EGUs technologies, the IGCC level is today's best performer, and provides an incremental step toward full carbon capture.

Figure 2, Schematic of IGCC Power Plant with CO_2 Capture[17]



[15] Water use is generally much lower in an IGCC plant than a PC plant, the quantity of solid waste generated is much reduced, and the potential for toxic components of waste to leach into groundwater is reduced by IGCC compared to PC.

[16] *The Cost of Mercury Removal in an IGCC Plant*, presentation by Parsons Infrastructure Group, 2002. While cost-effectiveness information becomes relevant only at step 4 in the current EPA top-down process, it is included here and referenced later.

[17] DOE Fossil Desk Reference, Figure 1.

Step 2. The second step of the BACT determination framework set out in the NSR Manual evaluates the degree to which each identified process or control option is "technically feasible," and as a result of this step, options are eliminated if, "based on physical, chemical, and engineering principles, … technical difficulties would preclude the successful use of the control option on the emissions unit under review." NSR Manual at B.6. This concept has been developed in the EAB case law such that a technology is considered "feasible" if it is either "demonstrated" – meaning installed and operating successfully elsewhere -- or is both "available" (i.e., can be obtained through commercial channels) and "applicable" (it can be applied or put in place or operated at the source in question). *Prairie State,* slip op. at 17; *In re Three Mountain Power, LLC,* 10 EAD 39, 42-43 (EAB 2001).

Again, an ACT will survive the hard look required by the Clean Air Act at Step 2 (indeed, at all steps of the BACT determination, *Prairie State,* slip op. at 33-34), if either it is already demonstrated or it can be obtained through commercial channels and used at the source in question. An ACT that is clearly still in the research and development phase is not a candidate to survive Step 2 – but an ACT technology such as IGCC that is now available survive a properly analyzed Step 2, because it can be applied directly for the purpose of generating electricity from coal.

Using the example of IGCC as one available ACT that can survive Step 2, at present there are approximately 417 gasifiers operating at 138 different plants worldwide with a capacity of approximately 56,000 MW (thermal). These plants operate primarily on coal (55%) and petroleum residue (32%) and produce chemicals (44%), liquids fuels (30%), electric power (18%), and fertilizer. Of the 138 gasification plants operating worldwide 19 are in North America (9 in Texas, 3 in Louisiana, and 1 each in Florida, Tennessee, Indiana, Kansas, North Dakota, Delaware, and Canada).[18]

There are currently 15 IGCC worldwide, operating for the production of electricity, with a net installed electrical generation capacity of 3,870 megawatts ("MW"). These projects are listed in Table 3 below. Several additional IGCC are currently under construction.[19]

[18] *The Gasification Industry: 2007 Status and Forecast,* presentation by Jim Childress, GTC, 2007 (on file with CATF).

[19] According to news releases construction of the KBR/Southern Company IGCC in Orlando, Florida began September 11, 2007. Start-up of a Mitsubishi IGCC in Japan is scheduled for sometime in 2007.

Table 3, IGCC Operating Worldwide[20]

Plant	COD	Size (MW)	Feed	Other Products
Nuon (Netherlands)	1994	250	Coal	-
Wabash (Indiana)	1995	250	Coal/Coke	-
Tampa Electric Polk 1 (Florida)	1996	250	Coal/Coke	-
Frontier Oil (Kansas)	1996	45	Coke	Cogen
SUV (Czech Republic)	1996	350	Coal	Cogen
Swarze Pumpe (Germany)	1996	40	Coal	Methanol
Shell Pernis (Netherlands)	1997	120	Tar	Cogen, H2
Puertollano (Spain)	1998	320	Coal/Pet Coke	-
ISAB (Italy)	2000	510	Asphalt	-
Sarlux (Italy)	2001	545	Tar	Steam, H2
Exxon Chemical (Singapore)	2001	160	Tar	Cogen
API Energia (Italy)	2001	280	Tar	Steam
Valero Refining (Delaware, USA)	2002	160	Coke	-
Nippon Refining (Japan)	2003	340	Asphalt	-
Eni Power (Italy)	2006	250	Asphalt	-

Of these 15 currently operating IGCC plants, the ISAB and Sarlux facilities both demonstrate that IGCC can be built at above 500 MW scale, and both were constructed using non-recourse financing provided by commercial banks and other institutions. Both plants also operate at above 90% availability.[21] The Nuon, Wabash, Tampa Electric, and Puertollano IGCC are all solid-fuel plants like PC power plants. The other IGCC listed share most primary process components with coal-based IGCC and indicate the technical and commercial capability of IGCC generally. Consortia offering these IGCC commercially include GE in partnership with Bechtel (offering both the gasifier and the power block), a partnership between Shell, Udhe, and Black & Veach (offering the gasifier and integration with a power block from a different supplier), Siemens (offering the former FutureEnergy gasifier and a Siemens power block), and Mitsubishi (offering the gasifier and the power block).

Step 3. The third step of the top-down BACT analysis contained in the NSR Manual ranks the various production processes, systems, techniques, etc. identified in step 1 and not eliminated in step 2, in descending order of control effectiveness for the air pollutant in question. The NSR Manual posits for each application, the creation of a matrix presenting for each

[20] Adapted from *Gasification – Versatile Solutions*, presentation by Gary Stiegel, US DOE, 2006 (on file with CATF).
[21] See *Refinery IGCC Plants are Experiencing 90% Availability After 3 Years*, Harry Jaeger, Gas Turbine World, January-February, 2006.

pollutant the control efficiencies, expected emissions rates, economic impacts (total and incremental cost effectiveness), environmental impacts; and energy impacts resulting from the application of each in the array of control technology alternatives. NSR Manual at B.7-B.8.

ACTs such as IGCC will appear at the top of the step 3 list as top performers relative to PC or SCPC units, for criteria air pollutants, and for mercury and CO_2. A permit applicant's ranking of control technologies for a coal-based electricity generation project will include both IGCC and PC at various levels of control for the two technologies. Although BACT is a site-specific analysis and will depend on fuel specifications (esp. coal rank and sulfur content), the available evidence strongly suggests that IGCC has lower criteria pollutant emissions than PC for any fuel at any conceivable level of add-on controls and would be the "top" control candidate (meaning the lowest-emitting technology) in most if not all cases:

a. For SO_2, existing domestic IGCC have emissions levels of around 0.1 lb/MMBtu heat input, which is comparable to or better than current permits for state-of-the-art PC plants. Recent permits for IGCC plants based on deep sulfur removal have limits near 0.01 lb/MMBtu, almost *90% lower than current PC* proposals;

b. For NOx, one existing domestic IGCC has emissions of around 0.055 lb/MMBtu heat input, which is below the lowest current permit limit of 0.067 lb/MMBtu for a state-of-the-art PC plant. Recent permits for IGCC plants based on use of SCR include NOx emissions limits of 0.025 lb/MMBtu, or approximately *65% less than the state-of-the-art PC*;

c. For PM (expressed as filterable PM-10), existing domestic IGCC have emission rates of 0.004 lb/MMBtu to 0.011 lb/MMBtu, which are lower than the levels of 0.012 lb/MMBtu and higher required by recent permits for PC plants. Recent permits for IGCC include PM limits of 0.0063 lb/MMBtu, or roughly *50% of the level of state-of-the-art PC*;

d. For CO and VOC, similar patterns apply;

e. For Hg, greater than 90% removal is possible;

f. For CO_2, at present, partial capture is possible without any fundamental reworking of the technical detail of an IGCC plant; storage is necessarily a site-specific determination, as is the case as well for a PC alternative.

Step 4. At the fourth step, the best performer in terms of emissions control of the air pollutants in question is selected, unless there are clearly justifiable reasons based in the statutorily defined dimensions of "energy, environmental and economic impacts and other costs." 42 U.S.C. §7479(3). The NSR Manual states that "both beneficial and adverse impacts should be discussed, and where possible, quantified." NSR Manual, at B.8. At this step, financial and other costs of the option are weighed together with environmental benefits, including the ability to capture some portion of the CO_2 emissions from the unit. "Partial capture" of CO_2 from an IGCC, for an example, can offer a way to reduce CO_2 emissions for limited cost,[22] and that analysis will be considered at this step.

Moreover, there is nothing in the Act requiring the *rejection* of a control technology here on cost-effectiveness grounds – the Act states that *the permitting authority* is to make the BACT determination based on this analysis, on a case-by-case basis. 42 U.S.C. §7479(3). Given that all air pollutants subject to regulation must be considered, where an ACT offers the promise of near-term partial carbon capture, that situation also must be quantified here. CATF is in the process of producing a step four analysis for one ACT, IGCC, based on information contained in EPA's Footprints Report. We believe that analysis will demonstrate that IGCC can be selected as the basis for BACT limit for a proposed coal-fueled EGU – that a hard look will demonstrate that IGCC cannot be eliminated from the analysis on cost-effectiveness grounds. And, when environmental benefits are factored into the discussion, IGCC remains a best performer.[23] This is true when CO_2 is analyzed as a pollutant whose emissions must be reduced or eliminated, but also independently because the environmental benefits of the incidental capability to capture CO_2 must be considered here, at step 4. DOE's Fossil Desk Reference indicates that SCPC currently enjoys approximately a 17% capital cost advantage over IGCC when costs of CO_2 capture equipment are not included. However, when costs of capturing CO_2 are included, however, IGCC is able to produce electricity for approximately 8% less than SCPC.[24]

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[22] This is particularly true where the captured CO_2 can be stored or used in an EOR application.

[23] IGCC plants also use less water than PC plants -- U.S. DOE estimates IGCC water usage at 678 gallons/MWh – 830 gallons/MWh depending upon the type of gasifier. In contrast, subcritical pulverized coal and supercritical pulverized coal were estimated to use 1,169 gallons/MWh and 1,042 gallons/MWh. US DOE/NETL, *Power Plant Water Usage and Loss Study*, August 2005, page xvi. IGCC plants also generate 40-50% less leachable solid waste than PC plants. MIT Interdisciplinary Study, The Future of Coal, 2007, page 142.

[24] DOE Fossil Desk Reference, Overview-6.

Step 5. Here, after the top-performing option is chosen based on the considerations in Step 4., a BACT emissions limit is established for the new source. The comparison set forth above provides a barebones illustration why IGCC can and should survive a top-down BACT analysis, without any further amendment by EPA to the NSR Manual's framework.

In brief, where the proposed facility's purpose is electricity generation, and the design fuel is coal, the EPA Administrator or the permitting authority -- commonly a state, *is required to* consider and evaluation of ACTs now, under existing statutory and regulatory authority. ACTs *must* be included in the BACT analysis because the statute directs this approach -- and ACTs also can be selected as the basis of the BACT emissions limit, to the extent that they represent the lowest emitting option for all of the pollutants under consideration, including carbon dioxide.