Phase II Report of the Climate Change Work Group of the Permits, New Source Review and Toxics Subcommittee, Clean Air Act Advisory Committee

August 5, 2010

I. Introduction

The Climate Change Work Group is pleased to provide this Phase II Report (Report) to the Permits, New Source Review and Toxics Subcommittee and the full Clean Air Act Advisory Committee (CAAAC). This second phase of the Work Group was commissioned by Assistant Administrator Gina McCarthy on April 9, 2010 (see Appendix 1) at which time she requested input from the Work Group on two specific issues:

1. How can the best available control technology (BACT) process be used to encourage the development of energy efficient processes and technologies?

2. How can the development and permitting of innovative emissions reduction measures, including the promotion of inherently efficient and lower emitting processes and practices for greenhouse gases (GHGs), be encouraged? How can the Innovative Control Technology (ICT) waiver be used or changed to better promote technology development and application?

Since the formal kickoff of Phase II, over the last three months, the Work Group has held twenty-four (24) conference calls averaging 2 hours each and three (3) all day meetings in Washington DC on these issues. The Work Group comprises a diverse membership of forty-five (45) representatives from around the country of state and local permitting authorities, environmental organizations, and industry. The Work Group membership is in Appendix 2 to this report.

What follows are the Work Group's perspectives and recommendations on these two specific issues.

II. Energy Efficient Processes and Technologies (EEPTs) and BACT

The GHG BACT Work Group was charged with addressing the question, “How can the BACT process be used to encourage the development of energy efficient technologies and processes?” This portion of the Work Group’s report examines the

ways in which EEPTs[1] could be incorporated into the top-down BACT process[2]. (Section II.A). Section II.B discusses different "levels of analysis" that might be used to define both the parts of a facility and the equipment or operations within a facility that might be subject to BACT. Finally, Section II.C presents general observations about BACT and EEPTs. Recommendations are provided at the end of the document.

Members of the Work Group hold divergent opinions about the question posed by Assistant Administrator Gina McCarthy. Some Work Group members assert, based on their experience and analysis, that the PSD program and top-down BACT process have been very effective in achieving meaningful air quality and public health benefits, as well as in promoting technology improvements to achieve pollution reductions. They believe that the PSD program and top-down BACT process also can be very effective at encouraging the development and application of EEPTs that will achieve meaningful greenhouse gas reductions. In their view, in addition to producing societal benefits that are reasonable compared to their costs, EEPTs considered in the BACT analysis will frequently produce a net savings to the applicant, although not always with a rate of return that meets internal company thresholds for investment.

Other Work Group members are of the view that the PSD program inhibits energy efficiency investments and discourages projects that, in the near term, could materially reduce greenhouse gas emissions. This is due in part to their belief that EEPTs prescribed as BACT will be of a fundamentally different character than EEPTs adopted for non-mandatory reasons, such as those developed under the EPA's Energy Star program, because BACT will likely require efficiency measures to be adopted that result in net costs rather than net savings for the applicant. These members suggest that an alternative approach to traditional BACT would best accomplish the objective of using the BACT process to encourage the development of EEPTs and could provide a more cost-effective way of materially reducing greenhouse gas emissions. This report should not be viewed as an endorsement by these members that the BACT process can be effectively used to encourage development of EEPTs.

Having expressed their divergent points of view, the Work Group members focused their attention on how EEPTs may be incorporated into the BACT process and on changes that can be made to existing policies, for example in implementing the BACT waiver provisions (see Section III), to better promote promising new technologies

[1] Use of the phrase "energy efficient processes and technologies" or EEPTs is intended to refer to processes and technologies that reduce GHG emissions.

[2] Consistent with the assumptions described on page 16 of the Interim Phase I Report, the Work Group agrees: (1) State and local agencies will use their existing SIP-approved processes for reviewing prevention of significant deterioration (PSD) permit applications and determining BACT for GHGs; (2) The Work Group does not envision a new BACT determination process for GHGs; (3) The predominant method for determining BACT is EPA's "top down" BACT determination process, but there are some States (Texas is at least one such State) that have an alternate process in their approved State Implementation Plan (SIP).

offering reductions in GHGs. The Work Group's report makes observations and recommendations in that context.

In its discussions, the Work Group focused on each step in the top-down BACT process and identified considerations a permit applicant and writer would likely need to address regarding the application of EEPTs to arrive at what constitutes BACT. The Work Group believes that the types of projects likely to come before State and local permitting authorities will include: modifications of stationary sources; replacement of existing emitting units; additions of emitting units to existing plant sites; and new greenfield facilities. The specifics of what should comprise the scope of BACT review required for each is something that the Work Group could not reach consensus on during its Phase I deliberations (see Phase I Interim Report, Section IV, pgs. 5-8). The Work Group also discussed different "levels of analysis" and their implications for the BACT process.

It is envisioned that benchmarking information, to the extent it is specific and relevant to the source in question, may provide useful information regarding EEPTs for consideration in the BACT assessment. Except where otherwise indicated, references to "benchmarks" in this document are intended to refer to the particular EEPTs discussed in available benchmark documents. For instance, EPA's Industrial Energy Star program has provided Energy Guides for a number of industries. These Energy Guides discuss in detail EEPTs that a permit applicant or permitting authority may wish to consider. Other sources of information include the Center for Clean Air Policy's international benchmarks for cement kilns, iron and steel, and other industries, GHG efficiency benchmarks for industrial products prepared for the European Union, and reports on GHG mitigation options for particular industrial sectors. A list of publicly available energy efficiency benchmark examples of which the Work Group is aware is provided in Appendix 3. This type of information may be particularly useful at the initial stages of the GHG BACT permitting process as the RACT/BACT/LAER clearinghouse is populated and updated. State and local permitting authorities, and permit applicants can utilize this type of resource to identify potentially relevant EEPTs. Reference to these benchmark resources is not intended to imply that any particular EEPT is relevant in any given BACT analysis or to suggest endorsement of these documents.

A. Incorporating EEPTs into Top-Down BACT

The following section provides an approach for incorporating energy efficiency into the existing BACT top-down framework ("framework") as currently practiced in the U.S. One strength of this framework is that it uses the top-down BACT analysis with which EPA, States, permit applicants, and stakeholders are already familiar. EPA has asked this Work Group to consider how the BACT process can be used to encourage the development of EEPTs. As such, this framework focuses on how to analyze such measures in the BACT process, but the framework is not intended to preclude analysis of other inherently lower emitting processes or control measures, e.g., end-of-pipe controls, if they are otherwise appropriate for consideration as BACT, or to suggest that only energy efficiency measures should be considered in the BACT process.

Following the approach in the Federal New Source Review (NSR) rules, the Work Group distinguishes between BACT analysis for new units at existing facilities, modification to existing units, replacement units, and greenfield facilities units, and presents the application of a top-down efficiency framework for each of those scenarios. The Work Group also notes that a source can "net out" of PSD applicability through energy efficiency measures, among other measures, such that there would be no significant net GHG emissions increase, as is currently done for other PSD pollutants.

In the context of the current report, some Work Group members assert that EEPTs that provide efficiency gains from non-emitting units that reduce the load on emitting units should be considered in the BACT analysis, while other Work Group members assert that only EEPTs which directly reduce emissions from the emitting units may be incorporated into the BACT process.

Importantly, the analytical framework that follows is based on the assumption that EPA's PSD and Title V Tailoring Rule (referred to as the "Tailoring Rule") is in place. *Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule; Final Rule*, 75 *Fed. Reg.* 31,514 (June 3, 2010). The Tailoring Rule provides that a 100,000 ton per year (tpy) CO_2e major source threshold and 75,000 tpy CO_2e significance level will apply before any BACT analysis for GHG emissions would be required.

1. New Emissions Unit at Existing Facility

Step 1. Identify EEPT Options - Identify significant and relevant EEPTs available for the new emissions unit. For example:

a. Comparison of the unit's energy performance with a benchmark may highlight additional energy efficiency possibilities. Note Energy Star Guides or other benchmarking information refer to technologies already in use and may suggest technologies available relative to the new emissions unit. Existing GHG efficiency BACT emissions limits, or analogous efficiency benchmarks, also provide a benchmark for analysis. Studies conducted on mitigation options for specific industry sectors may also identify EEPTs.
b. Newly available EEPTs that have been demonstrated should also be considered. For some industry sectors, the most efficient new units have been built outside the United States.
c. Note that "[c]ombinations of inherently lower-polluting processes/practices (or a process made to be inherently less polluting) and add-on controls are likely to yield more effective means of emissions control than either approach alone." *See 1990 Draft NSR Workshop Manual (referred to as the "NSR Manual") at B.14.* With respect to EEPTs, some technologies and/or processes may be additive in achievable benefits and the final GHG BACT determination may incorporate multiple

energy efficiency measures. It may be appropriate to identify sets of compatible EEPTs for consideration in the top-down analysis.

Step 2. Eliminate technically infeasible options

a. Eliminate EEPTs, or where applicable, sets of EEPTs, that are technically infeasible, (i.e., not available or not applicable to the new emissions unit) in a manner consistent with established EPA guidance/policy on feasibility.
b. The analysis and selection of technology may include considerations concerning reliability and operational characteristics of a technology, which will typically be presented by the permit applicant for the permitting authority to consider in setting an appropriate BACT limit. The NSR Manual states that demonstration of "technical infeasibility is based on a technical assessment considering physical, chemical and engineering principles and/or empirical data showing that the technology would not work on the emissions unit under review, or that unresolvable technical difficulties would preclude the successful deployment of the technique." *NSR Manual* at B. 20.

Step 3. Rank technically feasible EEPT options to establish a hierarchy - Rank remaining EEPTs, or where applicable, sets of EEPTs according to specific GHG CO_2e reduction potential for the new emissions unit.

Step 4. Evaluate most effective EEPT(s).

a. Analyze the energy, environmental, and economic impacts associated with the EEPT or set of EEPTs ranked at the top of the list from Step 3 above.
   i. The analysis should provide, perhaps in a table or chart, the following:
      1. Energy efficiency and/or GHG emissions rate[3];
      2. Economic impacts, such as total annualized costs, average cost effectiveness, and incremental cost effectiveness;
      3. Environmental impacts, including emission reductions/increases for other pollutants as well as impacts on water usage, toxic emissions, water quality, solid waste generated, etc.
   ii. Analysis should confirm the suitability of the top EEPT, or where applicable, set of EEPTs, in the listing for selection as BACT, or provide clear justification why the top candidate or set of candidates is inappropriate as BACT.

[3] Some EEPTs may reduce in part the use of grid-delivered power. Such reductions could be quantified and listed as an energy impact in Step 3 of the BACT process using the procedures outlined in the EPA guidance discussed below. Where associated energy benefits can be quantified in terms of cost reduction or income to the source, such an energy impacts analysis can also be factored into the economic impacts analysis. *NSR Manual* at B. 29-30.

iii. If the most effective technologies and processes are not selected, the next most effective EEPT, or where applicable, set of EEPTs should be considered and analyzed.

iv. While the permit applicant can submit a complete application that analyzes only the top ranked alternative, some members suggested that, upon analysis of that application, the permitting authority might want to request further analysis of more than just the "top" ranked option where those options are closely ranked in terms of GHG reduction effectiveness but have significantly varying environmental impacts. Some members suggest that the interplay between criteria pollutant controls and GHG controls needs to be examined when determining BACT for all pollutants emitted by the source.

b. Note that conventional BACT analysis for certain criteria pollutants may result in energy penalties that will need to be compared to the BACT analysis for GHGs (e.g., SO_2 scrubbers for a coal fired electric generating unit (EGU)). Permitting authorities need to assess the appropriate tradeoffs between all BACT analyses for each regulated pollutant.

Step 5. Incorporate EEPTs into GHG BACT emissions limit.

a. The EEPT or set of EEPTs selected in Step 4 will be used to determine the BACT limit.[4]

b. Just as with any BACT determination, permitting authorities will need to consider the emissions limit and associated compliance determination methods, such as stack testing or monitoring, reporting and/or record-keeping requirements necessary to enforce that limit.

i. For example, a long- or short-term BACT limit could include monitoring of various parameters, such as output or fuel use to assess compliance with the limit over the relevant period, taking into account real-world operation of the plant such as the effect of changing loads on energy efficiency and compliance with the BACT limits.

ii. Permitting agencies should develop appropriate compliance determination methods that recognize the concerns discussed below. The Work Group discussed, without resolving, some issues regarding establishing GHG emissions limits and compliance determination methods:

1. Some members noted it may be useful to consider the use of long averaging times in establishing an emissions limit.
2. Members also noted that energy efficiency may vary with time due to degradation of equipment or because of operational issues inherent to the industrial environment.

[4] As noted above, permitting authorities should consider other (non-energy efficiency) applicable production processes and available methods, systems, and techniques for control of GHG emissions.

3. Other members emphasized the importance of effective management systems to ensure that efficiency gains are achieved and maintained over time.
4. Some elements that could be considered in establishing appropriate limits include:
    a. A performance standard: An efficiency relevant BACT limit (lb CO_2/mwh, heat rate) with an appropriate compliance margin.
    b. Operating limits that help ensure continuous compliance with the BACT limit (such as limits on heat input).
    c. Work practice standards, such as a periodic tune-up requirement for a boiler.
    d. Design requirements, such as a condensing furnace.

2. Modification to Existing Unit

Follow the process used for a new emissions unit described above. When identifying potential efficiency gains, consider the extent of the modification.

3. Replacement Unit

If PSD is applicable to the replacement emission unit, the process is the same as for a new emission unit as described earlier. Efficiency gains that would reduce the load on the source that is being replaced could be used to avoid PSD applicability.

4. Greenfield Facility

Unlike with replacement units, modified units, and new units added to existing facilities, when a new facility is proposed, there may be greater opportunities to use EEPTs because higher efficiency equipment can be selected and there is no need to retrofit existing equipment. For example, some new facilities may be able to take advantage of opportunities to utilize waste energy and/or reduce the demand for water, fuel, or other resources in a manner that reduces GHG emissions from the facility.

B. Levels of Analysis, BACT, and EEPTs

In the Work Group's Interim Phase I Report, the Work Group agreed that EPA should continue to require the application of BACT to new emissions units and to existing emissions units that are undergoing a physical change or change in method of operation, but could not reach consensus on whether the BACT analysis may or should consider parts of the production process beyond the units undergoing a physical change or change in the method of operation. The two schools of thought are summarized at pp. 6-7 of the Phase I report.

Despite these differences as to the appropriate scope of BACT, the entire Work Group recognizes that a facility-wide "level of review" is appropriate in determining PSD

applicability in circumstances where a netting analysis is conducted. The opportunity to "net out" of PSD creates a strong incentive for affected sources to seek energy efficiency opportunities well beyond the confines of the project itself.

Without prejudice to the different views reflected in the Phase I report, the Work Group agreed to discuss how the top-down efficiency framework could apply for three possible levels of analysis. As a general matter, a broader level of analysis would incorporate more opportunities to utilize EEPTs, potentially providing more opportunities for GHG emission reductions and energy cost savings. At the same time, the broader the analysis the more complicated the permitting process would be for the applicant in time, effort, and perhaps cost. By agreeing to explore energy efficiency within these "Levels", the Work Group wants to make it clear that this should not be taken to imply consensus on whether GHG BACT should apply to a broader or narrower scope of analysis. Rather, the Work Group decided to proceed in this manner recognizing that EPA has not provided guidance on the issue of scope at this time. In the absence of EPA's guidance on the scope/extent of the source to be considered for GHG BACT analysis, the Work Group presents discussion of the levels of analysis solely for the purposes of addressing the policy implications of performing the top-down energy efficiency analysis at varying levels.

As recognized above in Section II.A, the Work Group also notes that projects triggering PSD will vary in nature and scope. A project could be an entire facility if a new plant is proposed. Alternatively, a project could be a replacement piece of emitting equipment (i.e., boiler) if that is the only thing being replaced or modified. A project might also be the replacement of emitting equipment (i.e., a boiler) and associated new or modified process equipment that is being supplied energy (i.e., steam) by the emitting equipment.

1. Definitions of Levels of Analysis

As used in this report, the term "Levels of Analysis" incorporates two distinctly different concepts. First, Levels of Analysis is used to define the parts of a facility that are subject to a BACT review (*e.g.*, just one piece of equipment, an entire process line, the entire facility). Second, once the part(s) of the facility subject to BACT review is determined, "Levels of Analysis" is used to describe the equipment or operations for which a BACT emissions limitation or work practice must be developed (*e.g.*, for a new facility consisting of a fossil-fuel fired boiler and a processing line that does not emit GHGs but does use steam from the boiler, does BACT apply just to the GHG emissions unit – in this case the boiler – or does BACT apply to the GHG emissions unit and associated non-emitting units that may influence how much GHG is emitted by the emissions unit).

a. Equipment Level

Analysis at the equipment level would consider EEPTs for a new emissions unit and/or or an emissions unit that is being physically or operationally changed. It would not consider ancillary systems or non-emitting process equipment or structures.

b. Production Line Level

Analysis at the production line level would consider EEPTs relevant to a new emissions unit(s) and/or an emissions unit that is being physically or operationally changed and the production capabilities served by those units. For a boiler, for instance, a production line level analysis would consider efficiency gains available from the boiler, steam delivery system, and all systems utilizing steam from that boiler. The scope of the "production line" level may vary depending on the factual situation. Efficiency gains from steam-driven equipment that reduces the need for steam, thus reducing GHG emissions from the boiler, would also be considered in the analysis. Where relevant to the production line in question, opportunities to utilize waste energy would be considered. Some Work Group members assert that the analysis is limited to the emitting units.

c. Facility Level

Analysis at the facility level would consider EEPTs available within the entire facility. This level could include consideration of opportunities to use waste energy, and efficiency gains across the full range of production lines, EGUs, and auxiliary equipment at the facility. Some Work Group members assert that the analysis is limited to the emitting units.

2. Implications of Levels of Analysis

a. When might each level of analysis be appropriate?

(1) *Greenfield facilities* - All Work Group members agree that a facility-wide level of review is appropriate upon construction of a new major source.

(i) Some Work Group members assert that BACT must be limited to emissions units within the facility. [BACT should not invade the process of designing the facilities.]

(ii) Other Work Group members assert that the BACT analysis should encompass emissions units and non-emitting units. Such an analysis might include opportunities for more significant GHG reductions, for example, "rightsizing" the boiler for the facility, considering efficiency gains available from non-emitting units, and incorporating systemic improvements such as use of waste heat.

(2) *New and replacement units added to existing facility*

(i) Some Work Group members assert that the BACT analysis must be limited to the new emissions unit.
(ii) Other Work Group members assert that a broader review is appropriate when a new process line is added to a facility, because consideration of efficiency gains throughout that process line may provide the greatest available GHG reductions and BACT requires consideration of production processes that can achieve emission reductions. (This is consistent with the "production line" level of analysis described earlier.)

(3) *Modification of unit at an existing facility*

(i) Some Work Group members assert that consideration of EEPTs in the BACT analysis must be limited to the emissions unit being modified. (This is consistent with the "equipment" level of analysis described earlier.)
(ii) Other Work Group members assert that, where a unit is being modified, the BACT analysis should consider possible efficiency gains available from both the emissions unit and the related non-emitting equipment, as this may enable the greatest GHG reductions. (This is consistent with the "production line" level of analysis described earlier.)

b. Is the appropriate level of analysis the same for all industries?

(1) Some Work Group members expressed the view that the same regulatory process should be used for all industries, and that the level of analysis should vary only depending on the nature and scope of the project.

(2) Some other Work Group members suggested that the level of analysis may also vary depending on the factual context of a particular industry, and that permitting agencies may be the appropriate entity to determine the level of analysis.

(3) Another Work Group member noted some GHG regulatory systems in other countries have established a boundary of analysis for each category of source while allowing a particular applicant to propose a different boundary when doing so leads to clear GHG reduction benefits.

c. To the extent discretion exists regarding level of analysis, what might be the implications of a narrow or broad level of analysis?

(1) *Emission Reductions*
(i) A broader analysis may reveal more EEPT opportunities for consideration to lower overall emissions.

(ii) Potential permit applicants may seek to avoid some projects triggering BACT as a result of potentially greater costs and complexity of permit reviews, as discussed in (2) below.

(iii) The level of review used can influence the inclusion in the BACT process of some systemic improvements that impact multiple pieces of equipment or processes, such as opportunities to use waste energy, or water efficiency improvements.

(iv) A broader level of analysis may result in publication of information about efficiency gains that may enable other facilities to benefit from the same types of efficiency gains.

(2) *Permit Processing and possible challenges and appeals*

(i) If the boundaries of an analysis beyond the emissions unit being changed are not clear, establishing when a permit application is complete (starting the time period for the permitting authority to process the application) may be more difficult.

(ii) Use of broader levels of analysis may create greater challenges for permit staff not yet familiar with efficiency gains available from non-emitting equipment, if non-emitting units are considered. Some members assert that only emitting units may be considered. .

(iii) Use of a broader level of analysis may require more time and expense due to more extensive analysis required, and increased scope of issues for negotiation and public response.

(iv) Because there may be more public support for use of a broader analysis, a permit using such analysis may be less likely to be challenged.

(v) If a broader analysis is used, there may be litigation or disputes between permitting staff and applicants over how broad the analysis should be and the scope of EEPTs that should be evaluated for such an analysis, particularly at complex facilities.

(vi) A company that wants to begin construction quickly may choose a broader level of analysis if the company believes such an approach would expedite permit review or forestall a challenge.

(vii) Applicants may be concerned that agreeing to a broader analysis for one permit will be construed as conceding such an analysis is required for all future permits and thus may be reluctant to do so.

C. General Observations about BACT and EEPTs

1. *Existing energy efficiency benchmarks provide suggestions regarding available technologies and processes for reducing GHG emissions* - Benchmarking information is currently available for many industrial sectors and can provide a useful means for identifying EEPTs.

2. Energy efficiency may require careful management.

a. When BACT includes a work practice, oversight and maintenance of equipment may be necessary to achieve and maintain the energy efficiency outcome. Because many energy efficiency gains are realized through careful oversight and maintenance of equipment, some form of energy efficiency management may be helpful or in some cases necessary to realize and maintain the desired efficiency gains.

b. Use of production process controls may lead to improved energy efficiency and greater emissions reductions.

3. Levels of analysis beyond the equipment level are useful where a source seeks to "net out" of PSD applicability.

a. The ability to "net out" of PSD using enforceable, voluntary GHG emissions reductions creates strong incentives to use EEPTs within the facility. The availability of those technologies may influence subsequent BACT determinations in situations where PSD is triggered.
b. For some industrial facilities, many energy efficiency opportunities will reduce in whole or in part use of grid-delivered electricity.
    i. Some Work Group members assert that such efficiency measures could not be used to "net out" of the PSD process.
    ii. Other Work Group members assert that the inability to consider those measures for netting purposes could discourage investment in such efficiency measures.
    iii. If EPA seeks to encourage reductions in the use of grid-delivered power, regulatory changes should be considered. These might include consideration of reductions in demand onsite in a netting analysis, provided provisions to guard against double-counting of emissions reductions are developed.

4. GHG reductions achieved by reducing use of grid-delivered electricity may be challenging to quantify, but EPA provides guidance for doing so.

Some EEPTs will reduce the use of grid-delivered power in addition to or instead of facility-generated power or heat. These types of gains may be particularly important for some industrial facilities. In such instances, it may be difficult to quantify the GHG reductions associated with such efficiency measures or to ensure that those measures are translated into actual reduced GHG emissions. The Work Group notes that EPA has provided guidance on consideration of energy efficiency gains in SIPs, including information on how to estimate emissions reductions from energy efficiency programs and methods to ensure those reductions are enforceable. See EPA Guidance on State Implementation Plan (SIP) Credits for Emissions Reductions from Electric-Sector Energy Efficiency and Renewable Energy Measures, 2004, pgs. 19-28, 29-33, available at http://www.epa.gov/ttncaaa1/t1/memoranda/ereseerem_gd.pdf

III. Encouraging Inherently Efficient and Lower Emitting Processes and Practices for GHGs

In her letter to the GHG BACT Work Group, Assistant Administrator Gina McCarthy also asked the GHG BACT Work Group to consider:

> How can development and permitting of innovative emissions reduction measures, including the promotion of inherently efficient and lower emitting processes and practices for GHGs, be encouraged? How can the Innovative Control Technology waiver be used or changed to better promote technology development and application?

Most of the Work Group's effort was spent focusing on the ICT waiver which exists in the current PSD program regulations. The Work Group's exploration of the history and experience with the waiver, however, resulted in recommendations for EPA actions that go beyond the waiver itself, as set out below.

As part of its inquiry, the Work Group discussed whether the existing ICT waiver can and should be used or changed to better promote the deployment of innovative techniques and technologies for GHG controls. We asked EPA and the states for background information on how the existing BACT waiver provisions, found at 40 C.F.R §§ 52.21(b)(19), 52.21(v), 51.166(b)(19), and 51.166(s), have been used, and for information about comments received when the Agency last considered revisions to the ICT waiver provisions in the 1996 New Source Review revisions proposal. This memorandum summarizes relevant background material presented and discussed on a series of conference calls and meetings during June and July 2010 and some resulting recommendations from the Work Group.

We note that the Work Group had limited time and therefore was not able to discuss other options for encouraging the development and permitting of innovative emissions reduction measures beyond the use of the ICT waiver. Nonetheless, the Work Group notes that the ICT waiver example provides insight into how EPA could encourage innovation in the regulatory context, beyond the details of the waiver, by working with permit-issuing authorities and applicants who seek the case-by-case flexibility to support moving promising new technologies into general use. In addition, voluntary programs, such as EPA's Industrial Energy Star program, may provide a useful mechanism for developing both experience with and a market for inherently efficient and lower emitting processes and practices for GHGs and other pollutants. While voluntary programs are designed to emphasize projects with a definable and demonstrated payoff and thus may not encourage all types of technologies necessary to reduce GHG emissions, these programs provide an important role in technology development and EPA should continue to invest in these areas.

A. Background.

1. Statutory Authority for the Waiver.

The Clean Air Act includes express authority for the Administrator to grant a waiver from the otherwise applicable New Source Performance Standards (NSPS), to "encourage the use of an innovative technological system or systems of continuous emission reduction," 42 U.S.C. §7411(j)(1)(A), that are not "adequately demonstrated," and that have a "substantial likelihood" (considering any previous failures to operate effectively or to meet NSPS) of achieving "*greater continuous emission reduction* than that required to be achieved under the standards of performance which would otherwise apply, or achieve *at least an equivalent reduction*, at lower cost in terms of energy, economic, or nonair environmental impact…." *Id.* § 7411(j)(1)(A)(i) & (ii). The waiver applies to the portion of the source on which the innovative system is used. *Id.* § 7411(j)(1)(F).

Although the statute uses the term "waiver," the ICT provisions do not offer a complete waiver of the requirement to meet the standard, but rather a temporal waiver, providing additional time for an owner or operator to meet the standard where an innovative system is utilized. The source is allowed an extended period of time – up to 7 years after the waiver is granted, or 4 years after source commences operation, whichever is earlier, *Id.* § 7411(j)(1)(E) – to bring the new technology into compliance with the required performance level. In addition, if the system fails to perform as expected, the statute makes available an extension of the waiver for "such minimum period as necessary to comply" with the otherwise applicable NSPS, and extending up to 3 years. *Id.* § 7411(j)(2).

The Administrator may grant such waivers with the consent of the relevant State Governor,[5] where the owner/operator of the proposed system demonstrates "that the proposed system will not cause or contribute to unreasonable risk to public health, welfare, or safety in its operation, function, or malfunction" (considering effects on other pollutants and methods for reducing risk to public health, among other factors listed in the statute). *Id.* §7411(j)(1)(A)(iii) & final paragraph. And, the Administrator is authorized to set permit terms and conditions as necessary to assure that emissions from the source will not prevent attainment or maintenance of any NAAQS and the proper functioning of the system. *Id.* §7411(j)(1)(B).

The Administrator also can determine the number of waivers that may be granted overall to a particular system of continuous emission reduction, which number "shall not exceed such number as the Administrator finds necessary" to ascertain whether the proposed system will operate effectively, and satisfy the other criteria of § 7411(j)(1)(A)(ii) and (iii). *Id.* §7411(j)(1)(C).

[5] The Governor as a general rule may delegate this authority to consent to the relevant person at the state permit-issuing authority.

2. Regulatory Provisions – the PSD BACT Waiver.

While there is no express authority for an equivalent BACT waiver in the Clean Air Act's PSD provisions, waiver provisions derived from the Clean Air Act §111(j) authority have been included in the PSD regulations since 1980. *See* 61 Fed. Reg. 38,249, 38,278 (July 23, 1996); *see also* 40 C.F.R. §§ 52.21(v), 51.166(s) (current regulatory language describing the waiver) and §§ 52.21(b)(19), 51.166(b)(19)(defining "innovative control technology"). According to EPA, the PSD BACT waiver originated in concerns that a source would be able to get a §111(j) waiver but then would still be subject to BACT, a situation that would discourage technology innovation. 61 Fed. Reg. at 38,278 (citing 45 Fed. Reg. 52,676 (August 7, 1980)). The regulatory provisions generally track the statutory authority for the section 111 waiver.

In the 1990 Draft NSR Workshop Manual's BACT section, EPA states: that "as a practical matter, if a waiver has been granted to a similar source for the same technology, granting of additional waivers to similar sources is highly unlikely since the subsequent applicants are no longer 'innovative'." NSR Draft Workshop Manual at B.13.

3. Experience with the BACT Waiver Provisions to Date.

It is generally agreed by EPA, and by the Work Group members, that the ICT waiver has only rarely ever been relied on in permitting new or modified sources since it was first promulgated in 1980. There is only one readily available EPA formal decision involving the waiver, and that is contained in a 1991 memorandum from the then-Chief of EPA's Permits Program Branch to the then-Chief of EPA's Air Compliance Branch, referred to here as the "*Kamine* Memo." In addition, Work Group member Bill O'Sullivan described his experience in New Jersey, in the early 1990s, in which more flexible permitting resulted in the transfer of a NOx control technology that was then more commonly used in Europe, to an application in the US, where it had not previously been relied upon. These two examples are discussed below.

***Example 1 - The Kamine Memo*.** In the early 1990s, the Kamine Development Corporation (KDC) requested an ICT waiver to apply NOx controls which were at that time undemonstrated, on three similar cogeneration facilities in New York. EPA issued a memorandum decision granting the waiver, and addressing three issues:

1. Whether the waiver was applicable, given the degree to which the technology was 'innovative';
2. Whether the waiver should be granted, in light of EPA's general policy not to grant a waiver for the same technology more than one time; and
3. What specific permit conditions should apply.

KDC sought to control NOx emissions with dry low combustion technology, rather than the then-conventional selective catalytic reduction (SCR) technology. KDC planned to install gas turbines similar to a model that included a guaranteed NOx emission limit of 9 ppm. Typically, a 9 ppm limit was only achievable with SCR. Because the turbines using

dry low combustion technology had not been demonstrated, but were capable of achieving similar NOx reductions at a lower economic cost, the technology qualified for a waiver.

The *Kamine* Memo describes EPA's policy position expressed in the memorandum that it would approve only a limited number of ICT waivers for a specific technology application, because after that, the technology is no longer "innovative." Here, EPA was willing to grant the waiver for three separate but similar applications of the same control technology only where the same owner controlled all three facilities, the same agency would permit each facility, and all three would be constructed simultaneously.

The statements in the *Kamine* Memo therefore represent a very limited view of the availability of the waiver provision for a given technology and application, appearing to narrow even further its availability as compared with the already limited statements about availability found in the 1990 Draft NSR Workshop Manual.

Example 2 - New Jersey/Logan Generating. Also, in the early 1990's, the New Jersey Department of Environmental Protection (NJ DEP) incorporated into an air permit a flexible emissions standard including a range of emissions limits, with the lower end of the range to be met at a minimum and the final limit determined at the end of a trial period for the technology required by the permit in order to facilitate the introduction of new NOx emission control technology. The agency collaborated with project developers at the coal-fired Logan Generating Plant to control NOx emissions with SCR. At that time, SCR had not been used on coal-fired EGUs in the United States but had been widely applied in Germany. NJ DEP believes that as a result of the agency's technology deployment strategy, SCR now plays a prominent role in controlling NOx emissions, not only at this particular New Jersey coal plant, but also at many other coal plants in the United States.

By contrast with *Kamine*, NJDEP worked within its existing authority to encourage technology transfer as part of the BACT/LAER standard setting. Specifically, the agency required the consideration of SCR as part of the Logan plant's BACT/LAER evaluation, and then worked with the applicant to structure the emissions standards contained in the air permit to provide the flexibility for the owner/operator to adopt the new technology without fear of violating emissions standards if it did not perform as well as expected. The agency coupled the BACT requirement with a range of permissible emission levels for a specified trial period. The final limit included a compliance margin. The project was a success – the SCR technology performed better than LNB and SNCR which were the bases of the upper end of the range specified in the permit. The permit flexibility opened the door to financing for the new technology because it removed the risk that emissions would violate the plant's air permit if the technology did not perform as well as expected.

Based on the technology's success, NJDEP adopted tighter NOx emissions standards and now requires SCR or its equivalent on all coal-fired power plants. Today, SCR is widely used andhas served as a basis for BACT for new coal-fired power plants

Proposed Changes to ICT Waiver in the 1996 NSR Reform Package. EPA, recognizing that its 1980 vintage ICT regulations had not been used to promote innovative control technologies, in 1996 proposed (but did not finalize) revisions to the waiver regulation to "make the innovative technology alternative simpler and more attractive in PSD areas … [and] to facilitate the use of innovative or undemonstrated pollution control, prevention, or reduction technologies in NSR permitting." 61 Fed. Reg. 38,249, 38,278 (July 23, 1996).

> As part of the process for developing of the proposed ICT waiver changes, The CAAAC's NSR Reform Subcommittee and the EPA recognized the risks associated with undertaking innovative projects while also recognizing the potential benefits to all stakeholders of a well designed and frequently used waiver that leads to greater use of previously undemonstrated control strategies.
>
> …
>
> [The] Subcommittee examined the reasons for the ICT waiver's limited usage and developed three possible outcomes, other than performance as expected, for the installation of undemonstrated control technology- that the technology performs better than expected; that there is a "marginal" failure; or that there is a "gross failure." The Subcommittee recommended options to reward the source for incurring the risk of failure, procedures to be taken by the permitting agency in case of failure, and certain air quality safeguards. *Id.*

Specifically, the revised waiver provisions stated that permits must contain the reference emission control performance objective of the (proposed newly named) "undemonstrated control technology or application" (UT/A) and the otherwise applicable BACT or LAER standard. EPA proposed for the revised waiver to be available for a period running 2 years from startup or 5 years from permit issuance. The CAAAC had recommended that the statutory maximum 4 and 7 year periods be authorized where needed. In addition, EPA proposed a mechanism to address what happens if an undemonstrated technology is ultimately unable to achieve the BACT limit because the technology failed to perform as expected. This was proposed to help mitigate the risks to the applicant of trying an innovative method of achieving BACT. The proposal would have required a permit to define and include emission limits for two modes: "Marginal Failure" and "Gross Failure." Gross failure would have required either the replacement of the UT/A or a retrofit, on an expeditious schedule, such that the source achieves BACT or LAER within 18 months.

Under the proposal, a UT/A based permit would include: (1) identification of potential failure modes, (2) projections of corresponding emissions increases expected, (3) corresponding emission increases as marginal or gross failures, and (4) identification

of potential contingency measures, short- and long-term, to reduce or mitigate increases in event of worse-than-expected emissions during the term of the UT/A waiver.

In addition, CAAAC had recommended that an applicant be allowed to use, bank, or trade the portion of emission offsets of any *nonattainment* pollutant that becomes surplus when the UT/A achieves greater emission reductions than originally anticipated; and among other things, to limit the benefit accruing to the UT/A source to protection from enforcement of the initial, (more stringent) UT/A-based BACT emission limit during the period of the waiver.

EPA staff made available to the Work Group summaries of the comments received by the Agency on its 1996 proposal. The comments received by the Agency were generally supportive of changing the ICT/undemonstrated technology waiver. Some commenters supported the CAAAC recommended period for waiver availability (up to the 4-7 years authorized by the statute), over the EPA proposal to shorten the duration to 2-4 years; others thought the permit-issuing authority should have discretion over waiver length. Commenters generally supported the 'Marginal' and 'Gross Failure' concept, although concerns were expressed about including mandatory definitions of such scenarios in the permit at the outset, and other commenters wanted to ensure that these concepts would not be abused.

B. Summary of Work Group Discussions.

The Work Group discussed the background presented above, presented in the attached Power Point developed by a subgroup of the Work Group, during a series of phone conversations and face-to-face meetings.

It was generally agreed that the ICT waiver provision, as it is currently written, has failed to provide incentives to permit applicants to apply innovative, new technologies for pollution control as part of the PSD permitting process, and, without some change, is unlikely to provide the incentive or encouragement of innovative control technologies for GHGs. Three general categories of problems with the current waiver were identified –

1. The very limited availability of the waiver for a given technology and application under current EPA policy,
2. The time frame within which the owner/operator has to meet the BACT limit under any waiver, and
3. The degree of risk borne by the applicant relying on a new or innovative technology to achieve an emissions limit, should the technology fail and an entirely different control technology be required.

The New Jersey experience, which took place outside the terms of a formalized ICT waiver, points out the need for cooperation between the applicant and the permit-issuing authority, so that not only is there the willingness to take risk on the part of the

applicant, but also flexibility on the part of the permit-issuing authority in order to move a promising technology into wide market acceptability.

The *Kamine* example describes the problem with EPA's current policy under which only one use of each specific "innovative technology" is eligible for the waiver. Moving new or innovative technologies into market demonstration can require a number of applications in various settings. To severely limit the availability of the waiver does not provide incentive for its use. In fact, rather than providing encouragement to rely on new and innovative technologies, EPA's current waiver policy actually may discourage applicants from seeking to rely on them, and permit-issuing authorities from suggesting them.

Comments on the 1996 proposal and Work Group discussion of it pointed out that too much risk of trying new technology now is borne by the applicant – the remedy for "failure" of the innovative technology is to get to "otherwise BACT" by the waiver deadline – which may require ripping out control technology and replacing it on a relatively short timeframe. Work Group stakeholders asserted this approach was too prescriptive to encourage an applicant to take the risk inherent in advancing completely new techniques or even technologies that are known but not yet mainstreamed.

Work Group members asserted that to be of any use in the GHG context, an ICT waiver should build in flexibility in meeting GHG BACT to the maximum extent authorized by the statute so that the risks are better shared by the applicant and the permit authority than under the current waiver. Additionally, it was generally agreed that the "one time only" nature of the current waiver policy has been implemented adds an unnecessary barrier, as the statute authorizes more flexibility. Making the waiver available to particular uses of technology during the period between when they are truly new and innovative and the point at which they are market-driven and no longer "innovative" or "new" may increase the likelihood that applicants use the waiver to achieve greater reductions than they would without it.

There was general agreement that the full length of time allowed for in the statute should be available for ICT waivers for new, innovative technologies, as needed on a case-by-case basis, and that EPA's 1996 proposal to shorten the waiver period would not be favored for a waiver for GHG technologies in many instances.

The Work Group's discussion also addressed whether the waiver should be available only for technologies that may achieve significant additional reductions beyond what might be achieved under a BACT case-by-case evaluation ("stepwise beyond otherwise BACT"). Some members of the Work Group represent State permitting authorities noted their reluctance at this point to consider energy efficiency technologies that are already in use as "innovative" enough to qualify for a waiver, while others expressed the view that they could make such assessments on a case-by-case basis. Others pointed out that to the extent it might be true for CO_2, for other pollutants such a limitation could be overly burdensome. They pointed out that even for CO_2 there are many industries where innovative efficiency options may be available but not tried if

there is no waiver. This might be particularly true in instances where carbon capture and sequestration (CCS) is not an option which is likely to occur in mainstream manufacturing settings. These members pointed out that the decision on innovative efficiency techniques could be evaluated by the permitting authority during the waiver process and should not be precluded generally.

Utility industry representatives noted that for expensive control options, such as CCS, a waiver will never be the only incentive needed to move them forward. In addition, other factors, such as the availability of Federal or State subsidies, have to be in play as well. And utility companies in regulated states must be able to show the investment in the technologies is prudent to support rate recovery.

There was a discussion about what industry needs in order to move new innovation to the mainstream – so that it is market-driven and no longer needs either the subsidy or the waiver. The question about how long/how many applications might be needed to get to that point will vary by pollutant, by technology, and by industry.

Several members of the Work Group described advantages that EPA has on this issue generally, in that there is a comment record (albeit focused on criteria pollutants since GHG regulation under PSD was not then at issue) on the 1996 proposed revisions to the ICT waiver, and on which EPA might be able to rely in issuing a supplemental proposal and finalizing some new language. The point was made that the 1996 proposal's terminology – including the use of the word "undemonstrated" and concepts about "gross" and "marginal" failure, perhaps implied a greater level of risk or harm than were really at issue. Some members preferred the use of the words "new" or "innovative" to describe techniques and technologies for which the waiver would be available. And with respect to the use of the terms "marginal or gross failure" – some members of the Work Group expressed strong disagreement with these terms because they imply the likelihood that technologies will fail significantly when the hope and expectation of the permitting authorities and applicants is generally that they will work. They preferred instead that the permitting authority have the flexibility to set a range of limits on a case-by-case basis to be met by the source employing the waiver provision. It was pointed out, though, that these terms may have been used in light of constraints permitting authorities perceived regarding their authority to express BACT as a range.

There was also discussion that the lack of history of GHG BACT determinations and of an NSPS for GHGs makes it difficult to estimate the environmental "risk" that may be associated with the concept of future waivers. The question, "What will be waived?" does not have a current answer. Therefore, it may be that innovative technologies could qualify as BACT, with no need for a waiver (especially if the source is employing energy efficient technologies as a part of the new or modified source). Should high cost technologies become demonstrated and accepted as BACT, incentives for developing technologies that can achieve comparable reductions for lower cost will be increased. The ICT waiver process could then be more significant.

IV. Recommendations

1. EPA should provide guidance based on the framework presented here about how to incorporate EEPTs into the top-down BACT process. ("Guidance" refers to the plain meaning of the term and is not intended to refer to a legal process or form.)

2. EPA should update the Office of Research and Development GHG mitigation database to incorporate information on EEPTs including information on relevant benchmarks.

3. EPA should encourage use of innovative control technologies for GHGs emitted by stationary industrial sources, consistent with the Clean Air Act provisions authorizing waivers for innovative technological systems of continuous emission reduction. The Work Group's review of experience to date with the existing BACT ICT waiver showed that the existing ICT regulatory provisions have failed to promote use of innovative technologies for pollution control. Although reliance on an ICT waiver will be expected to be the exception, rather than the rule, in how BACT limits are issued, the Work Group's discussion of this issue illustrates that it has not been used at all and that if revised, the waiver could serve its intended purpose of promoting innovative technological systems for GHGs. Furthermore, EPA can and should recognize the opportunity presented by the existence of the record from previous efforts to revise the waiver provisions to make them more attractive, and should take further comment on and, by the date GHG BACT reviews begin, finalize language revising the existing ICT waiver. In taking these steps,
    a. EPA should disavow its policy set out in the *Kamine* Memorandum (and, to the extent EPA believes it expresses it, the 1990 Draft NSR Workshop Manual) that an ICT waiver is available for only one application of a particular technological system of continuous emission reduction. EPA should instead exercise its authority under the statute, 42 U.S.C. §§ 7411 (j)(1)(C) and 7479(3), to allow permitting authorities to issue as many waivers as appropriate, in the case-specific circumstances that arise, to allow such innovative technologies for GHGs to be brought to market as soon as possible.
    b. EPA should formally and publicly state its views about the availability of the waiver in light of the length of time that a particular technology has been successfully deployed and the variation between units using a particular technology.
    c. EPA should reevaluate the appropriate maximum waiver length, in terms of time from permit issuance and time from startup, consistent with the statutory maximum period of 7 years from permit issuance or 4 years after the date the source or portion thereof commences operation, whichever is earlier. We encourage EPA to exercise its discretion to authorize permitting authorities to use up to the full time period authorized in the

statute to phase in BACT based on an innovative control technology, if needed, on a case-by-case basis.

d. EPA should support States in their efforts to promote new and innovative technologies or techniques for GHG reductions by expressly allowing permits to specify a range of emissions limits that constitute BACT for that particular application of the new or innovative technology, including express provisions for determining how a final BACT limit will be determined within the range after a sufficient period of experience.

4. EPA should commit, going forward, to working expeditiously with permitting authorities that wish to issue permits including BACT limits based on new or innovative technologies (using the waiver provisions as needed), and take steps to foster information sharing about cases in which permitting authorities use the flexibility under existing law to encourage new and innovative technologies.

Appendix 1: Letter from Gina McCarthy to Mark MacLeod and Eric Svenson

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR - 9 2010

OFFICE OF
AIR AND RADIATION

Mr. Eric Svenson
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Dear Mr. Svenson:

Thank you for the February 3, 2010 Interim Phase I Report on Issues related to Best Available Control Technology (BACT) for greenhouse gases (GHG). In addition to voicing my appreciation for your work on the report, I am also responding to your request for input on which issues to undertake for the Climate Change Workgroup (CCWG) in the follow-on effort (Phase II) that will be getting underway shortly.

Let me first express my gratitude for your hard work and leadership. Developing the Phase I Report was no small task, but with your combined leadership and the dedication of many others on the CCWG, you managed to forge through a contentious set of issues and effectively build consensus. You also clearly articulated areas of non-consensus while producing a highly valued set of recommendations. Please pass along my sincere thanks to all of the members of the CCWG.

In response to the Phase I recommendations, we are actively working with states on technical information and data needs. This includes work on the U.S. Environmental Protection Agency's (EPA) Office of Research and Development GHG Mitigation Strategies Database, Reasonably Available Control Technology/BACT /Lowest Achievable Emission Rate Clearinghouse enhancements, and developing sector based GHG control measures white papers. We are also gearing up to respond to your questions on BACT policy issues for GHGs. This will take considerable effort, but I understand how important it is for EPA to flesh out these issues and provide useful and timely policy guidance to pave the way for a smooth transition to permitting of GHGs. As we continue to develop our technical and policy guidance in response to the Phase I effort, I will keep you and the Clean Air Act Advisory Committee (CAAAC) informed through updates at upcoming CAAAC meetings.

I appreciate the thorough, informative and forward-looking ideas presented in the eight white papers that the CCWG provided, and I am very excited about this second phase of discussions. It is clear that there already has been a lot of creative thought on each of them. After reviewing the list of candidate Phase II issues with my staff, I have narrowed them to two specific issues on which we are seeking your input:

1. How can the BACT process be used to encourage the development of energy efficient processes and technologies?

2. How can the development and permitting of innovative emissions reduction measures, including the promotion of inherently efficient and lower emitting processes and practices for GHGs, be encouraged? How can the Innovative Control Technology waiver be used or changed to better promote technology development and application?

There is some overlap between these issues and you should feel free to combine them into one paper. As you may know from the Administrator's response dated February 22, 2010 to Senator Rockefeller and other Senators, we are considering aspects of some of the issues raised by the CCWG as part of our GHG rulemaking proposals. In other cases, we believe the issues being raised will be handled in the context of our response to the Phase I report (e.g., the clean fuels issue). Accordingly, I would like the CCWG's input and recommendations on these two specific areas.

I realize that you are aware of the time constraints as we move forward. Given the recent signature of the Light Duty Vehicle Rule, it would be useful to receive the feedback from the Phase II effort in the near term. At the same time, I want to provide a reasonable deadline which will allow for meaningful deliberations by the CCWG on these important issues. We would hope that you could provide a report to us at the next CAAAC meeting that is scheduled for May 26th and 27th. We understand that the above issues are challenging, but we hope that it is a manageable task for the CCWG to provide feedback within this timeframe. Also, we understand that providing a report like the one provided through Phase I is resource intensive and may not be realistic. If that is the case, it would be equally useful for the work group to provide vetted white paper(s) to enable us to consider your recommendations and perspectives on the Phase II areas.

The transition of EPA personnel for Phase II will be as follows: Peter Tsirigotis will hand control over to Bill Harnett, the Associate Director for Program Integration and International Air Quality Issues. Bill has selected Raj Rao, the New Source Review Group Leader, as his key facilitator similar to the role David Solomon performed for Phase I. As before, Pat Childers will remain involved in each of the meetings to ensure that Federal Advisory Committee Act procedures are maintained. Bill and Raj will work with you to plan out the details, including scope of the issues, the number of meetings, and the nature of the final work products. Bill can be reached at (919) 541-4979 and Raj can be reached at (919) 541-5344.

Again, thank you for the tremendous effort that you have already put forth. I look forward to seeing the recommendations from Phase II.

Sincerely,

Gina McCarthy
Assistant Administrator

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Appendix 3: List of Benchmark Sources

Benchmark sources

EPA, states, and permitting authorities may wish to consider energy efficiency benchmarks available from a number of sources, including:

1. EPA Energy Star Industrial Energy Management Information Center: http://www.energystar.gov/index.cfm?c=industry.bus_industry_info_center

2. DOE Industrial Technologies Program, http://www1.eere.energy.gov/industry/

3. Lawrence Berkeley National Laboratory Industrial Energy Analysis Program: http://industrial-energy.lbl.gov/

4. European Union Energy Efficiency Benchmarks, http://ec.europa.eu/environment/climat/emission/benchmarking_en.htm