# Climate Change and the Federal Environmental Review Process: Assessing existing Federal Environmental Impact Statements for conformity with proposed guidance regarding the inclusion of climate change into the environmental review process

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## Abstract

In recent years, some state and local governments have moved towards incorporating climate change and greenhouse gas emissions into their environmental review processes. At the federal level, the Council on Environmental Quality (CEQ), the body that oversees the implementation of the National Environmental Policy Act (NEPA), produced draft guidance in 2010 that laid out a framework for federal agencies to include climate change in the NEPA environmental review procedures. This paper examines four EISs that included climate change information prior to the release of CEQ's draft guidance. By examining the methods employed by the EISs and comparing them to the proposed guidance, it will illustrate the successes and shortcomings of the draft guidance, and it will give a glimpse into the potential style of future EISs.

## I. National Environmental Policy Act

The National Environmental Policy Act of 1970 (NEPA) is an important federal environmental law in the United States. Its passage paved the way for stronger oversight of environmental issues during the planning stages, and it continues to be a tool that allows for public input and environmental evaluation of proposed projects. NEPA provided a framework through which governmental agencies could evaluate and assess projects and plans for their potential environmental impacts before substantive and possibly irreversible actions were taken.

The opening declaration of intent from the National Environmental Policy Act quickly illustrates the ambitions of the law:

> The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment…declares that it is the continuing policy of the Federal Government…to use all practicable means and measures…to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans. (42 U.S.C. § 4331)

Reconciling man and nature in "productive harmony" is certainly subjective, and it would never be possible to come to a unanimous agreement about what that means, but NEPA ensured that environmental impacts would at least be discussed in the planning stages for federal projects and actions.

As part of the Act, a new executive-branch entity was created to oversee and implement the new law. The Council on Environmental Quality (CEQ) was established and is composed of three presidential appointees who advise the President on environmental matters, propose new regulations for NEPA and review the NEPA process (42 U.S.C. § 4342). In addition, CEQ issues an annual report to Congress on the current condition of the nation's environment, ongoing

environmental trends, the availability of natural resources, a review of governmental programs related to the environment, and proposals and legislation to improve existing programs (42 U.S.C. § 4344).

NEPA statutory language requires that federal agencies go through the environmental review process for proposed legislation and other "major Federal actions significantly affecting the quality of the human environment" (42 U.S.C. 4332). CEQ regulations have clarified this to include agency policies, programs, plans, and projects (40 C.F.R. Part 1508.18). CEQ also exercises its power to create regulations that dictate the way in which agencies complete the environmental review process. Using the federal rulemaking process, CEQ can tweak NEPA protocols as environmental challenges change or emerge over time. In the statutory language, the CEQ is charged with developing and recommending policies that "…foster and promote the improvement of environmental quality to meet conservation, social, economic, health and other requirements and goals of the Nation" (42 U.S.C. § 4344).

There are different levels of environmental review under NEPA, but this paper is focused on Environmental Impact Statements (EIS), the most thorough kind of review. Environmental Assessments (EAs) are the basic form of environmental review. Unless a project or project-type is specifically exempted from the environmental review process (due to agency policy or an act of Congress), federal actions require the completion of an EA, which includes "…brief discussions of the need for the proposal" and "Briefly provide[s] sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact" (40 C.F.R. § 1508.9). As indicated in the NEPA regulations, the result of an EA can result in one of two outcomes: If the environmental impacts are deemed to be not significant, the agency issues a Finding of No significant Impact, which is a document that

summarizes the reasons why the agency found there to be no significant environmental impacts (CEQ 2007, pg 12). The other outcome is that the environmental impacts are deemed to be "significant." If that is the case, the agency begins to prepare a more thorough review, which is the Environmental Impact Statement.

Once an agency begins the EIS process, the public is involved in the scoping process. During scoping, the agency solicits comments and based on these, establishes the types of issues that will be addressed in the EIS document. The agency then prepares a draft EIS, presents it to the public, and receives comments. Comments can come from any member of the public and other agencies will also comment on their respective areas of expertise. The agency that prepares the EIS must acknowledge the comments it receives by specifically replying to those that are relevant, then makes adjustments to the draft EIS and prepares the final EIS. After the final EIS is made public, the responsible agency releases a Record of Decision. (40 C.F.R. § 1500 – 1506). This document identifies the preferred alternative and addresses how environmentally-sensitive issues will be handled. If others object, they may take the agency to court to settle the matter. This process, or a variation of it, occurs for major agency actions and policy decisions.

As environmental challenges arise, NEPA can be adapted through CEQ guidelines, agency guidelines, and federal regulations, such that it continues to balance the "productive harmony" between human-activity and the environment. For instance, there has been discussion about including consideration of climate change and greenhouse gases into the federal environmental review process. Doing so could significantly alter the way that environmental review is performed in the future. As CEQ begins to work on this major policy change, it is helpful to understand the ways in which federal environmental impact statements (EISs) may be affected.

## II. Climate change and the environmental review process

The current CEQ's efforts to adopt policies relating to climate change are not a new concept. During the Reagan Administration the idea was considered (Sutley letter, 2009), and during the Clinton Administration, another attempt was made. The 1997 attempt included draft guidance from CEQ, which took steps to create guidelines regarding the inclusion of greenhouse gases into the environmental review process. In a memo dated October 8, 1997, CEQ presented draft guidance to agencies and solicited comments on the proposal; however, the plan ultimately did not proceed, and the CEQ left the issue alone for over a decade.

The 1997 CEQ draft guidance provides a framework with few detailed instructions for agencies. Of the eight-page memo, four pages are spent describing and explaining the science of climate change and explaining why it should be included in the NEPA process. The 1997 draft guidance establishes two ways in which climate change should be evaluated for federal actions:

> (1) The potential for federal actions to influence global climatic change (e.g., increased emissions or sinks of greenhouse gases) and (2) the potential for global climatic change to affect federal actions (e.g., feasibility of coastal projects in light of projected sea level rise). (CEQ, 1997)

The 1997 draft guidance also encourages agencies to focus their analysis on larger programs and policy decisions, rather than individual projects: "Analysis of the impacts of such emissions or sinks at the project level, however, would not provide meaningful information in most instances. Efforts would be better spent in assessing federal programs [sic] which may affect emissions or sinks of these gases" (CEQ, 1997).

The guidance document, however, does not prescribe methods for analyzing greenhouse gas emissions. There is no mention of quantitative or qualitative analysis in the 1997 draft

guidance; the document states that agencies "must analyze," but provides no examples or definitions:

> Thus, federal agencies must analyze the extent to which both their proposed and ongoing programs or other activities might influence such emissions and sinks, thereby contributing to, or reducing, the problems of global warming. (CEQ, 1997)

Individual agencies have the authority to expand upon the CEQ's guidance and create guidelines specific to their agency, so they would have the authority to expand and clarify such instructions.

As mentioned, the 1997 draft guidance did not progress beyond the draft stage, and the issue was not resurrected until the Obama Administration's CEQ released its own draft guidance in early 2010. The CEQ's 2010 draft guidance maintained similar goals as the 1997 draft guidance, but the 2010 version provides more specific instructions. Like the 1997 document, the 2010 draft guidance explains the relevance of climate change to the NEPA process, and it lays out two types of analysis which should be considered:

> (1) The GHG emissions effects of a proposed action and alternative actions; and (2) The relationship of climate change effects to a proposed action or alternative... (CEQ, 2010)

These are fundamentally the same requirements which were established in the 1997 draft guidance. Both documents want agencies to assess the effects of the project on climate change, and the effects of climate change on the proposed project or action. The 2010 draft guidance does go on to create more specific requirements for the disclosure of greenhouse gas emissions:

> Specifically, if a proposed action would be reasonable anticipated to cause direct emissions of 25,000 metric tons or more of $CO_2$-equivalent GHG emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. (CEQ, 2010)

CEQ notes that 25,000 metric tons should not be considered an indicator of whether or not the impact is "significant." As was previously discussed, in the NEPA process, if an environmental impact is deemed to be significant during an Environmental Assessment, then the agency may be

required to complete a full Environmental Impact Statement. The 2010 CEQ draft guidance goes on to mention that projects that emit less than 25,000 metric tons annually may warrant similar analysis, but federal agencies should use their discretion on a case-by-case basis.

In instances where a project will exceed 25,000 metric tons of greenhouse gas emissions per year, or if the scoping process determines that analysis of direct greenhouse gas emissions is warranted, the 2010 draft guidance provides some further clarification:

> In the agency's analysis of direct effects, it would be appropriate to (1) quantify cumulative emissions over the life of the project; (2) discuss measure to reduce GHG emission, including consideration of reasonable alternatives; and (3) qualitatively discuss the link between such GHG emissions and climate change. (CEQ, 2010)

CEQ explains further that "Analysis of emissions sources should take account of all phases and elements of the proposed action over its expected life, subject to reasonable limits based on feasibility and practicality" (CEQ, 2010).

The 2010 CEQ draft guidance also discusses the concepts of direct and indirect emissions, with indirect emissions being the most difficult for which to account. Direct emissions are those that are emitted as a direct result of a project or action (such as emissions from a power plant), while indirect emissions could cover a wide range of secondary emissions (e.g. emissions resulting from employees who drive to work at the power plant). While 25,000 metric tons of CO2 per year was given as a guideline for the quantification and exploration of direct emissions, CEQ does not include a threshold at which indirect emissions should be considered, but rather allows agencies the discretion to determine the appropriate course of action during the NEPA scoping process: "CEQ proposes to advise Federal agencies to consider, in scoping…, whether analysis of the direct and indirect GHG emissions from their proposed actions may provide meaningful information to decision makers and the public" (CEQ, 2010).

In contrast to the 1997 draft guidance, the 2010 CEQ draft guidance offers recommendations about the methods and tools that should be used for evaluating greenhouse gas emissions. Since many tools exist for estimating greenhouse gas emissions, the 2010 CEQ draft directs agencies to refer to three standardized tools and references that should be used when it is "useful and appropriate for the proposed action under NEPA" (CEQ 2010). First, for large projects that would be large emitters of direct emissions (for example, like those that would be expected from a new coal-fired power plant), CEQ recommends using U.S. Environmental Protection Agency-designed calculator that was created for use with the Mandatory Reporting of Greenhouse Gases rule (as promulgated by the EPA) (EPA Applicability Tool, 2011). Other types of direct emissions (referred to as Scope 1 emissions) are advised to use reporting guidance that was issued as part of Executive Order 13514, 2009 (which dealt with expanding and improving environmentally-friendly practices by the executive agencies). Finally, the guidance recommends that other types of emissions use the Department of Energy's Voluntary Reporting of Greenhouse Gases Program technical guidelines, which contains additional tools for estimating greenhouse gas emissions in addition to information regarding the possible emissions reductions resulting from sequestration and other emission-reduction strategies (DOE Voluntary Reporting of GHGs Program, 2011).

The 2010 draft guidance also recommends that certain types of projects be handled differently due to their unique nature. For example, some environmental impact statements deal with broad policy decisions rather than one project or action. These "programmatic" EISs look at a large-scale policy decision. The CEQ draft guidance explains that these situations may require greenhouse gas emissions to be evaluated at the project level, rather than in a programmatic analysis: "Other Federal policies, programs, or plans that cover multiple actions subject to NEPA

– such as actions tiered from programmatic NEPA documents – may more appropriately address GHG emissions at the level of individual projects" (CEQ, 2010). Yet in other situations, such as long-term planning, CEQ says that emission questions may be better addressed at the programmatic level instead of the project-level: "Federal programs that affect emissions or sinks and proposals regarding long range energy, transportation, and resource management programs lend themselves to a programmatic approach" (CEQ, 2010).

Another type of EIS that is specifically addressed in the guidance is land management plans. Agencies that oversee land resources (Bureau of Land Management, National Park Service, Fish and Wildlife Service, Forest Service, etc.) complete EISs that explain how the environmental impacts of the land under their jurisdiction will be managed. These plans deal with dynamic ecosystem conditions that naturally emit and sequester carbon dioxide (much harder to measure compared to emissions from a smokestack). CEQ acknowledges these unique circumstances, and exempts these actions from the proposed guidance while asking for recommendations about how to proceed:

> Land management techniques, including changes in land use or land management strategies, lack any established Federal protocol for assessing their effect on atmospheric carbon release and sequestration at a landscape scale. Therefore, at this time, CEQ seeks public comment on this issue but has not identified any protocol that is useful and appropriate for NEPA analysis… (CEQ, 2010)

The final section of the 2010 draft guidance focuses on the ways agencies should consider greenhouse gases, proper methods for scoping, and best practices. CEQ directs agencies to consider mitigation options and "reasonable alternatives" as part of the NEPA process when assessing greenhouse gas emissions, although no definition of "reasonable" is provided. The considered mitigation measures should also be vetted with regard to their "...permanence, verifiability, enforceability, and additionality" (CEQ, 2010). The document does provide a brief

list of mitigation options that would be advisable. The CEQ recommends the consideration of "...enhanced energy efficiency, lower GHG-emitting technology, renewable energy, planning for carbon capture and sequestration, and capturing or beneficially using fugitive methane emissions" (CEQ, 2010).

Finally, CEQ 2010 draft guidance addresses the ways that agencies should anticipate the impacts of climate change on the given action. The draft guidance recommends that the anticipated consequences of climate change be initially reviewed during the scoping process to determine which impacts should be considered. Among the impacts that the draft guidance acknowledges are "...greater risk of floods, storm surges, or higher temperatures" (CEQ, 2010) and emphasizes the fact that current actions that seem benign could have a much more damaging impact in the future:

> For example, an industrial process may draw cumulatively significant amounts of water from a stream that is dwindling because of decreased snow pack in the mountains or add head to a water body that is exposed to increasing atmospheric temperatures. (CEQ, 2010)

To begin the process of determining which impacts may reasonably be expected to follow from an agency action, the CEQ instructs agencies to "be clear" and identify "reasonably foreseeable" impacts. Agencies should also discuss the "probability or likelihood" of the future climate scenario(s) which they address.

In all, the recommendations from the 2010 draft guidance can be summarized as such:

1. If emissions are greater than 25,000 metric tons per year (or if scoping determines it is relevant) quantify the amount of emissions
    a. Quantify the cumulative emissions from the entire lifespan of project
    b. Discuss indirect emissions from the action

2. Discuss measures to reduce greenhouse gas emissions, including consideration of alternatives

3. Qualitatively discuss the link between greenhouse gas emissions and climate change

4. Discuss the potential for climate change to impact the action or project

## III. Methodology

Some government entities have begun to include climate change considerations in the environmental review process. Many of the early adopters of this procedure have been local governments and state agencies (Slotterback, 2011). A couple states have also adopted state-wide policies that accomplish this as well (Slotterback, 2011). As the federal government moves in that direction, it is helpful to gain a deeper understanding of the type of analysis being discussed by CEQ. Certainly individual agencies will take different approaches to explaining and evaluating climate change impacts as a result of agency actions, but CEQ guidelines will form a baseline foundation upon which those evaluations will be based. This paper will examine CEQ draft guidelines which were released in early 2010 and explain the different demands and suggestions provided by the guidance. Some federal EISs have been done prior to the CEQ's draft guidance, and these EISs included greenhouse gas analysis. These previously completed environmental review documents will be examined to see whether they would be deemed acceptable under the proposed draft guidance, and from that, it will become clearer what sorts of successes may occur in future EISs and what sorts of possible issues may arise if the CEQ draft guidance is adopted.

The CEQ recently released a list of a dozen federal that incorporated climate change considerations into their environmental review documents. This list was released as part of correspondence between CEQ and members of the U.S. Senate who inquired about the CEQ's

efforts to include climate change in the NEPA process (Sutley, 2009). These twelve documents were done without official guidance from CEQ about how to incorporate climate change information, and they were not done under the instruction of any particular agency policies. The impetus for the inclusion of climate change in these particular documents is not explained in all of the documents, but some included the analysis due to issues that arose during the scoping process, while others added sections about climate change and GHGs based on comments received on a draft EIS. Regardless of why the information is included, it can give a glimpse into the way future documents may be prepared if CEQ's 2010 draft guidance (or subsequent guidance) is ever adopted. By exploring these documents, it will give some idea about how future EISs may look, and it will also reveal ways in which the documents are lacking, perhaps exposing common flaws in the ways that agencies are considering climate change. Finally, there may be simple recommendations that could be adopted by the CEQ to improve the quality, consistency, and usefulness of future documents for decision-makers and the public.

This paper will perform a review of four completed EISs to evaluate how well these existing documents align with the proposed CEQ guidance, identify areas that may pose problems for the implementation of the CEQ guidance, and make recommendations about ways to improve the guidance.

In order to provide a sense of the different situations in which EISs must incorporate climate change considerations, it is helpful to examine several different types of EISs. Through recent correspondence, the CEQ released a list of federal EISs which included climate change and greenhouse gas analysis. In response to an inquiry by Senate Republicans about CEQ's actions to include climate change in the NEPA process, Nancy Sutley, chair of the CEQ, provided a list of previously-completed EISs that discussed climate change (Sutley, 2009). The list

included a dozen instances from a variety of federal actions within the past several years (2005-2009). CEQ acknowledged that it was not a comprehensive list, but it was a selection of EISs from recent years. From this list of twelve, there were four very distinct types of project that emerged: Five large energy projects (e.g. a coal gasification plant; refinery etc.); two programmatic analyses (which are broad, large-scale analyses of agency policy proposals); two transportation projects (e.g. highway expansion; bridge construction); and three natural resource management plans (e.g. wildlife and vegetation management plans). Ultimately, to give a sample of each of the distinct sub-groups, one EIS was chosen from each of the four groups.

Professor Carissa Schively Slotterback, of the Humphrey School of Public Affairs at the University of Minnesota (under whom I served as a graduate research assistant and performed much of the background research for this project), developed a template to use for examining completed environmental review documents that incorporated climate change and greenhouse gas analysis (see Appendix A). Using this template, each document was examined in a standardized way to glean information about the project. Each EIS was evaluated for basic background information; the length of its analysis; the style of analysis (qualitative and quantitative); the types of greenhouse gases addressed; the temporal and spatial reach of the analysis; proportion of the analysis which directly pertained to the specific project; methods, tools and models used for GHG emissions estimates; and other criteria. (A completed template for one of the case studies used in this paper can be found in Appendix C for reference.) Each document was assessed using the template criteria, and a template form was filled out with all relevant information from each of the twelve EISs listed by the CEQ.

After completing a template for each of the twelve cases, four cases were selected. The four selected cases were those that had the most text devoted to discussing climate change and

greenhouse gas analysis within their respective sub-group. In this way, the documents with the longest analysis of greenhouse gases and climate change were chosen from each of the four sub-groups (energy, programmatic, transportation, and natural resources). Of the cases that were not chosen, many of them had very short sections on climate change that did not address issues raised in the CEQ draft guidance. In order to get a sense of how the CEQ draft guidance would look in practice, it was important that these chosen cases included enough material to compare against the CEQ guidance.

The following four projects were chosen as the case studies for this paper (category is in parentheses): Gilberton Coal-to-Clean Fuels and Power Project (energy project); Outer Continental Shelf Alternative Energy Development (programmatic EIS); Columbia River Crossing (transportation); and Sequoia & Kings Canyon Management Plan (natural resource management).

The 2010 CEQ draft guidance was then analyzed using another template, also developed by Professor Carissa Schively Slotterback. This template was formulated for the assessment of environmental review policies that included greenhouse gas analysis (see Appendix B). Gathering these data from the 2010 CEQ draft guidance revealed the fundamental requirements and recommendations from CEQ, as discussed previously.

The four selected case studies were then compared to the requirements and recommendations from the 2010 CEQ draft guidance. Comparing the draft guidance to the selected EISs revealed how well the case studies complied with the draft guidance. After comparison, common themes were compiled, which will be examined in the “Discussion” section of this paper.

## IV. Case #1: Gilberton Coal-to-Clean Fuels and Power Project

The first case study was from the energy project sub-group, a "clean coal" demonstration project. The Gilberton Coal-to-Clean Fuels and Power Project planned to convert an existing coal-fired power plant into a coal gasification plant with electricity production, steam production, and liquid hydrocarbon fuels production. According to the EIS, which was completed in October of 2007, the project would be "...the first clean coal power facility in the United States using coal waste gasification as the basis for power, thermal energy, and fuels production" (DOE, 2007).

The Gilberton EIS was examined for its adherence to the requirements and recommendations as laid out in the CEQ draft guidance (see Table 1 for overview):

1. If emissions are greater than 25,000 metric tons per year (or if scoping determines it is relevant) quantify the amount of emissions
    i. Quantify the cumulative emissions from the entire lifespan of project
    ii. Discuss indirect emissions from the action

2. Discuss measures to reduce greenhouse gas emissions, including consideration of alternatives

3. Qualitatively discuss the link between greenhouse gas emissions and climate change

4. Discuss the potential for climate change to impact the action or project

In the summary section of the EIS, greenhouse gases are mentioned as a potential impact of the project, and the document explains that considerable comments were received in response the Draft EIS (DEIS) regarding greenhouse gas emissions. The Final EIS's (FEIS) discussion of greenhouse gases was done in response to comments received on the DEIS (the document uses italicized font to indicate language that was newly added for the FEIS, and almost all the greenhouse gas language is in italics).

The Gilberton case study discusses the greenhouse gas emissions impact of the project in the summary section of the EIS and twice again in later sections (sections 4 and 6). The EIS gives an estimate of anticipated annual emissions of $CO_2$, which are 2,282,000 tons of direct emissions annually from the project. This number is larger than 25,000 metric tons per year threshold established by the CEQ's draft guidance, and the project does quantify its direct emissions. When a project emits more than 25,000 metric tons annually, the CEQ draft guidance requires an estimation of cumulative emissions from the project's entire lifespan. The Gilberton EIS also provides this information. The project has an anticipated lifespan of 50 years, and in Section 5, the EIS estimates that 114,000,000 tons of $CO_2$ will be released over that time period.

The CEQ draft guidance also asks that EISs provide information about indirect emissions from proposed projects, and the Gilberton EIS does provide some information regarding the project's broader impacts. A large component of the proposed facility is its ability to convert coal into liquid fuel as part of its processes. The EIS explains that successful demonstration of the project could lead to an expansion of coal-to-liquid-fuels technology, and this could increase greenhouse gas emissions:

> Because coal has a higher carbon-to-hydrogen ratio than crude oil, production of liquid hydrocarbon fuel from coal generates more excess carbon (released as $CO_2$) than production of the same quantity of liquid fuel from petroleum (DOE 2007, pg 6-5)

The entire lifecycle of coal-derived fuels emits roughly 80 percent more $CO_2$ than traditional petroleum, but this could be reduced to 8 percent if carbon capture and sequestration technology were being used at the Gilberton coal-to-liquid-fuels facility (DOE 2007, pg 6-5 – 6-6). The EIS goes on to estimate what sort of impact a greater usage of coal-derived fuels could have on overall U.S. greenhouse gas emissions:

> ...the Energy Information Administration (2007) has forecast that by 2030 U.S. CTL [coal-to-liquid] production will consume 55,000,000 tons of coal annually...Based on this

> forecast and assuming the CTL fuel cycle generates 80% more greenhouse gas emissions than production and delivery of conventional petroleum-derived fuels...greenhouse gas releases of the U.S. liquid fuel sector [would be] 1.3% higher in the year 2030 than if the same quantity of liquid fuel was produced from petroleum. (DOE 2007, pg 6-6)

Again mentioning carbon sequestration, the EIS estimates that the predicted increase in greenhouse gas emissions due to coal-derived fuels could be kept to 0.1 percent by 2030 if all coal-to-liquid facilities were to use carbon sequestration technology. The EIS provided several additional scenarios regarding future greenhouse gas emissions using different assumptions about the extent to which coal-to-liquid fuels will be used in the future.

The CEQ draft guidance also asks environmental review documents to consider alternatives that could reduce greenhouse gas emissions from the project. Gilberton EIS outlines one possible alternative that would reduce emissions: carbon capture and sequestration. During the discussion of climate change and greenhouse gas emissions, the Gilberton EIS mentions that the project's emissions could be reduced using this technology:

> Underground storage, or geologic sequestration, of $CO_2$ is a promising technology being actively investigated and tested nationally and internationally…During the 50-year duration of commercial operation, a combination of economic incentives and new legal requirements might result in the industrial participant investigating the option to sequester $CO_2$ recovered from the proposed facility. (DOE 2007, pg 5-3)

The document also spends one page discussing the regional bedrock conditions where carbon could be potentially stored, if such technology were ever used at the Gilberton site. No other alternatives are discussed in the EIS.

The next requirement of the CEQ draft guidance is that projects discuss qualitatively the link between greenhouse gas emissions and climate change. In Section 2 of the EIS, there is text that gives some background information about climate change: "Carbon dioxide is a greenhouse gas that is generally regarded by a large body of scientific experts as contributing to global

warming and climate change (IPCC 2001, IPCC 2007)" (DOE 2007, pg 2-18). Section 4 of the EIS also mentions the scientific link between GHGs and climate change:

> International scientific consensus has indicated that the Earth's climate is changing and that human activity is a factor (IPCC 2001). The atmosphere allows a large percentage of incoming solar radiation to pass through to the Earth's surface and be converted to heat energy (infrared radiation) that does not pass back through the atmosphere as easily as the solar radiation passes in. The result is that heat energy is "trapped" near the Earth's surface. (DOE 2007, pg 4-12)

The document goes on to explain that worldwide concentrations of $CO_2$ have increased by 35% since pre-industrial times and that "...$CO_2$ concentrations likely have contributed to a corresponding increase in temperatures in the lower atmosphere" (DOE 2007, pg 4-12). The EIS contains some additional background information, drawn from Intergovernmental Panel on Climate Change reports, which discusses how $CO_2$ emissions become "uniformly mixed throughout" the atmosphere, which means that $CO_2$ effects are not localized where they are emitted.

The final criterion in the CEQ draft guidance involves a discussion of potential climate change impacts on the proposed action or project. In this instance, the Gilberton EIS did not include any such discussion. There was no explanation of how a changing climate might impact the project.

## V. Case #2: Outer Continental Shelf Alternative Energy Programmatic EIS

The second document examined is an example of a programmatic EIS. This type of EIS examines a proposed policy, program, or series of long-range decisions and tries to evaluate the broader impacts of the proposal. This 2007 programmatic EIS looked at the possibility of using the outer continental ocean shelf as a potential location for alternative energy projects. The EIS explained the different technologies (such as off-shore wind energy and energy generated from

tides) that could benefit from being sited on the outer continental shelf (OCS) and then explained the potential environmental impacts of such a decision.

Once again, the CEQ draft guidance requirements are listed below:

1. If emissions are greater than 25,000 metric tons per year (or if scoping determines it is relevant) quantify the amount of emissions
    i. Quantify the cumulative emissions from the entire lifespan of project
    ii. Discuss indirect emissions from the action

2. Discuss measures to reduce greenhouse gas emissions, including consideration of alternatives

3. Qualitatively discuss the link between greenhouse gas emissions and climate change

4. Discuss the potential for climate change to impact the action or project

The CEQ draft guidance acknowledges that programmatic EISs may not always be well-suited for some of these types of analysis since it can be especially difficult to quantify emissions from some large-scale programmatic EISs. Despite the potential issues that may arise with this type of EIS, for consistency, this document will be compared against all of the CEQ draft guidance criteria.

The Outer Continental Shelf Alternative Energy and Alternative Use Programmatic EIS, henceforward referred to as OCS EIS, uses qualitative analysis to assess the impacts of the proposed development of the outer continental shelf with alternative energy projects. The entirety of the discussion of the proposal's greenhouse gas impact is printed here:

> Alternative energy development would result in only very minor greenhouse gas emissions, mostly during the construction and decommissioning phases. These emissions would be from construction barges, transport vessels, and crew boats. Alternative energy development has the potential to provide significant benefits in terms of reducing greenhouse gas emissions from energy consumption. Alternative energy development could be used as part of a strategy to manage carbon emissions by providing energy with very low emissions. If such a strategy includes a cap-and-trade program, a carbon tax, or various incentives for cleaner technology, alternative energy could become more

> competitive and could provide a meaningful contribution to efforts to achieve national carbon emission reduction goals. (MMS 2007, pg 7-43)

The document does not include any quantitative analysis, nor does it include cumulative emissions from the lifespan of the project, and it also does not include a discussion of mitigation alternatives that would reduce greenhouse gas emissions.

The OCS EIS does, however, include background information that discusses the link between greenhouse gas emissions and climate change. Four pages are dedicated to the discussion of greenhouse gases and climate change in the OCS EIS. Of those four pages, one-and-a-half of them is devoted to background information about climate change and greenhouse gases:

> The so-called greenhouse gases, which include $CO_2$ and water vapor, keep the earth's surface warmer than it would be otherwise because they absorb infrared radiation from the earth and, in turn, radiate this energy back down to the surface. While these gases occur naturally in the atmosphere, there has been a rapid increase in concentrations of greenhouse gases in the earth's atmosphere from anthropogenic sources since the start of industrialization, which has caused concerns over potential changes in the global climate. (MMS 2007, pg 7-39)

The EIS also provides statistics regarding how much the concentration of atmospheric $CO_2$ has increased since the 1970s and provides information from the Intergovernmental Panel on Climate Change regarding the likelihood that humans are responsible (at least partially) for climate change:

> The IPCC in its Fourth Assessment Report published in 2007 concluded that: "Most of the observed increase in globally averaged temperatures since the mid-20$^{th}$ century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations." The IPCC defines the term "very likely" as meaning a probability of occurrence of greater than 90%. (MMS 2007, pg 7-40)

The OCS EIS continues to cite the IPCC report as it devotes the next two pages (out of a total of four that are dedicated to GHG analysis) to a discussion of potential impacts of climate change. The CEQ draft guidance proposed requiring that agencies discuss the impact that climate

change could have on the proposed action or project. In this instance, the OCS EIS does not discuss how climate change could impact alternative energy development in the outer continental shelf, instead it engages in a discussion of general impacts that might be expected as the climate changes. The following issues are discussed as potential ways that climate change will impact the Earth: decreased crop yields; increased exposure to vector-borne disease; more destructive droughts; increased or decreased river runoff; cause stress to fisheries; impacts on recreational fishing; increased shoreline erosion; and so on. None of these issues were discussed in relation to the proposed outer continental shelf alternative energy development program.

## VI. Case #3: Columbia River Crossing DEIS

The Columbia River Crossing (CRC) project is a pending Interstate Highway bridge project between two states, Washington and Oregon. The project is a collaboration of the U.S. Department of Transportation, the Oregon Department of Transportation, and the Washington State Department of Transportation.

` The document being analyzed for the CRC project is a draft environmental impact statement. The final EIS has not yet been released (as of August 2011), but the document still contains analysis related to climate change. Henceforward the CRC draft EIS will just be referred to as an EIS.

Once again, the CEQ draft guidance defined several requirements for projects that include greenhouse gas and climate change analysis:

1. If emissions are greater than 25,000 metric tons per year (or if scoping determines it is relevant) quantify the amount of emissions
    i. Quantify the cumulative emissions from the entire lifespan of project
    ii. Discuss indirect emissions from the action

2. Discuss measures to reduce greenhouse gas emissions, including consideration of alternatives

3. Qualitatively discuss the link between greenhouse gas emissions and climate change

4. Discuss the potential for climate change to impact the action or project

The CRC EIS contains seven pages dedicated to greenhouse gas discussion and included in that is a discussion of the greenhouse gas effects of the proposed bridge project. The EIS includes quantitative analysis of five different construction alternatives. The alternatives included constructing a brand new, supplemental span with transit options (light rail or bus rapid transit) which would stand in addition to the existing span, or constructing a replacement span for the existing Interstate 5 bridge and including transit options (again, light rail or bus rapid transit). The estimates are projected for the year 2030. For the purposes of this evaluation, only one of the construction alternatives will be the focus, rather than all five. The quantitative emission numbers vary only slightly between the five construction alternatives (between 450 and 495 tons of $CO_2$ per day).

The construction of a replacement bridge (equipped with light rail) would result in the daily release of 452 tons of $CO_2$. Extrapolating this out over a full year reveals that this project would annually emit nearly 165,000 tons of $CO_2$, so the CRC project exceeds the threshold of 25,000 tons per year which was established in the CEQ draft guidance. For comparison, the EIS provides estimated emissions in 2030 if the bridge were not to be replaced. According to the analysis, taking no action would result in the daily emission of 463 tons of $CO_2$ in 2030 (higher than emissions would be from a new bridge).

> If historic and recent transportation trends continue, $CO_2$ emissions will continue to increase…Without the CRC improvements, the highway crossing would produce 40

> percent more greenhouse gas emissions by 2030 than under existing conditions… (FHWA & FTA 2008, pg 3-432)

The EIS states that constructing a new bridge would result in fewer future emissions due to a reduction in congestion, combined with new transit options. The document does not quantify the expected emissions of the entire lifespan of the project. And neither does the EIS explicitly discuss indirect emissions (for some projects, vehicle emissions would be viewed as an indirect emission since they are not a central part of the proposed project, but in this EIS, vehicle emissions are treated as a direct emission; they are a direct result of the bridge decision).

The project does, however, provide a list of 12 mitigation options that could be used in a variety of combinations to reduce emissions associated with the project: encourage public transportation; promote transit-oriented development; provide safe sidewalks; provide safe and accessible bike paths; offer ride share programs; construct using materials that are efficient; recycle building materials; use sustainable energy for lighting fixtures; plant vegetation to absorb carbon; promote fuel efficiency improvements (low carbon fuel standard); promote diesel engine emission reductions; and consider carbon offsets.

The CRC EIS also contains background information which links greenhouse gases to climate change. The CRC document cites the Intergovernmental Panel on Climate Change as it describes what climate change is:

> Climate change, also referred to as global warming, is an increase in the overall average atmospheric temperature of the earth…In the coming decades, scientists anticipate that as atmospheric concentrations of greenhouse gases continue to rise, average global temperatures and sea levels will continue to rise as a result and precipitation patterns will change. (FHWA & FTA 2008, pg 3-430)

The CRC EIS also explains which types of GHGs will be addressed in the analysis and why it is important for this particular project. This was not required as part of the CEQ draft guidance:

> Transportation is a substantial source of greenhouse gas emissions, and contributes to global warming through the burning of petroleum-based fuel. Any process that burns fossil fuel releases carbon dioxide into the air. Carbon dioxide is the primary greenhouse gas emitted by vehicles, and therefore it is the focus of this analysis. (FHWA & FTA 2008, pg 3-430)

The project also provides background information that is regionally-specific to this project:

> Transportation accounts for an estimated 38 percent of Oregon's carbon dioxide emissions, with vehicle $CO_2$ emissions predicted to increase by 33 percent by 2025 because of increased driving. Washington State predicts that, with the state's reliance on in-state hydropower for electricity generation, the transportation sector accounts for almost 50 percent of greenhouse gas emissions in Washington. (FHWA & FTA 2008, pg 3-430).

The CEQ does not require agencies to include regionally-specific information about emissions, but it is something that an agency could include in its own NEPA process to further clarify the CEQ guidance.

The CEQ draft guidance also asked agencies to describe how potential climate changes could impact a proposed project, and the CRC EIS includes this discussion in the document:

> The Columbia River's water levels are affected by the amount of snow that falls during the winter and the amount of precipitation that falls as rain year round…Studies conclude that the increase in winter rain (which would historically fall as snow) will lead to increased winter flow of the Columbia River and a weaker snow-melt increase during the spring and summer. (FHWA & FTA 2008, pg 3-437)

Based on the expectation that future climate conditions could include increased runoff and higher water levels in the Columbia River, the CRC EIS lays out three possible adaptations for the bridge project that could mitigate these possible future conditions. The EIS proposes raising the height of the bridge to account for water level rise; ensure that the bridge is designed to handle droughts and large storm events; and minimizing the amount of construction located in the 100-year and 500-year floodplains of the Columbia River.

## VII. Case #4: Sequoia & Kings Canyon National Parks General Management Plan

The final EIS to be analyzed is a comprehensive management plan put forth by the National Park Service. The Sequoia and Kings Canyon National Parks General Management Plan was completed in 2007. National parks host sensitive ecosystems that could be seriously affected by changes in the climate, and there is also the potential for parkland to release carbon dioxide or sequester it, depending on the type of management strategy that is employed in a given park. As previously discussed, the CEQ did not intend for its draft guidance to apply to natural resources management plans due to their unique nature. The CEQ draft guidance explicitly asked for comments and input from agencies and members of the public "…on the appropriate means of assessing the GHG emissions and sequestration that are affected by Federal land and resource management decisions" (CEQ 2010). It implies that the CEQ would consider drafting special guidance for these unique situations based in part on feedback from agencies and the public. For the sake of this paper, despite the lack of specific guidance at this time, the Sequoia & Kings Canyon EIS will be assessed against the CEQ draft guidance to see if there are any aspects of the guidance which may be applicable for resource management plans. Once again, the CEQ criteria are listed here:

1. If emissions are greater than 25,000 metric tons per year (or if scoping determines it is relevant) quantify the amount of emissions
    i. Quantify the cumulative emissions from the entire lifespan of project
    ii. Discuss indirect emissions from the action

2. Discuss measures to reduce greenhouse gas emissions, including consideration of alternatives

3. Qualitatively discuss the link between greenhouse gas emissions and climate change

4. Discuss the potential for climate change to impact the action or project

In the Sequoia and Kings Canyon EIS, many of the CEQ requirement categories, listed above, do not apply. The project will not directly emit over 25,000 metric tons of greenhouse gases, and the EIS makes no effort to quantify emissions. In fact, the document does not discuss any potential emissions resulting from the management plan. The discussion of climate change is solely focused on the ways that climate change may impact the park resources, specifically vegetation and hydrological changes that could occur. For this EIS, only number 3 and 4 from the list above are applicable.

In Chapter 2 of the Sequoia and Kings Canyon EIS, the document discusses the major stressors of the park ecosystems. A section is dedicated to each of the following topics: loss of traditional fire regimes; invasive species; air pollution; habitat fragmentation; and climate change. Under the heading "climate change," the document discusses the link between greenhouse gases and climate change: "Internationally, climatologists and atmospheric scientists generally agree that at least part of this warming is due to human-caused increases in atmospheric greenhouse gases" (NPS 2007, Chap. 2A, pg 6). The EIS refers to the phenomenon as "rapid anthropogenic climate change." This term did not show up in any of the other documents; "climate change" or "global warming" was used in other EISs.

The Sequoia/Kings Canyon EIS also discusses the ways in which a changing climate may impact the ecosystems of the parkland. The discussion is focused very regionally on the impacts in the high-elevation, mountainous area where the parks are located. The EIS speculates that "Increasing average temperatures will probably result in higher snow lines, earlier snow melt, and prolonged summer droughts, affecting the viability of certain species" (NPS 2007, Chap. 1, pg 29). The EIS provides more details about how some species may respond to those climate

changes: “Some Sierran habitats will likely shift to higher elevations. Organisms with limited mobility may become extinct locally, and some habitats, such as high alpine, are likely to disappear entirely, leading to the irreversible loss of some species” (NPS 2007, Chap. 1, pg 29). Also, some of the parks’ most iconic species would potentially face difficulty from a changing climate: “Death rates would likely increase among adult [giant sequoia] trees as drought stress [make] them more vulnerable to insects, pathogens, and air pollution” (NPS 2007, Chap. 2A, pg 7). The EIS also examines geological records to speculate about how increasing temperatures might impact the broader park ecosystems:

> About 10,000 to 4,500 years ago global summertime temperatures were perhaps up to 2ºC higher than now, with prolonged summer drought in California...For example, forests growing on sites now occupied by sequoia groves were much more heavily dominated by pines...These and other paleoecological records clearly indicate that climatic changes smaller than or comparable to those projected for the next century may profoundly alter Sierran ecosystems. (NPS 2007, Chap. 2A, pg 6)

In Chapter 2B, the document examines some of the specific environmental consequences of each of the proposed action alternatives (no action, preferred action, and three alternatives). In particular, climate change is mentioned as a factor that will threaten the long-term viability of giant sequoias in the National Parks. The typical verbiage used is brief: “Ongoing threats include air pollution, unnatural effects of pathogens, and anthropogenic climate change” (NPS 2007, Chap. 2B, pg 115). That same language is used for each of the proposed action alternatives.

## VIII. Discussion

As a reminder, the EISs that were reviewed were completed without the CEQ 2010 draft guidance, but they illustrate potential incarnations that could emerge under such guidance from CEQ. Considering the guidance was not in existence when the documents were written, the four EIS cases meet many of the criteria laid out by the 2010 draft guidance. The Gilberton and

Columbia River Crossing EISs contain most of the CEQ's proposed guidelines. As one would expect, the Outer Continental Shelf and Sequoia/Kings Canyon EISs, which are exempted from many aspects of the draft guidance, do not include some of the components that the draft guidance addresses (see Table 1 for an overview of how well the case studies complied with the draft guidance).

The CEQ recommendations broke down into several main categories: quantification of emissions; discussion of greenhouse gas mitigation options; discussion of the link between greenhouse gases and climate change; and a discussion of the potential impacts of climate change on the project itself. Two of the projects met the CEQ's proposed threshold of 25,000 metric tons of greenhouse gas emissions annually, and those projects both quantified their expected emissions (Gilberton Coal and Columbia River Crossing). The Outer Continental Shelf (programmatic) and Sequoia/Kings Canyon EISs did not attempt to quantify emissions, but they were both unique cases identified by the CEQ as instances where quantification may not be appropriate. These case studies performed as one would expect them to if the CEQ draft guidance was in effect.

The discussion of mitigation options varied widely from project to project. This is not unexpected because the CEQ draft guidance did not provide detailed standards for the consideration of mitigation options. Gilberton Coal provided one alternative (carbon capture and sequestration), while Columbia River Crossing provided a list of twelve mitigation actions that could be taken. There were no mitigation options outlined for the Outer Continental Shelf or Sequoia/Kings Canyon EISs. Again, these latter two cases were given leeway by the draft guidance due to their unique nature.

The CEQ also asked that agencies discuss the connection between greenhouse gases and climate change. Each of the four case studies offered some text that explained the science behind climate change, but once again this discussion varied widely from the four cases. Three of the EISs cited the Intergovernmental Panel on Climate Change for much of the background information (Gilberton, Outer Continental Shelf, and Columbia River Crossing), and all offered at least a brief overview of the topic. Again this was a subject in the CEQ draft guidance that did not contain many detailed instructions for agencies, so the diversity of approaches is not surprising.

Finally, the CEQ requested that agencies discuss the ways that climate change could possibly impact the proposed action or project. Gilberton Coal and Outer Continental Shelf completely omitted this information, but the discussion was included in both Sequoia/Kings Canyon and Columbia River Crossing.

**Quantification of emissions**

When it came to the quantification of greenhouse gas emissions, the case studies exhibited traits that suited their individual projects. For Gilberton, there were large amounts of anticipated greenhouse gas emissions. Compared to CEQ's standard of 25,000 metric tons per year, Gilberton was well over that threshold with anticipated annual emissions over 2 million tons, and the project quantified the expected annual and lifespan emissions. Columbia River Crossing, another project with anticipated annual emissions greater than 25,000 metric tons per year, also provided quantitative data, and those were helpful in comparing the differences among the proposed alternatives.

The Outer Continental Shelf programmatic EIS did not attempt to provide quantitative values. Since it was exploring such a large portfolio of policy options, there really would not have been a clear way or reasonable way to explain anticipated greenhouse gas emissions for the overall project. At one point, OCS EIS mentioned that there might be greenhouse gas emissions associated with the construction of alternative energy projects. Perhaps there could have been included a rough estimate of how much would be emitted for each project installation. Conversely, it might have been beneficial for the project to explain how increased alternative energy use could reduce overall greenhouse gas emissions by the U.S. The EIS briefly discussed this topic, but it did not provide any quantitative estimates.

Finally, the Sequoia/Kings Canyon EIS also made no attempt to quantify emissions. As discussed previously, the CEQ draft guidance explicitly exempted natural resource EISs from the requirements of the guidance. Certainly different management strategies can impact how large land resources sequester or emit carbon dioxide, but these natural, large, dynamic systems can be extremely hard to measure and quantify, and the CEQ acknowledged those difficulties. Additionally, it is very difficult to separate out the natural processes from the human-influenced ones. The Sequoia/Kings Canyon EIS discussed removing some underbrush or thinning parts of the park property. Vegetation naturally sequesters carbon dioxide, so any removal would result in slightly less sequestration, and carbon dioxide would be emitted as the removed plant matter decomposed. Even without human management, perhaps increased drought from climate change would have naturally thinned out some of the underbrush causing the same effects. There are also dynamics that we still struggle to understand. Some studies have suggested that nitrogen fertilizers in forested areas can increase the potential to sequester carbon dioxide, but researchers have also learned that this process results in an increase in nitrous oxide emissions, which has

greater atmospheric heating potential than carbon dioxide (Smith & Conen, 2004). Understanding the balance and broader impacts of each management decision requires further research. Despite the challenges, the National Park Service and other natural resource agencies in aggregate own many millions of acres. Collectively, the impact is important to consider.

The CEQ also asked agencies to calculate cumulative emissions from the lifespan of the proposed project. Again, the Outer Continental Shelf and Sequoia/Kings Canyon EISs cannot reasonably calculate this information. Gilberton did provide cumulative emissions data over the anticipated lifespan of the project, but Columbia River Crossing did not. CRC chose to analyze emissions based on several scenarios and their projected emissions from automobiles in the year 2030. The approach did not lend itself to a long range projection since vehicle use can be influenced by so many factors (demographics, oil prices, changes in technology). The CEQ specifically mentioned that long-range transportation projects may pose some difficulty for quantifying emissions. Transportation projects, such as this, also blur the line between direct and indirect emissions. Usually the distinction between direct and indirect emissions is clear. Direct emissions are directly emitted by the project (like smoke from a smokestack) and indirect emissions are peripheral to the project but still due to its presence (vehicle emissions from the employees at a new power plant facility). The Columbia River Crossing project assumes that vehicle traffic is a direct source of emissions, but once the bridge is complete, it does not directly emit GHGs. Certainly the cars that drive on it do emit GHGs, but one can also argue that the bridge provides a convenient crossing such that cars do not need to drive as far as they would if the bridge did not exist. So the bridge may be contributing and reducing GHGs at the same time. A new roadway will lead to new routes being driven, but some of those cars would be on the road regardless of whether or not the roadway was built. It is not as simple as a coal power plant

where it is very clear which are the direct emissions. Besides the actual construction of the road and maintenance, it is difficult to determine which emissions are due to that specific transportation project.

Finally, when it came to quantification of emissions, the CEQ asked that agencies consider indirect emissions (when it was determined to be relevant). Outer Continental Shelf EIS mentioned that some GHGs would be emitted during the construction of the alternative energy projects, and Gilberton provided a discussion about the indirect impacts that coal-to-liquid-fuels would have on emissions in the transportation sector.

**Measures to mitigate greenhouse gas emissions**

Again, two of the case studies, Outer Continental Shelf and Sequoia/Kings Canyon, did not provide any mitigation alternatives in their EISs. This seems reasonable for both of these projects. For OCS alternative energy development, it makes sense to discuss mitigation options at the project-level. In a programmatic analysis, the subject matter is very broad, and it could be difficult to have a meaningful discussion about mitigation alternatives. In the case of Sequoia/Kings Canyon, one might argue that its potential to emit GHGs is less than that of other projects, and therefore the inclusion of mitigation options is not as important.

Columbia River Crossing did the most complete discussion of mitigation options, including 12 different ways to reduce greenhouse gas emissions from the proposed project. The mitigation options were of varying size and scope, such that it would be easy to select and one or two or seven different options to help mitigate emissions. It might be helpful to know the projected greenhouse gas emission reductions achieved by each of the options, however. Without

that information, it is difficult to know which mitigation options would achieve the highest level of reduction for the lowest cost.

Gilberton EIS offered one mitigation alternative: carbon capture and sequestration. This option was mentioned during the discussion of climate change impacts, and it was even given a small section to itself where the EIS discussed the potential of nearby geologic formations to host captured carbon. Certainly carbon capture and sequestration would be a very powerful mitigation option, but the project was not designed for it, there was no funding for it, and there were no plans to ever add the technology in the future. Buried in a paragraph separate from the discussion of climate change impacts, the document reveals the truth:

> In addition, DOE has considered the potential to reduce project $CO_2$ emissions using geologic sequestration. This is not a reasonable option because sequestration technology is not sufficiently mature to be implemented at production scale during the demonstration period for the proposed facilities. (DOE 2007, pg 4-51)

Perhaps the Department of Energy simply wanted to raise the issue to engage in a discussion about the merits of such a technology, but it never was a realistic alternative. It ends up seeming disingenuous and misleading to members of the public, especially since the document said that it might be possible to incorporate the technology. If projects can simply include any mitigation options that aren't feasible, then it defeats the whole purpose of including that discussion. For a project, such as Gilberton, which releases such massive amounts of greenhouse gases, it is very difficult to come up with mitigation options that would significantly reduce the amount of emissions. Carbon capture and sequestration is appealing because it can virtually eliminate those emissions by itself, but it should only be included if it is a viable option.

**Discussion of the link between GHGs and climate change**

The discussion of the link between GHGs and climate change was present in each of the four case studies, and it took very different forms in each EIS. Gilberton provided information that could be interpreted as an attempt to downplay the role of greenhouse gases in climate change. To begin with, the document makes sure to note that "...water vapor, a natural component of the atmosphere, is the most abundant greenhouse gas" (DOE 2007, pg 4-12). The document does acknowledge that $CO_2$ is the second-most abundant greenhouse gas. The Gilberton EIS also states that without the greenhouse effect, the planet Earth would be on average 60ºF colder. This is true, our atmosphere makes living here quite pleasant, but it could be perceived as an effort to confound the issue by making it seem that greenhouse gases are completely benign. The document also compares its annual projected emissions to worldwide emissions of $CO_2$. The document presents its own annual emissions (2,282,000 tons) and contrasts it to worldwide annual emissions of $CO_2$ (29,000,000,000 tons, according to the document). The preparer of the EIS also made the choice to spell out the 29 billion with all nine zeros. This, and the other case studies, was created under the Bush Administration, which was not willing to accept that human activity was contributing to climate change. It would not be surprising if some of that mentality permeated the Department of Energy, especially on a "clean coal" project, which was a major initiative of that administration.

The Outer Continental Shelf EIS had a very straightforward section that discussed the link between GHGs and climate change. It introduced the science (how light is trapped in the atmosphere and converted to heat), and then it acknowledged that greenhouse gases are natural while still pointing out that they are increasing unnaturally:

> While these gases occur naturally in the atmosphere, there has been a rapid increase in concentrations of greenhouse gases in the Earth's atmosphere from anthropogenic sources since the start of industrialization, which has caused concerns over potential changes in the global climate. (MMS 2007, 7-39)

It went on to discuss how concentrations of atmospheric $CO_2$ have increased over time as well. Overall, it was just under a page long, but it provided all the necessary information without including too much or misleading information.

Columbia River Crossing did a very brief background section consisting of two paragraphs. It did not discuss the greenhouse effect but leapt right into a quote from the IPCC: "Most of the observed increase in global average temperatures since the mid-20$^{th}$ century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations" (FHWA & FTA 2008, pg 3-430). From there, the document went into an explanation of transportation as a large source of greenhouse gases.

Finally, Sequoia/Kings Canyon used some of the strongest language regarding climate change. Gilberton and OCS both mentioned that the greenhouse effect is natural and that water vapor is the most common greenhouse gas, but Sequoia/Kings continually referred to climate change as "rapid anthropologic climate change." This phrase clearly acknowledges that human activity is playing a large role in the changing climate, and the EIS also names it as one of the greatest threats to the ecosystems of the park: "Rapid anthropogenic climate change has the potential to become the greatest stressor on the ecosystems of Sequoia and Kings Canyon National Parks" (NPS 2007, Chap. 2A, pg 6). This strong language stands in stark contrast to the words in the Gilberton EIS. Perhaps there are cultural differences between the agencies that account for the discrepancy, different levels of scrutiny of the final product, or the whims of the preparer, or a combination of all these factors. The fact remains that the background discussion of climate change is far from standardized in these EISs.

**Discussion of the potential for climate change to impact the project**

Gilberton EIS did not include any discussion of how climate change might impact the project. Many of the predicted consequences of climate change are hydrologically related. Large power plants require massive amounts of cooling water from waterways, and if water levels begin to drop in the future, this could certainly impact the operation of the Gilberton plant.

OCS also excluded this qualitative discussion but it probably would have been a worthy pursuit. Many of the most commonly cited consequences of climate changes would impact off shore developments. Rising sea levels could impact siting of proposed alternative energy facilities, or increased storm activity could significantly impact the operation of off shore energy projects. Some research has already been done on these topics. For wind energy, a warming planet could be a benefit. Wind strength could increase, which could necessitate different construction designs (Pryor & Barthelmie, 2010). In northern areas, there could be less icing of wind turbine blades, which can diminish energy output (Pryor & Barthelmie, 2010). This type of qualitative discussion would have provided some important factors to consider in the future, although, these issues can also be addressed at the project-level, instead.

As discussed earlier, Columbia River Crossing addresses the issues that seem to be most relevant for its type of project. A bridge should be designed to handle increased runoff from storm events and be prepared for higher water levels or flooding. The document addressed all those major concerns.

The Sequoia/Kings Canyon EIS really only discussed the impacts that climate change would have on the proposed action. As mentioned, the climate changes will potentially impact the landscape in significant ways. The document addresses the hydrological and vegetative changes that might take place, and it was particularly interesting to see the use of geological data to infer what future conditions might bring.

One of the difficulties of projecting the impacts that climate change will have on a given project is that it is impossible to know what future conditions will bring. The IPCC reports are an excellent resource to understand some of the macro-level changes that are going on, but regional changes in weather may be very different. Efforts are being made to create models that more accurately reflect changes at the regional level, but there are still major shortcomings. "The current generation of [Global Climate Models] still does not provide reliable estimates of rainfall variance, and it is currently difficult to develop appropriate downscaling methodologies" (Prudhomme et al., 2002). It seemed especially helpful to have information such as provided in the Sequoia/Kings Canyon EIS, which gave more specific predictions for the region in question. Certainly it is not always practical to get those data, or they may not exist, but it creates a document that is more relevant to decision-makers and the public.

## IX. Recommendations and conclusion

It should be noted that these four case studies were completed around roughly the same period of time (2007-2008), so they occurred under the same presidential administration and in a way this paper provides just a snapshot of how federal agencies were performing environmental review in those couple years. It should also be noted that the case study EISs and the CEQ draft guidance are not far apart. On many of the CEQ requirements, the case studies provided information that seemed adequate to meet the requirements. The fundamentals of the CEQ draft guidance touch on major issues that could create a meaningful discussion of climate change and greenhouse gas impacts. Based on the analysis of the four case studies, there are some slight tweaks that could improve the guidance and future EISs to improve their usefulness.

### 1. Provide more clarification for the quantification of emissions

The requirement that agencies do their best to quantify emissions is an essential part of the CEQ's guidance. The CEQ could improve this requirement by providing more guidance about when emissions should be quantified. For example, the CEQ guidance says that emitters of greenhouse gases should use 25,000 metric tons per year as a general guideline, and that emissions should be quantified if they are expected to be greater than 25,000. This standard works well for stationary projects, such as the Gilberton Coal project, but it is possible that other policy decisions may not directly emit 25,000 metric tons but might result in 25,000 fewer metric tons being released due to sequestration (such as a natural resource management decision). Perhaps the language should be changed to say that if the project would potentially influence the emission or sequestration of 25,000 metric tons per year, the amount should be quantified. It should also be expanded to clearly include situations where influencing indirect emissions by 25,000 metric tons per year should warrant quantitative analysis. As was seen with the Columbia River Crossing project, for some transportation projects, it is not always clear which emissions are direct and which are indirect. These types of project and agency-specific issues could be handled on a case by case basis through the scoping process. Without a clear understanding of how each ton of greenhouse gas emissions impacts climate change, quantified values can serve as a measuring stick for us to judge how impactful a given project will be and allow for easier comparisons among projects.

**2. Define what types of mitigation measures are acceptable**

There was a wide range in the style of the case studies when it came to the discussion of mitigation options; this area definitely needs clear guidance from the CEQ. The CEQ simply states that agencies "…should also consider mitigation measures and reasonable alternatives to reduce action-related GHG emissions" (CEQ 2010). In the case of the Gilberton Coal project, the

EIS insisted that carbon capture and sequestration was a legitimate mitigation option. As has been previously discussed, there were no plans or preparations made for ever adopting carbon capture and sequestration, and one sentence in the EIS acknowledged that it was not a feasible option. The CEQ should consider clarifying in the guidance that the requirement is for "reasonable and feasible" mitigation options. The CEQ must emphasize the fact that the mitigation options should be realistic; otherwise project proponents might use fanciful proposals to distract or pacify concerned members of the public.

In addition, it would be helpful for decision-makers and the public if the mitigation measures included an estimate of the impact on emissions. Quantifying the emissions reductions from mitigation options would allow for a better discussion and better comparisons between the respective mitigation measures. It may not be realistic in every instance.

**3. Standardize language discussing the link between GHGs and climate change**

The CEQ draft guidance requires that each EIS qualitatively discuss the link between greenhouse gases and climate change. The background information about climate change is an important part of the guidance, and it is important that readers of the document have some idea as to why greenhouse gas emissions are being included in the EIS. Scientific background information is especially important for members of the public who may not be familiar with the process of climate change. According to Gallup polling done in 2007 and 2008, at that time, 97 percent of Americans were aware of climate change (Gallup, 2009). The background section, however, is supposed to specifically discuss the link between greenhouse gases and climate change, and there is definitely some confusion and disagreement over that link. Polling data continues to show that more and more people are aware of climate change, but in recent years, the trend has been for Americans to become more skeptical of anthropogenic climate change.

Gallup polls from 2007 show that 61 percent of Americans believed that "human activities" were the main cause of temperature increases in "the last century" (Gallup, 2010). Yet in 2010, the percentage had dropped to 50 percent (Gallup, 2010). There is widespread awareness of climate change, but the details are not agreed upon by the public. As demonstrated in this small sample size of case studies, there are many ways to explain climate change and greenhouse gases.

To ensure that this section does not lead to further confusion, it might be helpful for the CEQ to provide standardized language that all EISs should use. In the long-run, this would reduce the amount of work expended by each agency on this new requirement in the EIS process, and it would provide some regularity in the way that climate change is discussed. It could ensure consistency by ensuring that the term, "climate change" is used instead of "global warming." Additionally, it would help prevent some agencies from downplaying the impact of a single project. Again, the Gilberton Coal project seemed to go out of its way to downplay its emissions by comparing them to worldwide $CO_2$ emissions. On top of that, Gilberton Coal also emphasized that water vapor is the single largest contributor to the greenhouse effect. While water vapor is an important gas that keeps our planet warm, it could be confusing information to introduce into a discussion of anthropogenic climate change impacts. Standardized procedures or text for this section could make sure that federal agencies are on the same page.

**4. Ask agencies to provide data about regional emissions and similar projects**

As the CEQ strives to expand NEPA to cover a worldwide issue, as opposed to local environmental issues, CEQ needs to find ways to make NEPA function as a tool that can provide broader level information. In a vacuum, it is meaningless to state that a new project will emit three million tons of carbon dioxide each year. It would be helpful if there were a way to compare that number to existing emissions and existing infrastructure. CEQ should consider

designating relatively small regions across the country in which projects would be assessed for their contribution to their region. If for example, a new project wants to proceed to emit three million tons each year, it would be helpful to know that your region emitted 15 million tons last year and projects similar to the proposed one usually emit two million tons per year. Designing a maximum level of emissions could also help achieve this goal (George, 1997). Projects in a defined region would be forced to stay within a pre-determined level of emissions. Defining such a target would ideally be global, since the impacts are worldwide (George, 1997). Then each project would have a quantitative value attached to it, and it could be more effectively evaluated against all others in the region. With these types of data, the information starts to be contextualized in a way that makes sense. This would not be an easy process, and it could create a burdensome requirement for projects, but the concept could be incorporated into the environmental review process. With the recently approved mandatory greenhouse gas reporting rule, there are more and more quantitative data that could be used for this type of purpose.

The attempt to include climate change in the environmental review process is an ambitious one. One of the most difficult aspects of evaluating climate change impacts is that it is a worldwide problem. NEPA is well-equipped to handle local or regional impacts of single actions or projects, but its project-specific focus makes it difficult to draw meaningful conclusions for issues of worldwide concern, such as climate change. The CEQ acknowledges these shortcomings in its draft guidance:

> However, it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand. The estimated level of GHG emissions can serve as a reasonable proxy for assessing potential climate change impacts, and provides decision-makers and the public with useful information for a reasoned choice among alternatives. (CEQ, 2010)

If a proposed project will result in the release of toxic emissions, those can be easily evaluated based on the potential impact on human health and the environment. If, however, the issue is something like climate change, the consequences of each metric ton of $CO_2$ are difficult to ascribe. The cumulative effects of many projects are hard for NEPA to take into account. Cumulative effects require examining the entirety of environmental impacts including the past, present, and as much as possible, the future (McCold & Saulsbury, 1996). Climate change is such a cumulative effect. Past emissions will continue to impact future climate changes.

Certainly one action that results in the release of 10,000 metric tons of $CO_2$ per year does not seem like much, and it would be hard to justify denying a project based on that level of emissions (the US released over 6.6 billion metric tons of $CO_2$ in 2009) (EPA, 2011). But several thousand projects, each emitting 10,000 metric tons of $CO_2$ per year, could have an impact on climate change over time. It is very difficult to make those determinations. CEQ also wrestles with this difficulty in its 2010 draft guidance:

> The global climate change problem is much more the result of numerous and varied sources, each of which might seem to make a relatively small addition to global atmospheric GHG concentration. CEQ proposes to recommend that environmental documents reflect this global context and be realistic in focusing on ensuring that useful information is provided to decision makers for those actions that the agency finds are a significant source of GHGs. (CEQ, 2010)

NEPA was designed to foresee and prevent environmental threats, but it also was designed to examine and assess individual projects and actions, not widespread global issues.

It remains to be seen if the CEQ draft guidance will be approved. If it does progress, the basic framework of the CEQ guidance seems to imitate some of the steps that were already being taken by agencies that have chosen to include greenhouse gas analysis in EISs (Slotterback, 2011). The fact that some of the proposed guidance has already been included in some EISs is a

good sign that it is feasible to incorporate such analysis. Based on some of the case studies, there are some basic areas that should be addressed in the CEQ's guidance, but overall, the case studies demonstrate that there is the potential to incorporate climate change and greenhouse gas analysis in a way that could provide beneficial information to the public while possibly allowing for better-informed decision making.

# Sources


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40 Code of Federal Regulations § 1508.18 (2011)

40 Code of Federal Regulations § 1500 – 1506 (2011)

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Table 1:
Case studies as compared to CEQ draft guidance requirements

| | | CEQ draft guidance requirements | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Quantify GHG emissions** | **Cumulative emissions over lifespan** | **Indirect emissions** | **Discuss mitigation options** | **Discuss GHGs and climate change** | **Discuss climate change impacts on project** |
| **Case Studies** | **Gilberton Coal-to Clean Fuels** | Yes; annual estimated emissions | Yes; calculated over 50 years | No discussion | Yes, but only discussed carbon capture which EIS later said was not possible | Emphasized water vapor as major GHG; cited IPCC; discussed how greenhouse effect necessary for life on Earth | No discussion |
| | **Outer Continental Shelf Alternative Energy (programmatic)** | No; not needed because it is programmatic | No; not needed because it is programmatic | No discussion | N/A | Cited IPCC report; clearly discussed link between GHGs and CC; mentioned water vapor as a GHG. | No discussion |
| | **Columbia River Crossing** | Yes; projected auto emissions for 2030 for project alternatives | No | No discussion | Yes, a dozen options discussed (transit, ped/bike, recycle materials, etc) | Assumed reader knew about link; cited IPCC; discussed regional impact and transportation's role in emissions | Yes; hydrological changes; rain events; floods |
| | **Sequoia/King's Canyon Park Management Plan** | Exempted from CEQ guidance | Exempted from CEQ guidance | Exempted from CEQ guidance | Exempted from CEQ guidance | Cited peer-reviewed research, but not IPCC; used term "rapid anthropogenic climate change" | Yes; snowfall, rain, drought, temperature |

# Appendix A: Template for EIS document analysis

- **Project Title**
- **EIS year and date**
- **Draft, Final, or Other**
- **Project Location**
- **Project Description**
- **Lead agency**
- **Section(s) where GHGs are addressed (include page numbers), such as in:**
- **Why was GHG analysis included (scoping process, public input, agency decision)?**
- **GHGs considered (CO2, others?)**
- **Was there qualitative analysis, quantitative, both?**
- **Description of qualitative analysis**
- **Description of quantitative analysis (including models used)**
- **Description of generic background info related to GHGs or climate change (i.e. description of generalized impacts of climate change, references to key evidence such as IPCC)**
- **Length of analysis (how many pages)**
- **Of the GHG section, what proportion is project-specific info and how much is generic background info (rough estimate)?**
- **Sources addressed (stationary sources, mobile sources, etc)**
- **Temporal focus**
- **Spatial focus**
- **Any discussion of climate change or GHGs relative to cumulative impacts**
- **For final EISs, presence of climate change/GHG content in comment letters and response to letters**
- **References**

# Appendix B: Template for CEQ draft guidance analysis

- **State or other jurisdiction or agency**
- **Key dates**
- **General overview (2-4 sentences, highlight unique features)**
- **Who administers?**
- **What is required?**
- **What is recommended?**
- **Methods of analysis?**
- **Where addressed in document (e.g. air quality, cumulative impacts) as defined by policy and/or in practice?**
- **Which GHGs addressed as defined by policy and/or in practice?**
- **Projects (e.g. transportation, residential, industrial) for which climate change is addressed?**
- **Temporal focus (e.g. lifecycle, construction phase, operation phase, cradle to grave)?**
- **Spatial focus (i.e. site to broader impacts)**
- **Focus on stationary and/or mobile sources?**
- **Do thresholds of significance exist?**
- **Guidelines/issues related to public and/or agency involvement specific to GHGs?**
- **How are positive GHG impacts addressed (i.e. carbon sequestration)?**
- **Direct or indirect connections to agency, state, regional, or local level climate policy or plan?**
- **Projects for which environmental review documents prepared (include links to project information and all documents – scoping documents, EAs, Draft and Final EISs, record of decision documents)**
- **Reference list**

# Appendix C: Completed Gilberton Coal case study

**Project**
Gilberton Coal

**Lead Agency**
US Department of Energy (National Energy Technology Laboratory)

**Type of environmental review**
Final Environmental Impact Statement

**Date**
October 2007

**Project Location**
Gilberton, Pennsylvania (eastern-central part of the state; rural area; roughly 100 miles north and slightly west of Philadelphia).

**Project Description**
Gilberton is a "clean coal" project with the aim of producing electricity, steam, and liquid fuels from coal waste. The project is being advanced by a collaboration of corporations: Shell Global Solutions; Uhde GmbH; Sasol Technology Ltd.; and Chevron Lummus Global.[1]

There is an existing coal plant in Gilberton, and this project would use anthracite coal waste and a gasification process to produce electricity, steam and liquid hydrocarbon fuels. "The proposed project would demonstrate the first clean coal power facility in the United States using coal waste gasification as the basis for power, thermal energy, and fuels production."[2]

**Section(s) where GHGs are addressed (include page numbers), such as in:**

- Summary
  - Mentions annual yearly emissions (page xxvii)
- Chapter 2, Proposed Action and Alternatives: Sub-section 2.1.6.1, Air Emissions
  - Estimates annual emissions of CO2 (page 2-13 and page 2-18)
- Chapter 4, Environmental Consequences: 4.1.2.2, Operation: Global Climate Change
  - Background info and emission estimates (pages 4-12 and 4-51)
- Chapter 5, Impacts of Commercial Operation: 5.1.4, Carbon Dioxide Emissions
  - 50-year estimate of emissions (page 5-3 - 5-4)
- Chapter 6, Cumulative Impacts: 6.1, Air Quality
  - Covers info already mentioned and touts the project's benefits (pages 6-5 - 6-7)

[1] US Department of Energy. Final Environmental Impact Statement for the Gilberton Coal-to-Clean Fuels and Power Project. October 2007. Page 1-1
[2] Ibid. Page 1-3

**Why was GHG analysis included (scoping process, public input, agency decision)?**
In the scoping section the EIS discusses the issues that will be addressed; it does not specifically refer to climate change or GHG emissions. The document does, however, provide a list of concerns that were raised by local residents, and "global warming" appears in the long list of concerns.[3]

**GHGs considered (CO2, others?)**
Throughout the document, carbon dioxide is the only GHG that is explicitly mentioned. The document sometimes uses the term "greenhouse gas," but specific details are only provided for carbon dioxide.

**Was there qualitative analysis, quantitative, both?**

Both were included in the document. The qualitative discussion spent a lot of time focusing on the potential benefits to be derived from the addition of sequestration technology (not part of the project proposal).

The quantitative section had one interesting aspect. Since the plant will be producing liquid fuel from coal waste, the document analyzed the potential GHG impacts of an increased use of coal as a liquid fuel source. That discussion can be found in Chapter 6, Cumulative Effects.

**Description of qualitative analysis**

The one-page section on GHGs occurs in Chapter 4, Environmental Consequences. Under the heading, "Global Climate Change," the EIS discusses emissions from the plant operation.[4] Roughly two-thirds of this section discuss the "possibility of changes in the global climate" and generic information about the science of climate change (this section almost exclusively cites the IPCC as its source).[5] The document points out that water vapor is the most abundant GHG (followed by CO2), and acknowledges that "increasing CO2 concentrations *likely* have contributed to a corresponding increase in temperature" (interesting note: the word likely was in italics, again indicating that it was added between the release of the DEIS and the publication of the FEIS; I wonder what led to the addition of that word).[6] It appears, however, that there was some generic science information about climate change in the DEIS, but nothing specific to this project. I'm making this assumption based on the fact that the specific project information is in italics, indicating that this text was added between the DEIS and FEIS. There is background information text that is in normal font indicating that it was present in the DEIS.

Chapter 4 also looks at the real number estimates of emissions on a yearly basis. This information can be found below, under "quantitative analysis."

There is one last paragraph of interest in Chapter 4 (Environmental Consequences) under the heading, "Pollution Prevention and Mitigation Measures:

[3] Ibid. Page 1-9
[4] Ibid. 4-12
[5] Ibid. 4-12
[6] Ibid. 4-12

> "Additional mitigation measures have been considered for the concentrated stream of CO2 exiting the gas cleanup system (the Rectisol unit). The measures considered include the sale of the concentrated CO2 stream and geologic sequestration of this stream. However…the industrial participant has informed DOE that sale of the CO2 byproduct would not occur in the foreseeable future. In addition, DOE has considered…geologic sequestration. This is not a reasonable option because sequestration technology is not sufficiently mature to be implemented during the demonstration period of the proposed facilities."[7]

**Description of quantitative analysis (including models used)**

The first mention of CO2 comes in the "Summary" at the very beginning of the FEIS document. The text is in italics, indicating that it was added after the DEIS was released. The section does not include background information; it jumps right in, assesses the estimated emissions from the project, and includes some information about the emissions associated with fuels derived from coal.[8]

> "Carbon dioxide emission…would add about 2,282,000 tons per year to global CO2 emissions…Over the entire fuel lifecycle (from production of the raw material in a coal mine or oil well through utilization of the fuel in a vehicle), production and delivery of liquid transportation fuels from coal has been estimated to result in about 80% more greenhouse-gas emissions than from production and deliver of conventional petroleum-derived fuels (Marano and Ciferno 2001, Williams and Larson 2003, Williams et al. 2006). Recent estimates by EPA of lifecycle emissions are even higher [the document mentions lifecycle emissions here but does not offer any additional information about lifecycle emissions]."[9]

In Chapter 2, Proposed Action and Alternatives, the EIS again provides information about the estimated emissions from the project. Table 2.1.1 lists expected outputs of a variety of air pollutants and lists CO2, subdivided into two categories. Carbon dioxide from the thermal units: 832,000 tons per year. Carbon dioxide from the Rectisol unit: 1,450,000 tons per year. Without getting into too much detail about the technology, the plant operates several distinct phases, so the CO2 emissions are broken down based on the phases in which it is emitted.[10] The numbers corresponding to CO2 were written in italics which indicates that this data was added after the publication of the DEIS for inclusion in the FEIS.

Later on in Chapter 2 (Proposed Action and Alternatives), under the subheading 2.1.6.1 Air Emissions, the EIS includes its first text related to GHG emissions from the project:

> "The proposed facilities would also produce about 2,282,000 tons per year of CO2 (Radizwon 2006), which would be released to the atmosphere. Carbon dioxide is a greenhouse gas that is generally regarded by a large body of scientific experts as contributing to global warming and climate change (IPCC 2001, IPCC 2007). Although

[7] Ibid. 4-51
[8] Ibid. xxvii
[9] Ibid. xxvii
[10] Ibid. 2-13

not proposed by the applicant, during the 50-year duration of commercial operation it may become feasible to reduce the proposed project's contribution to global climate change by sequestering some of the CO2 underground."[11]

That is the complete text related to CO2. Also it should be noted that the entire quote above was in italics, indicating that it was added after the publication of the DEIS.

In Chapter 4, Environmental Consequences, under the heading, "Global Climate Change," the document offers one page discussing climate change. The first two-thirds of the page deal with background information, but the last paragraph offers specific information for this project:

" Carbon dioxide…would add about 2,282,000 tons per year to global CO2 emissions, thus adding to global emissions…which are estimated to have been 29,000,000,000 tons during the period 2000 to 2005 (IPCC 2007). The total emissions from WMPI [the corporation running the project] would include CO2 emitted directly to the atmosphere by (1) facility operations (832,000 tons per year), and (2) the concentrated CO2 stream separated in the gas cleanup system (1,450,000 tons per year)."[12]

The document again mentions that, although no sequestration was proposed for this project, it might be possible to reduce emissions through sequestration at a later date. The entire paragraph dealing with emissions from this particular project was added after the release of the DEIS.

Chapter 5, Impacts of Commercial Operation, also contains quantitative information about emissions under subsection 5.1.4, "Carbon dioxide emissions." This two-page section discusses the estimated emission over the fifty year lifespan of the plant and the potential of sequestration (once again the entire section was in italics, indicating that it was added after the DEIS was published):[13]

"Over the 50-year duration of commercial operation, the facilities could release a total of about 114,000,000 tons of CO2 to the global atmosphere, consisting of about 42,000,000 tons of CO2 emissions from facility operations and 72,000,000 tons of CO2 recovered in the Recitsol unit and released through the thermal oxidizer stack.

"In the long term (following the demonstration phase), the industrial participant may negotiate the sale of the concentrated CO2 stream for use in other types of industrial or commercial operations. In addition, during the 50-year period, it might become feasible to reduce the project's contribution to global climate change by sequestering some of the recovered CO2 (1,450,000 tons/year) underground." [14]

The rest of the "carbon dioxide emissions" section of Chapter 5 discusses several potential sequestration sites, their respective capacity for CO2, and related logistical issues.[15]

[11] Ibid. 2-18
[12] Ibid. 4-12
[13] Ibid. 5-3
[14] Ibid. 5-3
[15] Ibid 5-3 – 5-4

Chapter 6, Cumulative Effects, has a subsection, 6.1.2, entitled, "Greenhouse Gas Emissions" (the entire section is in italics, indicating that it was added after the DEIS). This rehashes the information that has already been discussed in previous chapters. It is roughly two pages long and again mentions the estimated annual emissions. This section, however, expands on an interesting concept that was first mentioned in the opening summary: the fact that fuels derived from coal will emit more emissions than traditional petroleum.[16]

> "Over the entire fuel lifecycle…fuels from coal has been estimated to result in about 80% more greenhouse-gas emissions than from production and delivery of conventional petroleum-derived fuels…Recently the U.S. Environmental Protection Agency (EPA) reported an estimate that greenhouse gas emissions from CTL could be as much as 119% higher than those from conventional petroleum fuels.
>
> "…the Energy Information Administration (2007) has forecast that by 2030 US CTL production will consume 55,000,000 tons of coal annually (3.1% of the nation's coal use) and produce the equivalent of 440,000 barrels of crude oil per day, supplying 1.6% of the nation's liquid fuel consumption. Based on this forecast and assuming the CTL fuel cycle generates 80% more greenhouse-gas emissions than production and delivery of conventional petroleum-derived fuels, the use of CTL technology for producing transportation fuels would cause the life cycle greenhouse gas releases of the US liquid fuel sector to be 1.3% higher in the year 2030 than if the same quantity of liquid fuel was produced from petroleum."

The document goes on to assess the potential liquid fuel GHG emissions for two additional scenarios: 1) the production of CTL if with sequestration, and 2) the impact of higher oil prices in the future and therefore even more use of coal-to-fuel technology.[17]

**Description of generic background info related to GHGs or climate change (i.e. description of generalized impacts of climate change, references to key evidence such as IPCC)**

It should be noted that Chapter 4, Environmental Consequences, had a section entitled, "Global Climate Change," in its DEIS. Much of the information that I've been citing and discussing was added after the publication of the DEIS, but there was a section about climate change in the DEIS. With that being said, it only included generic background information and no information about the project itself or its expected emissions.

The background information discusses the science of gases trapping radiation from the sun, and the document provides a list of GHGs (the big six plus water vapor). Again, the document cites the IPCC as its source for the background info. As we've seen in other documents, the EIS contains the following sentence: "Water vapor, a natural component of the atmosphere, is the most abundant greenhouse gas." [18]

The document goes on to mention that fossil fuel burning is a large source of CO2 and increasing concentrations of CO2 are of concern.[19]

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[16] Ibid. 6-5
[17] Ibid. 6-6 – 6-7
[18] Ibid. 4-12
[19] Ibid. 4-12

**Of the GHG section, what proportion is project-specific info and how much is generic background info (rough estimate)?**

I would guess that roughly 80% of the GHG information in the document was specific to this project. As mentioned above, there was a section that contained generic information about climate change, but the vast majority of it was specific information about this project.

With that being said, there was a lot of redundancy. Information about the annual emissions from the plant showed up in several chapters, and there was a lot of discussion about the potential to use sequestration.

**Sources addressed (stationary sources, mobile sources, etc)**

Primarily the document looked at on-site, operational emissions.

**Temporal focus**

This analysis was primarily focused on annual emissions from the proposed project, but it also contained estimates of its emissions over a 50-year period (the estimated lifespan of the project).

I guess the DOE assumes that the facility would not be operational in 50 years? Or perhaps that is just the standard lifespan they assign to power-generating projects. I don't know; I'm just speculating.

**Spatial focus**

One interesting aspect of this analysis was the inclusion of a discussion/analysis of GHG emissions resulting from the coal-derived liquid fuel (the final product from the proposed project). This is an interesting element of the project, and it was interesting to see an estimate that US GHG emissions from the fuel sector could actually increase in the long run if coal-to-fuel technology becomes more common.

**Any discussion of climate change or GHGs relative to cumulative impacts**

Yes, in Chapter 4, Environmental Consequences, there is a discussion about the science, the causes of climate change, and so on:[20]

> "A worldwide environmental issue is the possibility of changes in the global climate (e.g., global warming) as a consequence of increasing atmospheric concentrations of "greenhouse" gases. International scientific consensus has indicated that the earth's climate is changing and that human activity is a factor (IPCC 2001, 2007). The atmosphere allows a large percentage of incoming solar radiation to pass through to the earth's surface and be converted to heat energy (infrared radiation) that does not pass back through the atmosphere as easily as the solar radiation passes in. The result is that heat energy is "trapped" near the earth's surface."

**For final EISs, presence of climate change/GHG content in comment letters and response to letters**

- Comment from citizen who is worried about the carbon dioxide and other coal plant emissions and the potential impact on climate change.[21]

[20] Ibid. 4-12
[21] Ibid. D-171

    - Response: "DOE has attempted to identify and consider all of the potential long- and short-term environmental impacts of the proposed facilities, not just the short-term benefits."[22]
- The NRDC included a comment that was very critical of the comparison of the plant's emissions to worldwide emissions. Also wants inclusion of consideration of sequestration and projected lifespan emissions. Several other criticisms as well.[23]
    - Response: The EIS was revised to include consideration of sequestration. DOE revised emission estimates to account for the entire project, extended the expected lifespan of the plant to 50 years and calculated emissions accordingly.[24]
- A citizen has concerns about the fact that fuels derived from coal have a larger carbon footprint than traditional petroleum.[25]
    - Response: Section 6.1 was revised with cumulative effects analysis.[26]
- The Coalition of Concerned Coal Region Citizens wanted a regional context for the emissions instead of being given the worldwide emission numbers.[27]
    - Response: DOE eliminated the use of percentages for comparing the plant's emissions to worldwide emissions. Instead of estimating Gilberton's emissions as a percentage of worldwide emissions, the DOE wrote out the total amount of CO2 released worldwide and the expected emissions from the proposed project .[28]
- A citizen wanted more detailed info about GHGs and the consideration of sequestration.[29]
    - Response: The DOE added absolute numbers for emissions and revised Section 6.1 to include sequestration analysis.[30]
- A group called Citizens for Pennsylvania's Future requested more detailed info about all the emissions from the entire energy plant. Also sequestration should be examined.[31]
    - Response: Estimates of the CO2 were updated and revised. A new section about sequestration was added.[32]

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US Department of Energy. Final Environmental Impact Statement for the Gilberton Coal-to-Clean Fuels and Power Project. October 2007.

[22] Ibid. D-171
[23] Ibid. D-236 - D240
[24] D-241 - D-244
[25] Ibid. D-387
[26] Ibid. D-387
[27] Ibid. D-277
[28] Ibid. D-278
[29] Ibid. D-319
[30] Ibid. D-319 - D-320
[31] Ibid. D-445
[32] Ibid. D-445