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Dear Sir/Madam:

This letter, on behalf of Millennium Bulk Terminals -- Longview ("Millennium"), comments on the scope of the climate change impact analysis in the Environmental Impact Statement ("EIS") for the Gateway Pacific Terminal Project ("Terminal Project") under the National Environmental Policy Act ("NEPA") and the State Environmental Policy Act ("SEPA"). Millennium understands that Green House Gas (GHG) emissions and their environmental impacts will receive considerable attention in the EIS for both the Gateway and Millennium terminals and offers these comments at this time to promote a consistent approach for both projects. As discussed below, the review of this topic should (a) discuss environmental impacts when the science provides for such discussion, and note when the state of the science precludes such an analysis, (b) carefully consider causal relationships between emissions and activities, and (c) use existing information where available to discuss the issue..

A. <u>The EIS should discuss Greenhouse Gas impacts as well as quantities to the extent possible</u>.

Impact Statements often use quantities of GHG emissions as a surrogate for an analysis of actual climate change impacts. An analysis that only addresses emission quantities, however, stops short of NEPA and SEPA's central inquiry—that is an assessment of environmental effects. Therefore, the analysis should also—to the extent possible—assess environmental impacts. Where the state of the science precludes drawing conclusions regarding specific project impacts, the EIS should so note. The Bureau of Land Management used this approach in climate change analysis in its 2010 EIS for the Wright Area Coal Lease Applications (see attached).

B. The GHG Analysis should carefully consider the extent of the causal connection between the project and various emissions.

In general, NEPA only requires the analysis of impacts with a "reasonably close causal relationship" to the proposed action; "but-for causation by itself is generally insufficient."[1] The terminal EIS should carefully determine whether the causal relationship between a given emission and the project is sufficiently close to attribute the emission (and any associated impact) to the project. If a close causal relationship cannot be established for emissions, they should be accounted for as part of the No Action Alternative as an impact that would have occurred without the project and studied nonetheless in the cumulative impact section of the EIS as a non-project impact.

For example, the U.S. Energy Information Agency projects that global coal consumption is likely to increase dramatically through at least the next decade based largely on the growth in Asian energy demands, with estimates of Asian consumption varying but on the order of 5 billion tonnes annually. Therefore, it is likely that the same amount of coal will be consumed in the foreseeable future with or without the three northwest terminal projects with pending applications (estimated at a total of 100 million tones). Under such a scenario, emissions from coal consumption would be accounted for in the No Action Alternative and discussed in the cumulative impact discussion as a non-project impact.

C. The EIS's climate change analysis should focus on cumulative impacts using existing information.

Climate change has been recognized in court opinions as essentially a cumulative impact.[2] As discussed above, careful consideration of causality will help assign impacts properly to the No Action Alternative, cumulative impact discussion, and project alternatives. Existing information should also help in presenting cumulative impacts. Specifically, the Intergovernmental Panel on Climate Change ("IPCC") has developed models for projecting climate change through 2100. Fortunately, NEPA encourages lead agencies to use existing resources such as the IPCC models rather than recreate them.

The IPCC models include varying development scenarios, each of which differently affects the pace of climate change. These scenarios illustrate the uncertainties and variables associated with the projections for appropriate consideration. The U.S. Army Corps of Engineers should consider using the IPCC models to identify the No Action Alternative and cumulative impact assessment and to frame the discussion of project level impacts. Again, the Wright Area EIS illustrates how one federal agency has recently used this approach in practice.

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[1] *U.S. Dep't of Tranp. v. Public Citizen*, 541 U.S. 752, 767 (2004)
[2] *Barnes v. U.S. Dept. of Transportation*, 655 F.3d 1124, 1139 (9th Cir. 2011).

Thank you for this opportunity to comment.

Very truly yours,

K&L GATES LLP

By
Eric Laschever

EL:klj

Enclosure

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ATTACHMENT

Jacobs Ranch, and North Antelope Rochelle) from projected operations under the Proposed Actions and alternatives over the life of the actions.

4.2.14.1 Greenhouse Gas Emissions, Global Warming and Climate Change

Ongoing scientific research has identified the potential impacts of anthropogenic (man-made) greenhouse gas (GHG) emissions and changes in biological carbon sequestration due to land management activities on global climate. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused the carbon dioxide equivalent (CO_2e) concentrations to increase in our lower atmosphere. As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documented trends (EPA 2008a). However, the science is not settled and there is strong debate among the scientific community that natural variability is the overwhelming factor influencing climate rather than the accumulation of anthropogenic GHG emissions in the atmosphere.

The National Assessment of the Potential Consequences of Climate Variability and Change, an interagency effort initiated by Congress under the Global Change Research Act of 1990, Public Law 101-606, has confirmed that climate changes, while impacts in and of themselves, can affect other aspects of the environment. The Synthesis Report, the final part of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (available online at http://www.ipcc.ch), was released in preliminary form on November 17, 2007. The Synthesis Report (Bernstein et al. 2007) summarizes the results of the assessment carried out by the three working groups of the IPCC. Observations and projections addressed in the report include:

- "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperature, widespread melting of snow and ice, and rising global average sea level."
- "Observational evidence from all continents and most oceans show that many natural systems are being affected by regional climate changes, particularly temperature increases."

The term global warming is commonly used to refer to surface air temperature changes that are a response to increasing atmospheric GHG concentrations, along with other climate-influencing factors (NOAA 2007). From 1850 to present, historic trend data show an increase of 1° Centigrade (C) (1.8° Fahrenheit) in global mean temperature. However, the warming is not expected to be uniform over the globe, nor is it expected to be the same during all seasons of the year. There have been extended periods (decades) where temperature has dropped or stayed constant. This historic warming over that same period has caused sea levels to rise by about 20 centimeters on average, and has also resulted in changes in climate patterns on land. In some areas near the equator, temperatures have cooled by about 5°C, while closer to the poles, temperatures have risen by equal amounts (Hansen and Lebedeff 1987). In northern latitudes (above 24° N), temperature increases of nearly 1.2°C (2.1° Fahrenheit) have been documented since 1900. The IPCC Fourth Assessment Report found that the "...projected warming in the 21st century shows scenario-independent geographical patterns similar to those observed over the past several decades. "Warming is expected to be greatest over land and at most high northern latitudes, and least over the Southern Ocean and parts of North Atlantic Ocean." Observations and computer models agree that arctic surface air temperatures are warming twice as fast as the global average, which is due partly to what is called the ice-albedo feedback (albedo is a term used to describe the fraction of sunlight reflected by an object) (NOAA 2007). Because temperature is a part of climate, the phenomenon of global warming is both an element of and a driving force behind climate change.

There has been, and continues to be, considerable scientific investigation and discussion as to the causes of the recent historic rise in global mean temperatures, and whether the warming trend will continue. Several activities contribute to the phenomena of climate change, including emissions of GHGs (especially carbon dioxide and methane) from fossil fuel development, large wildfires and activities using combustion engines; changes to the natural carbon cycle; and changes to radiative forces and reflectivity (albedo). It is important to note that GHG emissions will have a sustained climatic impact over different temporal scales (EPA 2008a).

Solar variability may play a role in global climate change, though the magnitude of the influence of increased sun activity is not well understood. Physical aspects of the sun, like sunspots and solar radiation output, are known to vary over time. The intensity of energy from the sun has varied through time and has resulted in global temperature variation.

Human population doubled to two billion from the period 1780 to 1930, then doubled again by 1974. The atmospheric concentrations of GHGs have increased as human populations have increased. More land and resources were used to provide for the needs of these populations. As human activities have increased, carbon-based fuels have been used to provide for those additional energy needs. Forests and vegetation were cleared in order to provide for food production and human use.

Carbon dioxide (CO_2), methane (CH_4), water vapor (H_2O), ozone (O_3), and nitrous oxide (N_2O) are recognized as the major GHGs, although there are other gases that are considered GHGs. These are called "greenhouse gases" because, when released into the atmosphere, they prevent the escape of reflected solar radiation and heat from the Earth's surface. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks (i.e., forests) cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. In this way, the accumulation of GHGs in the atmosphere exerts a "greenhouse effect" on the earth's temperature. Like glass in a greenhouse, these gases trap radiation from the sun and act as an insulator around the Earth, holding in the planet's heat. The present CO_2 concentration of about 385 parts per million (ppm) is about 30 percent above its highest level over at least the last 800,000 years. U.S. average temperature has increased by about 2° Fahrenheit over the last 50 years, which is more than the global average temperature increase (U.S. Global Change Research Program 2009).

According to the IPCC's Synthesis Report (Bernstein et al. 2007):

- "Global atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years."

- "Most of the observed increase in globally-averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations. It is likely there has been significant anthropogenic warming over the past 50 years averaged over each continent (except Antarctica)."

- "There is high agreement and much evidence that with current climate change mitigation policies and related sustainable development practices, global greenhouse gas emission will continue to grow over the next few decades."

- "Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would be very likely to be larger than those observed during the 20th century."

- "There is high confidence that by mid-century, annual river runoff and water availability are projected to increase at high latitudes and in some tropical wet areas and decrease in some dry regions in the mid-latitudes and tropics. There is also high confidence that many semi-arid areas (e.g., Mediterranean Basin, western U.S., southern Africa and northeast Brazil) will suffer a decrease in water resources due to climate change."

- "Anthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized."

- "Anthropogenic warming and sea level rise could lead to some impacts that are abrupt or irreversible, depending upon the rate and magnitude of the climate change."

- "There is high agreement and much evidence that all stabilization levels assessed can be achieved by deployment of a portfolio of technologies that are either currently available or expected to be commercialized in coming decades, assuming appropriate and effective incentives are in place for their development, acquisition, deployment and diffusion and addressing related barriers."

The National Academy of Sciences has confirmed these findings, but also has indicated there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures is more likely than increases in daily maximum temperatures. Increases in temperatures would increase water vapor in the atmosphere, and reduce soil moisture, increasing generalized drought conditions, while at the same time enhancing heavy storm events. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict (EPA 2008a).

Relatively steep elevation gradients between valley floors and adjacent mountain ranges in the western U.S. produce considerable geographic climate variability. Warm, dry, semiarid conditions are typical on valley floors; moist and cool conditions are typical in higher parts of mountain ranges. Different plant communities occur within specific elevation zones. There also have been patterns of historic climatic variation in these areas for more than 10,000 years, during which plant communities gradually shift to higher or lower elevations depending on the direction of temperature and precipitation changes (Tausch et. al. 2004).

Temperature changes can result in shifts of weather patterns (rainfall and winds), which may then affect vegetation and habitat. If global warming trends continue into the foreseeable future, Chambers (2006) and the 2008 report by the U.S. Climate Change Science Program (U.S. Climate Change Science Program 2008a) indicate that the following changes may be expected to occur in the West:

- The amount and seasonal variability of precipitation will increase over most areas. IPCC (2001) climate model scenarios indicate that by 2100, precipitation will increase about 10 percent in summer, about 30 percent in fall, and 40 percent in winter. Less snowfall will accumulate in higher elevations, more precipitation will occur as rain, and snowmelt will occur earlier in the spring because of higher temperatures.

- Streamflow patterns will change in response to reduced snowpacks and increasing precipitation. Peak flows in spring are expected to occur earlier and be of lower magnitude because of snowpack changes. Runoff from greater amounts of winter rainfall will cause higher winter flows.

climate change. To the extent that emission data were available or could be inferred from representative type data, potential GHG emissions that could result from development of the pending LBA tracts in the PRB (Table 1-2) have been identified, as well as emissions that would result from selection of the No Action alternatives.

Although the effects of GHG emissions and other contributions to climate change in the global aggregate are estimable, given the current state of science it is impossible to determine what effect any given amount of GHG emissions resulting from an activity might have on the phenomena of global warming, climate change, or the environmental effects stemming from it. It is therefore not currently possible to associate any particular action and its specific project-related emissions with the creation or mitigation of any specific climate-related effects at any given time or place. However, it is known that certain actions may contribute in some way to the phenomenon (and therefore the effects of) climate change, even though specific climate-related environmental effects cannot be directly attributed to them.

4.2.14.3 U.S. Actions and Strategies to Address Greenhouse Gas Emissions

Potential regulatory policies to address climate change are in various stages of development at the federal, state, and regional levels (USDOE 2009b). A number of bills have been introduced in the U.S. Congress related to global climate change. At this time, there is no national policy or law in place that regulates GHG emissions.

The Lieberman-Warner Climate Security Act, which was introduced in October 2007 by Senators Joseph I. Lieberman (ID-CT) and John W. Warner (R-VA), would establish a cap-and-trade within the United States. In short, the "cap" would set a legal limit on the quantity of greenhouse gases that a region can emit each year and "trade" would allow companies to exchange the permission – or permits – to emit greenhouse gases. The cap would get tighter over time, until by 2050, emissions would be reduced by 63 percent below 2005 levels. The bill was approved by the Senate Environment and Public Works Committee in December, 2007 (http://www.pewclimate.org, accessed 12/21/2007). The bill was introduced in the Senate and read the first time on May 20, 2008. The Boxer-Lieberman-Warner substitute amendment to the Climate Security Act of 2008 was subsequently released by the Senate Environment and Public Works Committee on May 21, 2008. The bill was then read a second time and placed on the Senate Legislative Calendar under General Orders, Calendar No. 742. In June 2008 the U.S. Senate voted to invoke cloture on the Boxer amendment but did not pass the cap-and-trade legislation.

On June 26, 2009, the U.S. House of Representatives passed The American Clean Energy and Security Act of 2009. The legislation includes a federal GHG emissions cap-and-trade program that would take effect in 2012. The declining emissions cap requires that total GHG emissions be 17 percent below 2005 levels by 2020 and 83 percent below 2005 levels by 2050. In November 2009, cores (Section 3.18.2) is more than 20 times less than this estimate that is based on EIA's 2009 report (USDOE 2009c).

Since 1990, when BLM began leasing using the lease by application (LBA) process, total U.S. anthropogenic methane emissions declined from 783.5 million tonnes CO_2e to 737.4 million tonnes CO_2e in 2008. Total coal mining related emissions declined from 106.4 million tonnes CO_2e to 82.0 million tonnes CO_2e during the same time period. The EIA attributes the overall decrease in coal mine emissions of methane since 1990 to the fact that the coal production increases during that time had been largely from surface coal mines that produce relatively little methane (USDOE 2009c).

CBNG is currently being commercially produced on a large scale by oil and gas operators from wells located within and near the WAC LBA tracts. CBNG that is not recovered prior to mining would be vented to the atmosphere during the mining process. Selection of the No Action alternatives would potentially allow more complete recovery of the CBNG from the six WAC LBA tracts in the short term (roughly 10 years), during the time that the three applicant mines' currently leased coal is being recovered. However, BLM's analysis suggests that a large portion of the CBNG resources that are currently present on the tract would be recovered prior to mining under the Proposed Action or Alternatives 2 or 3 (a complete discussion is included in Section 3.3.2.1.2.1). Selection of the No Action alternatives would not be likely to directly decrease U.S. methane emissions attributable to coal mining in the long term because there are multiple other sources of coal that could supply the coal demand beyond the time that the Black Thunder, Jacobs Ranch, and North Antelope Rochelle mines recover the coal in their existing leases.

Nitrous oxide (N_2O) is the one other GHG of concern that is associated with coal mining; however, the largest source in the U.S. is agricultural (about 76 percent comes from fertilization of soils and about 24 percent from management of animal waste) (USDOE 2009c).

Specific levels of significance have not yet been established for GHG emissions, and given the current state of science, it is not yet possible to associate specific actions with the specific climate impacts. As a consequence, impact assessments of effects of specific anthropogenic activities cannot be performed. Tools necessary to quantify incremental climatic changes associated with these GHG emission estimates for the projected coal mine development activities in the PRB are presently unavailable. Technology to conduct such an analysis at this spatial and temporal scale simply does not exist; therefore, conclusions as to the magnitude or significance of the emissions on climate change cannot be reached. The impacts of climate change represent the cumulative aggregation of all worldwide GHG emissions, land use management practices, and the albedo effect. The analysis does provide a meaningful context and measure of the relative significance of coal use from the overall projected PRB coal production on total GHG emissions. Therefore, climate change analysis in this EIS is limited to accounting for and disclosing of factors that contribute to

Power plant buyers attempt to buy coal from suppliers at the most economical prices that meet their needs. PRB coal has competed well in this market due to its low sulfur content, providing a way for electric generators to achieve acid rain reduction requirements. This makes it valuable in lowering sulfur dioxide (SO_2) pollution, as well as competitive mining costs when compared to delivered costs of coal from other coal producing areas.

Wyoming coal production has increased at a more rapid rate than other domestic coal. Coal coming out of the Wyoming PRB is mined using surface mining methods which are generally safer and less labor intensive than underground mining. Rural rangelands are the areas that are mainly mined; they are reclaimed according to WDEQ/LQD's standards (see Section 3.9.4). PRB coal reserves are in thick seams, resulting in more production from areas of similar land disturbance, and lower mining and reclamation costs.

Coal-fired power plants have been identified as principal sources of anthropogenic GHG emissions. Assuming that all coal produced from all coal mines in the Wyoming PRB would be burned to generate electricity; the amount of GHG emissions that could be attributed to that coal production can be estimated. This is done by relating the portion of coal mined in the PRB to the total emission of GHG from all coal mined in the U.S. It is assumed that all PRB coal is used for coal-fired electric generation as part of the total U.S. use of coal for electric generation. This gives an upper estimate of the GHG emissions resulting from the use of the total PRB coal production to produce electricity.

U.S. coal production increased from 1,029.1 million tons in 1990, when the Powder River Federal Coal Region was decertified, to 1,161.4 million tons in 2006, an increase of 12.9 percent (USDOE 2007a). Wyoming coal production increased from 184.0 million tons in 1990 to 444.9 million tons in 2006, an increase of 242 percent (Wyoming Department of Employment 1990 and 2006). The share of electric power generated by burning coal was consistently around 50 percent during that time frame. Also, the percentage of total U.S. CO_2 emissions related to coal consumption was consistently around 36 percent during that same time frame. The percentage of U.S. CO_2 emissions related to the coal electric power sector increased from about 30 percent in 1990 to about 33 percent in 2006 (USDOE 2009c).

In 2008, the Wyoming PRB coal mines produced approximately 451.7 million tons of coal. Using factors derived from laboratory analyses, it is estimated that approximately 749.6 million metric tons (tonnes) of CO_2 would be generated from the combustion of all of this coal (before CO_2 reduction technologies are applied). This number is based on an average Btu value of 8,600 per pound of Wyoming coal and using a CO_2 emission factor of 212.7 pounds of CO_2 per million Btu (USDOE 1994). The estimated 749.6 million tonnes of CO_2 represents approximately 35.3 percent of the estimated 2,125.2 million tonnes of U.S. CO_2 emission from coal combustion in 2008 (USDOE 2009c). In 2008, Wyoming PRB mines accounted for approximately 38.5 percent of the coal produced in the U.S. (USDOE 2009a).

According to the U.S. Department of Energy (USDOE), Energy Information Administration's (EIA's) 2008 Emissions of Greenhouse Gases in the U.S. report (USDOE 2009c) and EIA's 2008 U.S. Coal Report (USDOE 2009a):

- CO_2 emissions represent about 83 percent of the total U.S. greenhouse gas emissions.

- Estimated CO_2 emissions in the U.S. totaled 5,839.3 million tonnes in 2008, which was a 1.5 percent decrease from 2006 (which was 5,928.7 million tonnes).

- Estimated CO_2 emissions from the electric power sector in 2008 totaled 2,359.1 million tonnes, or about 40.6 percent of total U.S. energy-related CO_2 emissions in 2008 (which was 5,814.4 million tonnes).

- Estimated CO_2 emissions from coal electric power generation in 2008 totaled 1,945.9 million tonnes or about 33.5 percent of total energy-related CO_2 emissions and about 82.5 percent of CO_2 emissions from the U.S. electric power sector in 2008.

- Coal production from the Wyoming PRB represented approximately 43.4 percent of the coal used for power generation in 2008, which means that combustion of Wyoming PRB coal to produce electric power was responsible for about 12.8 percent of the estimated U.S. CO_2 emissions in 2008.

As discussed earlier in this chapter, Task 2 of the PRB Coal Review projects coal development in the PRB into the future for the years 2010, 2015, and 2020. Due to the variables associated with future coal production, two projected coal production scenarios (representing an upper and a lower production level) were developed to bracket the most likely foreseeable regional coal production level. In the low scenario, the percentage of coal use for electric generation would stay about the same, assuming that all forms of electric generation would grow at a proportional rate to meet forecast electric demand. In the high scenario, percentage of coal use would also remain about the same, but with PRB coal displacing coal from other domestic coal regions. Table 4-37 shows the estimated annual CO_2 emissions that would be produced from the combustion of all of this coal (before CO_2 reduction technologies are applied).

In the following analysis, the contribution of the pending LBAs (Table 1-2) to cumulative effects on the environment by historic and projected development activity is evaluated. To do this, it is assumed that coal mining will proceed in accordance with existing permit conditions. It is further assumed that this coal will be sold to coal users in response to forecasts of demand for this coal. Historically these users have been electric utilities in the U.S., although there is potential for sales outside the U.S. This coal market is open and competitive and users can buy from the most cost effective suppliers that meet their needs.

Table 4-37. Estimated Annual CO_2 Emissions from Projected PRB Coal Production Levels According to Task 2 or the PRB Coal Review[1].

Projected Coal Production Scenario	Year	Coal Production Rate (million tons per year)	CO_2 Emissions (million tonnes per year)
	2010	411	682
Lower	2015	467	775
	2020	495	821
	2010	479	795
Upper	2015	543	901
	2020	576	956

[1] BLM 2005a

The BLM does not determine the destination of this coal, and the use of the coal is determined by the coal consumer. The electric utilities where this coal has historically been used are throughout the U.S., and have a variety of coal combustion technologies and emission control, but all are licensed by the appropriate regulatory authorities in their locale, and operate under necessary permit requirements, and in compliance with regulation.

Table 4-38 shows the estimated cumulative annual CO_2e emissions produced by all mines in the PRB that currently have LBAs pending (listed in Table 1-2). The cumulative emissions calculated are those associated with the actual mining operations and not from the combustion of the coal produced and sold on the open coal market. The LBA tracts are addressed individually in the following EISs: the South Gillette Area Coal (SGAC) Lease Applications FEIS (BLM 2009g), the Wright Area Coal (WAC) Lease Applications EIS (this document), the West Antelope II Coal Lease Application FEIS (BLM 2008d), and the Hay Creek II Coal Lease Application DEIS (BLM 2010). Under the Proposed Actions and Alternatives 2 and 3, the three applicant mines (Black Thunder, Jacobs Ranch, and North Antelope Rochelle) anticipate producing coal included in the North Hilight Field, South Hilight Field, West Hilight Field, West Jacobs Ranch, North Porcupine, and South Porcupine LBA Tracts at or less than currently permitted levels using existing production and transportation facilities. Estimates of greenhouse gas emissions resulting from the specific mine operations at the Black Thunder, Jacobs Ranch, and North Antelope Rochelle mines from projected operations under the Proposed Actions and alternatives are also included in Section 3.18.2.

The CO_2 emissions related to burning coal that is produced from the three applicant mines to generate electricity would be extended as a result of leasing and mining the WAC LBA tracts. Table 4-39 shows the estimated annual coal production of each of the three applicant mines and the related annual CO_2 emissions that would be produced from the combustion of the coal produced from each of the six WAC LBA tracts as applied for and as reconfigured under Alternative 2 (BLM's preferred alternative), if this coal is burned to generate electric power. The total contribution of CO_2 emissions that would be produced

Table 4-38. Estimated Annual CO_2 Equivalent Emissions* from Coal Production at PRB Mines With Pending LBAs.

Source	**2007**	**With LBA Tracts**
Four SGAC Mines/Four LBA Tracts	0.716	1.182
Three WAC Mines/Six LBA Tracts	1.245	2.503
Antelope Mine/West Antelope II Tract	0.225	0.348
Buckskin Mine/Hay Creek II Tract	0.197	0.197
Total	**2.535**	**4.229**

* CO_2e in million metric tons (tonnes)
Source: BLM 2008g, J&S 2009, WWC 2009

from the combustion of all the coal produced from each tract, if this coal is burned to generate electricity, are shown in Table 4-39. A scenario resulting in the maximum possible annual CO_2 emissions from burning the coal produced from the WAC LBA tracts would occur assuming all six tracts were leased under Alternative 2, and that coal removal from all six tracts were to be sequenced to maintain each of the three applicant mines at full permitted production until the new reserves were fully depleted. Under this scenario, the Black Thunder Mine would be able to extend production for 14.2 years, the North Antelope Rochelle Mine for 11.4 years, and the Jacobs Ranch Mine for 22.8 years.

It is not possible to accurately project the level of CO_2 emissions that burning the coal from the six WAC LBA tracts would produce due to the uncertainties about what emission limits would be in place at that time or where and how the coal in these LBA tracts would be used if they are leased and the coal is mined. Furthermore, the rate of mining and the timing of when coal removal from the tracts would actually begin are only the applicant mines' best estimate. As shown in Tables 2-2 through 2-13, under the No Action alternatives the mines are projecting that after 2008 approximately 10 to 11 years of currently permitted mine life remains. Therefore, coal removal from these six proposed maintenance lease tracts would not begin until approximately 2018 or 2019. More rapid improvements in technologies that provide for less CO_2 emissions, new CO_2 mitigation requirements, or an increased rate of voluntary CO_2 emissions reduction programs could result in significantly lower CO_2 emissions levels than are projected here.

The three WAC applicant mines produced 228.3 million tons of coal in 2008, which represents about 50.5 percent of the coal produced in the Wyoming PRB in 2008. Combustion of those 228.3 million tons of coal to produce electricity produced approximately 378.7 million tonnes of CO_2 emissions, or about 5.4 percent of the total estimated anthropogenic CO_2 emissions produced in the U.S. in 2008, which was approximately 7,052.6 million tonnes (USDOE 2009c). Under the No Action Alternative, CO_2 emissions attributable to burning coal produced by the Black Thunder, Jacobs Ranch, and North Antelope Rochelle mines would be extended at about this level for up to approximately 10 years

Table 4-39. Estimated Annual CO_2 Emissions Produced from Combustion of Coal Produced from WAC LBA Tracts.

Applicant Mine/ LBA Tract	Anticipated Average Annual Coal Production by Applicant Mine[1] (mmtpy)	CO_2 Emissions Related to Annual Coal Production[2] (million tonnes)	Recoverable Coal Added Under Proposed Action[1] (mmt)	Mine Life Added Under Proposed Action[1] (years)	CO_2 Emissions Added by Proposed Action[2] (million tonnes)		Recoverable Coal Added Under Alternative 2[1] (mmt)	Mine Life Added Under Alternative 2[1] (years)	CO_2 Emissions Added by Alternative 2[2] (million tonnes)	
					Total per LBA Tract	Average per Year			Total per LBA Tract	Average per Year
Black Thunder/ North Hilight Field	135	224.0	263.4	2.0	437.1	218.5	652.8	4.8	1,083.0	225.6
Black Thunder/ South Hilight Field	135	224.0	213.6	1.6	354.4	221.5	304.3	2.3	504.8	219.5
Black Thunder/ West Hilight Field	135	224.0	377.9	2.8	626.9	223.9	965.2	7.1	1,601.3	225.5
Jacobs Ranch/ West Jacobs Ranch	40	66.4	669.6	16.7	1,110.9	66.5	912.6	22.8	1,514.0	66.4
North Antelope Rochelle/ North Porcupine	95	157.6	601.2	6.3	997.4	158.3	745.4	7.8	1,236.6	158.5
North Antelope Rochelle/ South Porcupine	95	157.6	309.7	3.3	513.8	155.7	339.3	3.6	562.9	156.4

1 Anticipated coal production rates at each applicant mine, coal tonnages within each LBA tract, and anticipated mine life added by each LBA tract are addressed in Chapter 2.

2 Determined using emission factor of 1.659 tonnes CO^2/ton of coal burned (USDOE 1994).

beyond 2008, while the mines recover their remaining estimated 2,483 million tons of currently leased coal reserves.

It is not likely that selection of the No Action alternatives would result in a decrease of U.S. CO_2 emissions attributable to coal mining and coal-burning power plants in the longer term, because there are multiple other sources of coal that, while not having the cost, environmental, or safety advantages, could supply the demand for coal beyond the time that the Black Thunder, Jacobs Ranch, and North Antelope Rochelle mines complete recovery of the coal in their existing leases.

In 2006, transportation sources accounted for approximately 29 percent of total U.S. GHG emissions (EPA 2008b). Transportation is the fastest growing source of U.S. GHGs, accounting for 47 percent of the net increase in total U.S. emissions since 1990. Transportation is also the largest end-use source of CO_2, which is the most prevalent GHG (EPA 2008b). Transportation is also the largest end-use source of CO_2, which is the most prevalent anthropogenic GHG (EPA 2008b, NOAA 2007).

Carbon dioxide is not the only GHG of concern. Another GHG, methane, in the form of coal bed natural gas (CBNG), is released into the atmosphere when coal is mined. The other major sources of U.S. methane emissions are from agriculture and waste management. According to the EIA (USDOE 2009a and 2009c):

- U.S. anthropogenic methane emissions totaled 722.7 million tonnes CO_2e in 2007 and 737.4 million tonnes CO_2e in 2008.

- U.S. 2008 methane emissions from coal mining were estimated at 82.0 million tonnes CO_2e, which represents approximately 11.1 percent of the U.S. total anthropogenic methane emissions in 2008.

- Surface coal mining operations in the U.S. were estimated to be responsible for methane emissions of about 15.7 million tonnes of CO_2e in 2008, which represents about 2.1 percent of the estimated U.S. anthropogenic methane emissions in 2008, and about 19.1 percent of the estimated methane emissions attributed to coal mining of all types.

- The Wyoming PRB produced approximately 55.5 percent of the coal mined in the U.S. in 2008 using surface mining techniques, which means that Wyoming PRB surface coal mines were responsible for approximately 1.17 percent of the estimated U.S. anthropomorphic methane emissions in 2008. The three applicant mines (Black Thunder, Jacobs Ranch, and North Antelope Rochelle) contributed about 50.5 percent of the Wyoming PRB production in 2008, which is the equivalent of about 4.4 million tonnes CO_2e vented methane emissions. It should be noted that the estimated amount of annual methane emissions vented from the applicant mines based on the gas content analyses of local coal cores (Section 3.18.2) is more than 20 times less than this estimate that is based on EIA's 2009 report (USDOE 2009c).

Since 1990, when BLM began leasing using the lease by application (LBA) process, total U.S. anthropogenic methane emissions declined from 783.5 million tonnes CO_2e to 737.4 million tonnes CO_2e in 2008. Total coal mining related emissions declined from 106.4 million tonnes CO_2e to 82.0 million tonnes CO_2e during the same time period. The EIA attributes the overall decrease in coal mine emissions of methane since 1990 to the fact that the coal production increases during that time had been largely from surface coal mines that produce relatively little methane (USDOE 2009c).

CBNG is currently being commercially produced on a large scale by oil and gas operators from wells located within and near the WAC LBA tracts. CBNG that is not recovered prior to mining would be vented to the atmosphere during the mining process. Selection of the No Action alternatives would potentially allow more complete recovery of the CBNG from the six WAC LBA tracts in the short term (roughly 10 years), during the time that the three applicant mines' currently leased coal is being recovered. However, BLM's analysis suggests that a large portion of the CBNG resources that are currently present on the tract would be recovered prior to mining under the Proposed Action or Alternatives 2 or 3 (a complete discussion is included in Section 3.3.2.1.2.1). Selection of the No Action alternatives would not be likely to directly decrease U.S. methane emissions attributable to coal mining in the long term because there are multiple other sources of coal that could supply the coal demand beyond the time that the Black Thunder, Jacobs Ranch, and North Antelope Rochelle mines recover the coal in their existing leases.

Nitrous oxide (N_2O) is the one other GHG of concern that is associated with coal mining; however, the largest source in the U.S. is agricultural (about 76 percent comes from fertilization of soils and about 24 percent from management of animal waste) (USDOE 2009c).

Specific levels of significance have not yet been established for GHG emissions, and given the current state of science, it is not yet possible to associate specific actions with the specific climate impacts. As a consequence, impact assessments of effects of specific anthropogenic activities cannot be performed. Tools necessary to quantify incremental climatic changes associated with these GHG emission estimates for the projected coal mine development activities in the PRB are presently unavailable. Technology to conduct such an analysis at this spatial and temporal scale simply does not exist; therefore, conclusions as to the magnitude or significance of the emissions on climate change cannot be reached. The impacts of climate change represent the cumulative aggregation of all worldwide GHG emissions, land use management practices, and the albedo effect. The analysis does provide a meaningful context and measure of the relative significance of coal use from the overall projected PRB coal production on total GHG emissions. Therefore, climate change analysis in this EIS is limited to accounting for and disclosing of factors that contribute to climate change. To the extent that emission data were available or could be inferred from representative type data, potential GHG emissions that could result from development of the pending LBA tracts in the PRB (Table 1-2) have been identified, as well as emissions that would result from selection of the No Action alternatives.

Although the effects of GHG emissions and other contributions to climate change in the global aggregate are estimable, given the current state of science it is impossible to determine what effect any given amount of GHG emissions resulting from an activity might have on the phenomena of global warming, climate change, or the environmental effects stemming from it. It is therefore not currently possible to associate any particular action and its specific project-related emissions with the creation or mitigation of any specific climate-related effects at any given time or place. However, it is known that certain actions may contribute in some way to the phenomenon (and therefore the effects of) climate change, even though specific climate-related environmental effects cannot be directly attributed to them.

4.2.14.3 U.S. Actions and Strategies to Address Greenhouse Gas Emissions

Potential regulatory policies to address climate change are in various stages of development at the federal, state, and regional levels (USDOE 2009b). A number of bills have been introduced in the U.S. Congress related to global climate change. At this time, there is no national policy or law in place that regulates GHG emissions.

The Lieberman-Warner Climate Security Act, which was introduced in October 2007 by Senators Joseph I. Lieberman (ID-CT) and John W. Warner (R-VA), would establish a cap-and-trade within the United States. In short, the "cap" would set a legal limit on the quantity of greenhouse gases that a region can emit each year and "trade" would allow companies to exchange the permission – or permits – to emit greenhouse gases. The cap would get tighter over time, until by 2050, emissions would be reduced by 63 percent below 2005 levels. The bill was approved by the Senate Environment and Public Works Committee in December, 2007 (http://www.pewclimate.org, accessed 12/21/2007). The bill was introduced in the Senate and read the first time on May 20, 2008. The Boxer-Lieberman-Warner substitute amendment to the Climate Security Act of 2008 was subsequently released by the Senate Environment and Public Works Committee on May 21, 2008. The bill was then read a second time and placed on the Senate Legislative Calendar under General Orders, Calendar No. 742. In June 2008 the U.S. Senate voted to invoke cloture on the Boxer amendment but did not pass the cap-and-trade legislation.

On June 26, 2009, the U.S. House of Representatives passed The American Clean Energy and Security Act of 2009. The legislation includes a federal GHG emissions cap-and-trade program that would take effect in 2012. The declining emissions cap requires that total GHG emissions be 17 percent below 2005 levels by 2020 and 83 percent below 2005 levels by 2050. In November 2009, the Senate Environment and Public Works Committee passed a GHG cap-and-trade bill that borrows much from the House American Clean Energy and Security Act and tightens the GHG emissions cap to 20 percent below 2005 levels by 2020. Several other committees are expected to weigh in before the final bill is crafted and brought before the Senate floor (USDOE 2009c).

On April 2, 2007, in *Massachusetts v. EPA*, the U.S. Supreme Court found that GHGs are air pollutants covered by the Clean Air Act (CAA). The Court held that the Administrator of the EPA must determine whether or not emissions of GHGs from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. At that time, the court directed EPA to review the latest science on climate change in order to make a determination. On April 17, 2009, the Administrator signed Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the CAA. On December 7, 2009, the Administrator signed two distinct findings regarding GHGs under Section 202(a) of the CAA. The Administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)—in the atmosphere threaten the public health and welfare of current and future generations and that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to climate change. The findings do not in and of themselves impose any emission reduction requirements but rather allow EPA to finalize the GHG standards proposed earlier in 2009 (EPA 2009c). The agency is now poised to regulate CO_2 as a pollutant, and the findings allow EPA to begin regulating GHG emissions from power plants, factories and major industrial polluters, although the precise details of that regulation have yet to be worked out. An endangerment finding under one provision of the CAA would not by itself automatically trigger regulation under the entire Act.

As a result of the Supreme Court's decision in 2007, the EPA drafted the Prevention of Significant Deterioration/Title V Greenhouse Gas Tailoring Rule. The draft rule, published in the Federal Register on October 27, 2009, limits the applicability of CO_2 emissions standards to new and modified sources that emit more than 25,000 tonnes CO_2e annually, rather than applying the threshold of 250 tons per sources for triggering the regulation of criteria pollutants specified in Title V of the CAA. At the 25,000 tonnes CO_2e annual level, the EPA expects that 14,000 large industrial sources, which are responsible for 70 percent of the U.S. GHG emissions, will be required to obtain Title V operating permits. That threshold would cover large power plants, refineries, and other large industrial operations (USDOE 2009c).

EPA has issued the Final Mandatory Reporting of Greenhouse Gases Rule (EPA 2010). The rule requires reporting of GHG emissions from large sources and suppliers in the U.S., and is intended to collect accurate and timely emissions data to inform future policy decisions. Under the rule, suppliers of fossil fuels or industrial greenhouse gases, manufacturers of vehicles and engines, and facilities that emit 25,000 tonnes or more per year of GHG emissions are required to submit annual reports to EPA. The gases covered by the proposed rule are carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and other fluorinated gases including nitrogen trifluoride (NF_3) and hydrofluorinated ethers (HFE). The final rule was signed by the Administrator on September 22, 2009. EPA's new reporting system will provide a better understanding of where GHGs are coming from and will guide development of the best possible policies and programs to reduce emissions. Reporters must begin to monitor their emissions on January 1, 2010 and the first annual emissions reports will be due in 2011 (EPA 2010).

The American Recovery and Reinvestment Act of 2009 ("The Stimulus Bill") was signed into law by President Obama on February 17, 2009, and under the Act, the U.S. DOE received $36.7 billion to fund renewable energy, carbon capture and storage, energy efficiency, and smart grid projects, among others. The projects are expected to provide reductions in both energy use and GHG emissions (USDOE 2009c).

Federal, state, and local governments are also developing programs and initiatives aimed at reducing energy use and emissions. The 2002 Clear Skies and Global Climate Change Initiative is a voluntary national program to reduce greenhouse gas emissions. There are federal tax incentives for energy efficiency and conservation, and some states have renewable energy and energy efficiency policies. Regional initiatives have been started in the northeast (Northeast Regional Greenhouse Gas Initiative) as well as the Western Climate Initiative in the western states. At this time, it is not possible to predict how all of these programs would be melded into a national regulatory process if one were to be enacted.

A number of U.S. financial and corporate interests have acknowledged that enactment of federal legislation limiting the emissions of CO_2 and other greenhouse gases seems likely (NARUC 2007). There is uncertainty about anticipated CO_2 emission limits and carbon capture/sequestration regulations. This has caused some proponents to cancel or delay their proposed projects that use existing and emerging technologies to produce electricity from coal (Casper Star Tribune 2007c). Capacity planning decisions for new generating plants and investment behavior in the electric power sector are being affected by the potential impacts of policy changes that could be made to limit or reduce GHG emissions (USDOE 2009b).

4.2.14.4 Current and Future Energy Sources and Emissions of Greenhouse Gases in the U.S.

The key determinant of energy consumption is population. Population influences demand for goods, services, housing, and travel. In the U.S. the population has increased by about 20 percent and energy consumption by a comparable 18 percent since 1990, with variations in energy use per capita depending on factors such as weather and the economy. To meet the nationwide consumer demand and requirement for energy, coal is burned in power plants to produce electricity. Coal is an important component of the U.S. energy supply partly because it is the most abundant domestically available fossil fuel (USGS 2002b). One-quarter of the world's coal reserves are found within the U.S.; the energy content of U.S. coal resources exceeds that of all the world's known recoverable oil; and coal resources supply more than half of the electricity consumed by Americans (USDOE 2008 and 2009d). Many countries are even more reliant on coal for their energy needs than is the United States. More than 70 percent of the electricity generated in China and India comes from coal (USGS 2000). The value of coal is partially offset by the environmental impacts of coal combustion (USGS 2000).

In the USDOE 2007 Annual Energy Outlook, energy-related CO_2 emissions were projected to grow by about 35 percent from 2006 to 2030 (USDOE 2007b). By comparison, the USDOE 2008 Annual Energy Outlook projected energy-related CO_2 emissions to grow by 16 percent, from 5,890 million tonnes in 2006 to 6,851 million tonnes in 2030 (USDOE 2008). However, USDOE's 2009 Annual Energy Outlook projects energy-related CO_2 emissions to grow by 7 percent, from 5,991 million tonnes in 2007 to 6,414 million tonnes in 2030. The mix of sources for these generation projections include coal, natural gas, nuclear, liquids (petroleum), hydro-power, and non-hydro renewables (wind, solar, etc.). The most recent, lower projected emissions growth rate is due to a slower demand growth combined with increased use of renewables and a declining share of electricity generation that comes from fossil fuels (USDOE 2009b).

Total U.S. anthropogenic GHG emissions in 2008 were 2.2 percent below the 2007 total. The decline in total emissions–from 7,209.8 million tonnes CO_2e in 2007 to 7,052.6 million tonnes in 2008–was largely the result of a 177.8 million tonne CO_2e drop in CO_2 emissions. There were small percentage increases in emissions of other GHGs, but those increases were more than offset by the drop in CO_2 emissions. The decrease in U.S. CO_2 emissions in 2008 resulted from higher energy prices, economic contraction, and lower demand for electricity (USDOE 2009c).

Energy-related CO_2 emissions dominate (about 81 percent in 2008) the total U.S. GHG emissions. Petroleum is the largest fossil fuel source for energy-related CO_2 emissions, contributing 41.9 percent of the total, whereas coal is the second-largest fossil fuel contributor, at 36.5 percent. Petroleum made up 44.6 percent of total fossil fuel energy consumption in 2008, as compared with coal's 26.8 percent. Natural gas accounted for 28.5 percent of the fossil fuel energy use in 2008, but only 21.4 percent of total energy-related CO_2 emissions. Energy-related CO_2 emissions account for 98 percent of the total U.S. CO_2 emissions (USDOE 2009c).

The U.S. emits about 1,900 million tonnes annually from coal-fired power plants–33 percent of total energy-related CO_2 emissions and 81 percent of CO_2 emissions from the U.S. electric power sector (USDOE 2009c). If public sentiment results in changed electric demand, or if GHG emissions are ultimately regulated, the demand forecast for coal for electric generation could change. The potential impacts of policy changes that could be made to limit or reduce GHG emissions is affecting planning decisions for new power plants, particularly with respect to new coal-fired capacity.

To assess the national electric generation portfolio and the mix of future electric generation technologies, BLM reviewed the Annual Energy Outlook 2010 Report (USDOE 2009e). An independent study representing a forecast to the year 2035, it examined the ability of the domestic electric generation industry to alter the present electric generation portfolio (mix of electric generation technologies). This report compares the 2035 projection to the electric generation mix that existed in 2008. This most recent report incorporates the 2009 downturn in electric demand, which resulted from lowered electric demand for manufacturing in the depressed domestic economy of 2009. This forecast estimated the percentage of coal-fired electric generation in the domestic electric generation portfolio at 44 percent by 2035, based on a slowing in electric demand through 2035, and a doubling, to 17 percent, of renewable electric generation in the domestic electric generation portfolio by 2035. Based on this study, even with a considerably more optimistic projection for renewable sources, coal use continues to be projected as the largest portion of the domestic electric fuel mix.

Technologies for producing cleaner, more efficient and more reliable power from coal are currently available and are being improved. These include advanced pulverized coal, circulating fluidized bed, coal gasification or Integrated Gasification Combined Cycle (IGCC), and carbon sequestration or carbon capture and storage (CCS) technologies. Systems that utilize carbon capture technologies are being developed to capture at least 90 percent of emitted CO_2, which would be stored within geological formations (i.e., oil and gas reservoirs, saline formations, unmineable coal seams). These technologies are not yet commercially established due to extremely high capital costs and low system reliability, which are the biggest obstacles to integration of these technologies into the power market. However, regulatory uncertainties are affecting planning decisions, for example, unless new coal-fired power plants are equipped with CCS equipment they could incur higher costs as a result of higher expenses for siting and permitting. However, costs would not be directly affected by regulatory uncertainty for nuclear and renewable power plants because they do not emit GHGs (USDOE 2009c).

The Electric Power Research Institute (EPRI) has also attempted to identify a scenario of how the full portfolio of technologies to provide for electric energy would respond if national policy were to require that CO_2 emissions be reduced to 1990 levels (James 2007). EPRI updated this research in an October 2009 report, The Power to Reduce CO_2 Emissions: The Full Portfolio (EPRI 2009), which used the EIA's Annual Energy Outlook 2009 Report for comparison.

The EPRI study predicts that national policy that forces a reduction of CO_2 emissions to 1990 levels would promote increased energy efficiency, and the growth of "non carbon" sources such as nuclear and renewable. Renewable sources include wind and solar, as well as emerging technologies like tidal power, river turbines and others reported in the media. Hydropower is limited because most opportunities for hydropower have been used or require large infrastructure. Use of carbon based sources such as natural gas and petroleum are less than forecasted by the USDOE EIA, while coal use remains about the same in the EPRI forecast, mostly due to forecasted improvement in GHG emission reduction in coal-fueled generation. Both EIA and EPRI forecast increases in electricity cost.

Figure 4-13 shows the current (2008) electric generation mix, compared to the 2035 EIA forecast (USDOE 2009e) as well as the older 2030 EPRI forecast (EPRI 2009). Both forecasts are consistent that the amount of electric generation fueled by coal is expected to drop from nearly fifty percent of the total presently to about 40 percent of the total in future years. Coal is forecast to remain as the major electric generation component until at least 2035. Renewable energy (other than hydroelectric) and nuclear are forecast to increase, while natural gas and other fossil fuels (i.e., oil) are forecast to remain stable or decrease to a degree.

In 2003 the USDOE initiated the FutureGen project–a commercial-scale coal-fired power plant incorporating IGCC with CCS–thus being the first facility of its kind to combine and test several cutting-edge technologies. FutureGen is a public-private partnership between the USDOE and the FutureGen Alliance, a non-profit organization that represents some of the world's largest coal producers and electric utilities, to build a first-of-its-kind coal-fired near-zero emissions power plant. The FutureGen Alliance and the USDOE reached an agreement in June 2009 to proceed with the project, which will be located at Mattoon, Illinois. The project proposes to produce electricity by turning coal into gas, remove impurities, extract CO_2 from the waste stream, and then sequester the CO_2 underground. The Alliance is responsible for design, construction, and operation of the facility, and USDOE is responsible for independent oversight and coordinating participation of international governments. USDOE's financial contribution will come from the American Recovery and Reinvestment Act. The USDOE issued a NEPA Record of Decision (ROD) on July 14, 2009 to move forward toward the first commercial scale, fully integrated, carbon capture and sequestration project in the country (USDOE 2009f). The ROD allows the Alliance to proceed with site-specific activities, and over the following 8 to 10 months the project design, costs and funding plan will be refined. The USDOE and the Alliance will then decide in early 2010 whether to continue the project through construction and operation. When fully operational the FutureGen facility will produce 275 MW

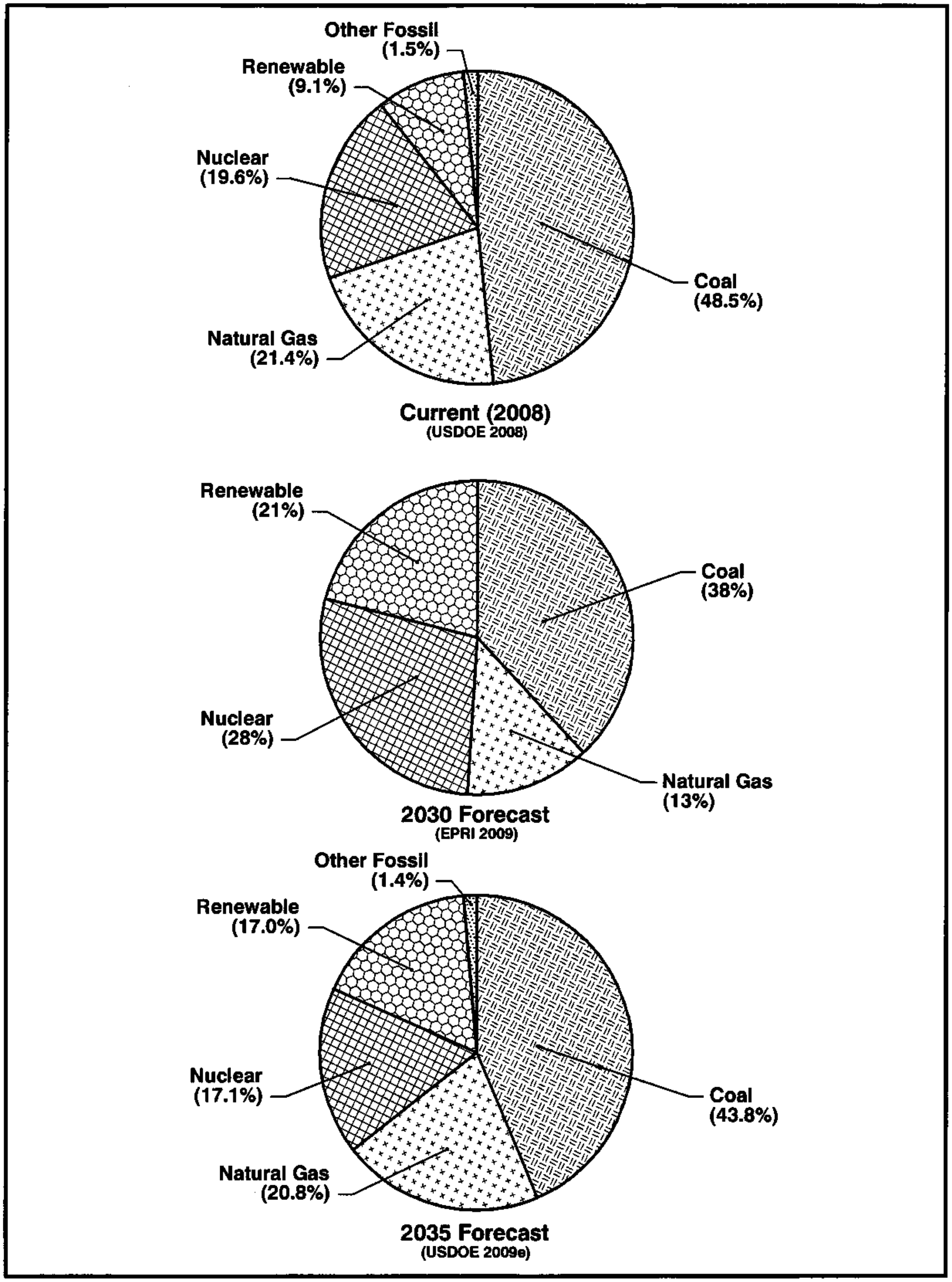

Figure 4-13. Current and Forecast Mix of Electric Generation Sources.

of power and capture 90 percent of the carbon emissions; however, it may be operated at a 60 percent capture rate in the first 3 years to validate plant integration and sequestration capability, as well as manage the startup risks and costs. This technology should sequester a million tons of CO_2 annually (USDOE 2009f).

Other methods of generating electricity that result in fewer GHG emissions than burning coal include natural gas, nuclear, hydroelectric, solar, wind, and geothermal resources.

Natural gas plays a key role in meeting U.S. energy demands. Natural gas, coal and oil supply about 85 percent of the nation's energy, with natural gas currently supplying about 22 percent of the total. The percent contribution of natural gas to the U.S. energy supply is expected to remain fairly constant for the next 20 years. According to EIA's 2010 Annual Energy Outlook (USDOE 2009e), concerns about GHG emissions have little effect on construction of new capacity fueled by natural gas.

Unconventional natural gas resources are expected to play a larger role in the demand for natural gas for electricity generation (USDOE 2009b and 2009e). Natural gas production from hydrocarbon rich shale formations, known as "shale gas" is one of the most rapidly expanding trends in onshore domestic oil and gas exploration and production today. Analysts estimate that by 2011, most new natural gas reserves will come from unconventional shale gas reservoirs (NETL 2009). From 2007 to 2030, domestic production of natural gas is expected to increase by 22 percent (USDOE 2009b).

The nuclear share of power generation is projected by EPRI (2009) to increase to about 28 percent by 2030 as the addition of new power plants and upgrades at existing units increases overall capacity and generation, and the nuclear power share of total electricity generation remains somewhat constant at 17-19 percent by 2035 according to EIA (USDOE 2009e).

The share the nation's total electricity generation from renewables (i.e., biomass-based diesel, hydroelectricity, geothermal, solar, wind, ethanol), supported by federal tax incentives and state renewable programs, is expected to increase from 9 percent in 2008 to 17 percent in 2035 (USDOE 2009e). EPRI (2009) is more optimistic with renewable sources reaching 21 percent by 2030.

The estimated cumulative CO_2 emissions that would be produced annually from the conventional combustion of the coal produced from the six WAC LBA tracts, if they are all leased under either the Proposed Action or Alternative 2 (Section 4.2.14.2) are based on the applicant mines' projected future mining rates. Those estimates present a scenario that assumes the demand for coal in the future would not differ from current demand, technologies for producing cleaner, more efficient and more reliable power from coal (i.e., advanced pulverized coal, circulating fluidized bed, IGCC, and CCS) would not yet be commercially established, and an explicit federal policy has not been enacted to limit or reduce U.S. GHG emissions. However, if there is a strong shift toward natural gas, nuclear, and renewable power generation, as well as fossil technologies with CCS equipment, those estimates of CO_2 emissions from the combustion of coal produced from the PRB would be lower than estimated in the prior discussion (Section 4.2.14.2).

4.2.14.5 Mercury, Coal Combustion Residues, and Other By-Products

One of the concerns associated with burning coal for the production of electricity is the release of elements from coal to the environment (USGS 2000). When coal is burned, GHGs as well as mercury and other compounds and elements, including lead and cadmium, that may have direct or indirect effects on human health are released (EPA 2009d). The principal pollutants generated by coal combustion that can cause health problems are particulates, sulfur and nitrogen oxides, trace elements (including arsenic, fluorine, selenium, and radioactive uranium and thorium), and organic compounds generated by incomplete coal combustion (USGS 2000).

In coal combustion, concentrations of these elements and compounds vary depending on the chemistry of the coal deposits and on the type of air pollution controls in place when the coal is burned. Coal use in developing countries can potentially cause serious human health impacts (USGS 2000). Some coal mined in China is known to have caused severe health problems in several local populations because the coal was mined and burned with little regard to its chemical composition (USGS 2000). Chinese coals that contained high levels of arsenic, fluorine, selenium, and polycyclic aromatic hydrocarbons have caused severe, life-threatening health impacts to some residents that burned the coal in unvented stoves in their homes (USGS 2000).

Coal that is burned in the U.S. generally contains low to modest concentrations of potentially toxic trace elements and sulfur (USGS 2000). Specifically, PRB coal is recognized as being a clean burning coal due to its low sulfur and low ash properties. In a 2002 analysis conducted by USGS (2002b), PRB coal was found to contain, on average, approximately eight times less sulfur than coals being utilized from the Appalachian and Illinois basins to supply U.S. power plants (feed coal). PRB feed coal was also found to contain nearly half as much uranium (8.9 ppm), seven times less arsenic (17 ppm), five times less lead (19 ppm), and three times less cadmium (1.1 ppm) as compared to Appalachian and Illinois basin feed coals. When burned, PRB coal produced, on average, 38 percent less fly ash than Appalachian and Illinois basin coals (USGS 2002b). The fly ash resulting from combusted PRB coal contained approximately 39 times less mercury than fly ash that was generated from combusted Appalachian and Illinois basin coal (USGS 2002b).

Additionally, many U.S. coal burning power plants use sophisticated pollution-control systems that efficiently reduce the emission of hazardous elements (USGS 2000). The EPA conducted a detailed study of possible health impacts