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6.1 INTRODUCTION

This section discusses a reasonable range of alternatives for the Hydrogen Energy California Project (HECA or Project), and examines the ability of these alternatives to feasibly attain most of the Project objectives set forth in Section 6.1.2, to minimize or avoid significant environmental impacts of the Project, and to meet the purpose and need set forth in Section 6.1.3.

The following terminology will be used throughout this section:

- **Project or HECA.** The Integrated Gasification Combined-Cycle (IGCC) electrical generation, low-carbon nitrogen-based products Manufacturing Complex and associated equipment and processes, including its linear facilities.

- **Project Site or HECA Project Site.** The 453-acre parcel of land on which the HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes (excluding off-site portions of linear facilities), will be located

- **Occidental of Elk Hills, Inc. (OEHI) Project.** The use of the carbon dioxide (CO_2) for enhanced oil recovery (EOR) at Elk Hills Oil Field (EHOF) and resulting sequestration, including the CO_2 pipeline and associated EOR equipment.

- **OEHI Project Site.** The portion of land in the EHOF in which the CO_2 produced by HECA will be used for EOR and resulting sequestration.

- **Controlled Area.** The 653 acres of land adjacent to the Project Site over which HECA will control access and future land uses.

- **Proposed Action.** Department of Energy **(**DOE) financial assistance for the funded components of the Project. The Proposed Action applies to the HECA Project Site (including the integrated gasification combined-cycle electrical generation facilities, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes, except for the air separation unit), potable water linear, transmission linear, process water linear , natural gas linear and railroad spur.

- **Connected Actions.** Components of the Project that will not be funded by DOE, which include the air separation unit, OEHI CO_2 pipeline, OEHI CO_2 EOR and sequestration facilities, or certain other facilities.

- **Gasification Block.** Process units needed to produce hydrogen (H_2)- rich fuel—i.e., Gasification, Shift, Low-Temperature Gas Cooling (LTGC), Mercury Removal, Acid Gas Removal (AGR), Sulfur Recovery, Tail Gas Treating, EOR CO_2 Compression Units, and associated utilities.

- **Power Block.** Equipment associated with combined cycle power generation—i.e., combustion turbine (CT), steam turbine (ST), generator, heat recovery steam generator (HRSG), condenser, switchyard, and associated support systems.

- **Manufacturing Complex.** Process units needed to produce low-carbon, nitrogen-based products—i.e., Pressure Swing Adsorption (PSA), CO_2 Purification and Compression, Ammonia Synthesis, Urea, Urea Pastillation and Storage, Nitric Acid, Ammonium Nitrate, Urea Ammonium Nitrate (UAN) Units, and associated utilities.

6.1.1 Regulatory Background

The Energy Facilities Siting Regulations California Code of Regulations (CCR), guidelines titled *Information Requirements for an Application* require an applicant to consider:

> ". . . the range of reasonable alternatives to the project, including the No Action Alternative, that would feasibly achieve most of the basic objectives of the project, but would avoid or substantially lessen any of the significant impacts of the project, and an evaluation of the comparative merits of the alternatives" (20 CCR Appendix B).

The California Environmental Quality Act of 1970 (CEQA) also requires consideration of:

> ". . . a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant impacts of the project, and evaluate the comparative merits of the alternatives" (14 CCR § 15126.6[a]).

Thus, the focus of an alternatives analysis should be on those alternatives that:

> ". . . could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects" (14 CCR § 15126.6[c]).

The CEQA Guidelines further provide that

> ". . . among the factors that may be used to eliminate alternatives from detailed consideration in an Environmental Impact Report" (14 CCR § 15126.6[c]) are:
>
> - Failure to meet most of the project objectives;
> - Infeasibility;
> - Inability to avoid significant environmental impacts.

The National Environmental Policy Act (NEPA) similarly requires that federal agencies identify and analyze a reasonable range of alternatives in an Environmental Impact Statement (EIS) prior to approving or taking federal action that could have a significant impact on the environment. The EIS must rigorously explore and objectively evaluate all reasonable alternatives that meet the purpose of and need for the proposed action, including those alternatives that are not within the jurisdiction of the lead agency.

> "Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant" (Council on Environmental Quality (CEQ), 1983).

NEPA also requires a brief explanation of the reasons for eliminating an alternative from detailed study.

The Project objectives, as well as DOE's purpose and need statement, are outlined in Section 6.1.2 and Section 6.1.3.

6.1.2 Project Objectives

California is the most populous state in the United States. Its population is projected to continue to grow at a rate of just over 1 percent per year until 2030, putting California above the national population growth rate of about 0.8 percent per year. The combination of continued population growth and long-term economic prosperity will result in robust growth in energy demand. At the same time, the state has set aggressive environmental objectives, including reductions in levels of greenhouse gas (GHG) emissions. The Project represents an opportunity to satisfy several of California's environmental policy objectives regarding low-carbon power generation and GHG reduction, while supporting sustainable economic growth. The Project will respond to the future energy demands of California and will play an important role in eventually meeting the state's objective of reducing CO_2 emissions to 1990 levels by 2020.

A critical component of the alternatives analysis is the ability of the alternatives to feasibly attain most of the basic objectives of the Project. Project objectives are summarized as follows:

- Provide dependable, low-carbon electricity to help meet future power needs and to help "back-up" intermittent renewable power sources, such as wind and solar, to support a reliable power grid.

- Enhance the production and availability of in-state nitrogen-based products for use in agricultural, transportation, and industrial applications by producing approximately 1 million tons per year of low-carbon products, including urea, UAN, and anhydrous ammonia.

- Conserve domestic energy supplies and enhance energy security by using abundant solid feedstocks, coal and petroleum coke, to generate electricity and manufacture low-carbon nitrogen-based products.

- Mitigate impacts related to climate change by dramatically reducing average annual GHG emissions relative to those emitted from a conventional power plant and/or nitrogen-based product manufacturing facility by capturing, at a rate of at least 90 percent, and sequestering CO_2.

- Use captured CO_2 for EOR to produce additional oil reserves.

- Demonstrate advanced solid-fuel-based technologies that can generate clean, reliable, and affordable electricity in the United States and prove out carbon capture and sequestration as a viable method for reducing the carbon footprint of power generation and manufacturing.

- Facilitate and support the development of H_2 infrastructure in California by supplementing the quantities of H_2 available for future energy and transportation technologies.

- Help restore local groundwater quality and enhance agricultural production by using brackish groundwater water that currently threatens local agriculture.

- Minimize environmental impacts associated with the construction and operation of the Project through technology selection, Project design, and implementation of feasible mitigation measures, where necessary.

- Site the Project at a location over which HECA will have control, and which offers reasonable access to necessary infrastructure, including natural gas, process water supply, transmission and rail interconnection, and geologic formations appropriate for CO_2 EOR and sequestration.

- Ensure the economic viability of the Project by integrating electricity production with the manufacture of multiple products to meet market demand.

- Meet all requirements necessary to secure and retain DOE funding for the Project.

6.1.3 DOE's Purpose and Need

The purpose and need of the Proposed Action (i.e., providing limited financial assistance to the Project) is to advance the Clean Coal Power Initiative (CCPI) objectives as established by Congress: the commercialization of clean coal technologies that advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies that are currently in commercial service.

The Project will fulfill a need for additional baseload electricity generation by producing a nominal 300 megawatts (MW) output of low-carbon baseload electricity to the grid during operations, feeding major load sources, while providing environmental benefits regarding GHGs (among other benefits), and helping California to meet its obligations under California Assembly Bills 32 and 1925, California Senate Bill 1368, and California Executive Orders S-7-04 and S-3-05. These policies and executive orders address the need to reduce GHG emissions from power plants.

Additional details regarding DOE's purpose and need for the Project are provided in Appendix B1.

6.2 NO PROJECT/NO ACTION ALTERNATIVE

Under the No Project/No Action Alternative, HECA would not receive authorization from the California Energy Commission (CEC) to construct and operate a low-carbon IGCC polygeneration facility or receive funding from DOE to build the facility. As a result, the Project would not be developed. The potential environmental impacts identified in this Application for Certification (AFC) Amendment associated with the construction and operation of the Project would not occur. Electricity that would have been produced by the Project to help meet future electrical power needs would have to be generated by another source; electricity would be generated by other power-generation facilities that operate less efficiently and release larger quantities of air pollutants and GHG emissions than the Project. Likewise, nitrogen-based

products that would have been generated by the Project would have to be produced by another source with a higher carbon footprint.

The No Project/No Action Alternative would not contribute to the goal of the CCPI Program, which is to accelerate commercial deployment of advanced coal technologies that provide the United States with clean, reliable, and affordable energy. Therefore, the No Project/No Action Alternative would not meet DOE's purpose and need, as defined in Section 6.1.3.

The No Project/No Action Alternative fails to achieve all Project objectives identified above related to production of energy, advancement of technology, and enhancement of energy security. Failure to achieve the Project objectives would also mean that the No Project/No Action Alternative would not further the important state laws and policies discussed below.

In 2005, the state energy agencies issued Energy Action Plan II (EAP II) followed by an update in 2008. EAP II emphasized "[the] need to develop and tap advanced technologies to achieve [the] goals of reliability, affordability and an environmentally sound energy future." The Project capital and operating costs, as well as the associated environmental benefits, were balanced such that the Project could provide baseload low-carbon power and new technology development. This technology development would not be advanced under the No Project/No Action Alternative.

California Assembly Bill 32 (AB 32) requires reduction of GHG emissions to 1990 levels by 2020. Furthermore, Executive Order S-3-05 sets a state target of reducing GHG emissions to 80 percent below 1990 levels by 2050. AB 32 requires the California Air Resources Board (CARB) to assign emissions targets to each sector in the California economy and to develop regulatory and market methods to ensure compliance, which takes effect in 2012. The satisfaction of AB 32 and Executive Order S-3-05 will require zero- or low-carbon power generation for facilities that are brought online in the next decade. In the absence of new low-carbon technologies policies, the state will miss its GHG reduction targets by a large margin. The Project's reliable low-carbon baseload generation will help California meet its GHG goals. The No Project/No Action Alternative does not advance these goals.

Senate Bill 1368 (SB 1368), passed in 2006, established an Emission Performance Standard (EPS) for GHG emissions from power plants used to serve baseload power in California. One of the requirements of SB 1368 is that utilities may sign long-term contracts (5 years or more) only with power plants that produce no more GHG emissions than a natural-gas combined-cycle (NGCC) power plant. Pursuant to SB 1368, the California Public Utilities Commission has set the EPS at 1,100 pounds of CO_2 per megawatt hour of electricity generated by the Project. This law effectively prohibits California utilities from owning or contracting long term with coal-fired power plants, in or out of state, unless they are operated with carbon capture and sequestration (CCS). The intended effect of SB 1368 is to encourage baseload low-carbon power production. The Project's GHG emissions will be well below this threshold requirement.

The HECA Manufacturing Complex will have significantly lower carbon emissions than traditional fossil-fueled production facilities. This is of heightened importance because carbon emissions are a component of GHGs that has been linked to global warming. Across the HECA facility, at least 90 percent of the CO_2 in the syngas will be captured as high-purity CO_2 and

injected into deep-underground hydrocarbon reservoirs for sequestration. Based on this capture rate and expected production volumes, HECA nitrogen-based products will save significant GHG emissions, compared to similar production facilities using natural gas.

AB 1925, passed in 2006, required CEC to provide a report to the California legislature by November 2007 "with recommendations for how the state can develop parameters to accelerate the adoption of cost-effective geologic carbon sequestration strategies." This type of legislation clearly demonstrates California's commitment to supporting and encouraging in-state CCS demonstration technology. Again, the No Project/No Action Alternative would hinder the execution of this legislative mandate.

The use of a coal/petcoke fuel blend for the life of the facility provides the Project the greatest operational and commercial flexibility. The Project will add a nominal 300 MW of baseload low-carbon power to the grid, provide environmental benefits with regard to GHGs (among other benefits), and help California meet its obligations under AB 32, SB 1368, and AB 1925. In contrast, the No Project/No Action Alternative fails to meet the basic Project Objectives, and therefore fails to advance these goals. As a result, the No Project/No Action Alternative was rejected in favor of the proposed Project.

In accordance with CEQA Guidelines §15126.6(e)(2) and Council on Environmental Quality Regulations for implementing NEPA §1502.14(d), the No Project/No Action Alternative analysis set forth below discusses the existing conditions at the time environmental analysis was commenced, as well as what would be reasonably expected to occur in the foreseeable future if the Project were not approved. A more detailed discussion of existing conditions is provided in Section 5 of this AFC Amendment.

6.2.1 Air Quality

The Project Site is located near the unincorporated community of Tupman, Kern County, in the jurisdiction of the San Joaquin Valley Air Basin (SJVAB), which is the second-largest air basin in the state. The SJVAB has an inland Mediterranean climate, averaging more than 260 sunny days per year. The valley floor is characterized by warm, dry summers and cooler winters. The Project Site receives an average of 6 inches of rain annually. During the winter, average low and high temperatures vary from the mid-30s to the mid-50s, respectively. About 80 percent of the precipitation in the area occurs from November through March.

SJVAB is designated as an extreme non-attainment area for ozone (O_3); SJVAB is designated as a federal and state non-attainment area for particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). The basin was designated as a federal attainment area for particulate matter less than 10 microns in diameter (PM_{10}) in 2008; however, the basin is designated as state non-attainment for PM_{10}. SJVAB is designated as an attainment area for all other state and federal criteria pollutants. Air quality monitoring data representing existing air quality in the Project Area were obtained from the U.S. Environmental Protection Agency Air Data (2012) and the California Air Resources Board-California Air Quality Data website (2012). The monitoring data indicate that the air is in compliance with all National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) for NO_2, CO, and SO_2 for all averaging periods. However, the monitoring data indicate that the NAAQS and/or the CAAQS are periodically exceeded for O_3, PM_{10}, and $PM_{2.5}$.

The No Project/No Action Alternative would not involve construction or operation of the Project. Therefore, emissions from construction, commissioning, and operations would not be generated. Nonetheless, it is highly likely that the No Project/Action Alternative would result in greater fossil fuel consumption, GHG emissions, and air pollution than the Project over the long term. Without the Project, electricity would likely be generated from other, less-efficient plants with higher air pollutant and GHG emissions than the Project. The carbon capture and sequestration benefits of the Project would not be realized. Therefore, air quality impacts would be greater under the No Project/No Action Alternative relative to the Project. Additional details pertaining to the air quality impacts and air quality monitoring and control at the Project Site are discussed in Section 5.1, Air Quality.

6.2.2 Biological Resources

The Project Site is currently used for cultivation of cotton, alfalfa, and onions. The primary land uses in the Project vicinity are agriculture, oil exploration, and oil production. Several potential aquatic features are in the area; these features include canals and irrigation ditches.

Three listed plant species have the potential to occur in the study areas for the linear facilities. Eight non-listed special-status plant species have the potential to be found in the study areas for the linear facilities.

Three threatened or endangered wildlife species (blunt-nosed leopard lizard, Tipton kangaroo rat, and San Joaquin kit fox) are likely to occur along the linear facilities. Portions of the Project would be in the Western Kern County Core recovery area (See Section 5.2, Biology in this AFC Amendment). In addition, six non-listed special-status wildlife species (burrowing owl, loggerhead shrike, short-nosed kangaroo rat, Tulare grasshopper mouse, San Joaquin pocket mouse, and American badger) are also likely to occur along the linear facilities.

Existing uses in the area are likely to continue to impact biological resources through disturbance, habitat degradation, fragmentation, or potential mortality. These include agricultural activities and oil and gas development. Impacts from these existing uses are likely to continue under the No Project/No Action Alternative.

Due to the fact that the No Project/No Action Alternative would not involve construction or operation of the Project, no adverse biological resources impacts would occur, including adverse impacts to special-status plant and wildlife species, sensitive habitats, and aquatic features. The Project would have less-than-significant biological resources impacts with implementation of mitigation measures. Because biological resources impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to biological resources at the Project Site are provided in Section 5.2, Biological Resources.

6.2.3 Cultural Resources

The landscape in the Project vicinity has been altered by previous surface and subsurface disturbance from agriculture, oil and gas production, construction of irrigation and drainage canals, and unpaved roads.

Cultural resource investigations and reports for this site were conducted in accordance with state and federal requirements and guidance, as described in Section 5.3. Eleven archaeological resources have been identified in or within close proximity to the archaeological resource study area as defined for the Project. Although the Project would avoid impacts to the eleven known archaeological resources in the study area, it is possible that archaeological deposits could be inadvertently exposed during Project-related construction activities.

The historic period architectural survey identified historic-period built environment properties present in the Project Area, including two resources eligible for listing in the National Register of Historic Places or the California Register of Historic Places: Old Headquarters Weir, and the California Aqueduct. None of the Project components or construction activities, therefore, would cause a substantial adverse change to the weir or the Aqueduct such that they would be materially impaired and unable to continue to convey their significance; however, potential impacts to these resources could occur from changes to the surrounding setting.

Existing uses in the Project Area currently impact cultural resources through disturbance, including agricultural activities and oil and gas development. Impacts to cultural resources as a result of these existing uses is likely to continue under the No Project/No Action Alternative.

Under the No Project/No Action Alternative, land disturbance that could have the potential to result in loss or degradation of cultural resources would not occur. Although the Project would have less-than-significant impacts on cultural resources, the degree of cultural resources impacts would be lower under the No Project/No Action Alternative. However, because cultural resources impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to cultural resources at the Project Site are discussed in Section 5.3, Cultural Resources.

6.2.4 Land Use

The Project Site is in western unincorporated Kern County, approximately 7 miles west of the outermost edge of the city of Bakersfield, 2 miles northwest of the unincorporated community of Tupman, and approximately 4 miles south of the unincorporated community of Buttonwillow. The Project Site is currently used for farming purposes, including the cultivation of cotton, alfalfa, and onions. Land in the Controlled Area to the north, west, and south of the Project Site is also currently used for the cultivation of these crops. Land within 1 mile of the Project Site consists primarily of agricultural use and undeveloped areas. Primary land uses surrounding the Project linear features are agriculture and oil extraction.

The Project Site is categorized as Prime Farmland, as defined by the California Department of Conservation. The Prime Farmland and Semi-Agricultural and Rural Commercial Land classifications extend over the Controlled Area, which is to the north, south, and west of the Project Site. Land within 1 mile of the Project Site is primarily included in the Prime Farmland classification. Grazing Land is located on the southern side of the Outlet Canal. Land within 0.25 mile of the Project linears is primarily included in the Prime Farmland or Grazing Land classifications.

The 453-acre Project Site is currently under Williamson Act contract, although the contract was tentatively cancelled by the Kern County Board of Supervisors in 2010. The Williamson Act restrictions over the tentatively cancelled acreage continue to remain in place until the conditions set forth in the Certificate of Tentative Cancellation are satisfied, including payment of the assessed cancellation fee, and recording of the final Certificate of Cancellation. Williamson Act contracts also cover most of the land currently used for farmland within 1 mile of the Project Site, as well as properties adjacent to the Project linear features.

Under the No Project/No Action Alternative, the Project Site would likely continue to be used for agricultural purposes. Impacts associated with the conversion of Prime Farmland and cancellation of Williamson Act contracts for the 453-acre Project Site would not occur. Although the Project would result in less-than-significant land use impacts, the degree of such impacts would be lower under the No Project/No Action Alternative. However, because land use impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative will not meet any of the Project objectives. Additional details pertaining to land use at the Project Site are provided in Section 5.4, Land Use.

6.2.5 Noise

A small number of noise-sensitive residential receptors are located approximately 0.5 to 4.5 miles from the Project Site, and are comprised of widely scattered farmhouses. The nearest single-family residences are located approximately 1,400 feet to the east of the Project Site. There are no hospitals, libraries, schools, places of worship, or other facilities where quietness is an important attribute in the area.

Ambient noise-level surveys were conducted in 2009 and 2012, as described in Section 5.5. Noise sources observed during the surveys consisted of local and distant traffic noise, barking dogs, wildlife, aircraft, trains, agricultural equipment, and farm animals.

Under the No Project/No Action Alternative, no noise would be generated from the Project because the Project would not be constructed or operated. Hence, there would be no changes to the current ranges of natural environmental conditions and types and intensities of human activities (both transportation-related and stationary) that might otherwise cause a change to the range of ambient environmental sound levels and their character. Although the Project would have less-than-significant noise impacts, the degree of such impacts would be lower under the No Project/No Action Alternative. However, because noise impacts would be less than significant under the Project (during construction and operation), the No Project/No Action

Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to noise at the Project Site are provided in Section 5.5, Noise.

6.2.6 Public Health and Safety

The Public Health and Safety analysis considered residential and sensitive receptors within a 6-mile radius of the Project Site. The closest residential neighborhood is in the unincorporated community of Tupman, approximately 2 miles southeast of the Project boundary. There are also additional single-family residences in the immediate Project vicinity, including residences approximately 1,400 feet to the east and 3,300 feet to the southeast of the Project Site. Additionally, Elk Hills elementary school is 1.3 miles to the southeast of the Project, and the Tule Elk State Natural Reserve is approximately 1,700 feet to the east of the Project Site and Controlled Area.

Under the No Project/No Action Alternative, public health and safety would not be affected by criteria air pollutants or toxic air contaminants associated with Project construction or operation. However, the Project would have less-than-significant public health and safety impacts under construction and operations. The potential for such impacts would be greater under the No Project/No Action Alternative, due to greater fuel consumption, GHG emissions, and toxic air contaminants resulting from status quo activities compared to the Project over the long term. As described in Section 6.2, under the No Project/No Action Alternative, electricity and nitrogen-based products would be generated by facilities that operate less efficiently and release larger quantities of toxic air contaminants and GHG emissions than the Project. Therefore, public health impacts could be greater under the No Project/No Action Alternative. Additional details pertaining to public health and safety at the Project Site are discussed in Section 5.6, Public Health.

6.2.7 Worker Safety and Health

Under the No Project/No Action Alternative, the Project would not be constructed and operated. Therefore, workers would not be employed by HECA or its subcontractors, and no risk of injury would exist to workers. However, because worker safety impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to worker safety at the Project Site are provided in Section 5.7, Worker Safety and Health.

6.2.8 Socioeconomics

The study area for the purposes of socioeconomic analysis included Kern County, Los Angeles County, the City of Bakersfield, the City of Wasco, and the unincorporated communities of Tupman and Buttonwillow. Generally, the economic conditions in these areas reflect the recent recession, with increases in unemployment and a downturn in the housing market.

Under the No Project/No Action Alternative, the Project would not be built, and therefore would not provide the anticipated increase in jobs or the potential increase in revenues to the local

economy. Specifically, an average of 1,159 workers per month over the approximate 49-month construction and commissioning period, including a maximum of approximately 2,500 workers during peak construction activities, would not be employed under this alternative. Approximately, 200 full-time operations jobs would not be created.

The No Project/No Action Alternative would not support employment and wages in other industries in Kern County or the communities surrounding the Project Site. Substantial indirect and induced employment would not be created, and considerable tax revenues would not be generated under this alternative. Construction of the Project is estimated to cost approximately $3.15 billion. The total direct labor for construction is projected to cost approximately $1.37 billion. An estimated 60 percent of non-labor construction cost is anticipated to be spent in Kern County on materials and supplies. The remaining materials (comprising approximately 40 percent of non-labor cost), would be purchased outside Kern County. Annual direct labor income of operations for the Project would be approximately $30 million. Approximately 30 percent of material and supply purchases during operations would occur in Kern County.

Vacant housing, as well as temporary housing, in the study area would not be used by construction or full-time operations workers under the No Project/No Action Alternative. Local schools, public services, facilities, and utilities would not be affected under the No Project/No Action Alternative; however, the Project would have less-than-significant impacts on these resources. Under both the Project and the No Project/No Action Alternative, no impacts associated with the environmental justice population would occur. The Project would result in positive socioeconomic impacts that would not occur under the No Project/No Action Alternative. Additional details pertaining to socioeconomics impacts are provided in Section 5.8, Socioeconomics.

6.2.9 Soils

The predominant soils at the Project Site and along the associated linears consist of clays, loamy sands, gravely sandy loams, silt loams, fine sandy loams, and sandy loams. Details on the geology of the Project Site and vicinity are included under Section 5.15, Geological Hazards and Resources. Information regarding Agriculture and Important Farmlands is presented under Section 5.4, Land Use.

The No Project/No Action Alternative would not involve construction or operation of the Project. Therefore, there would be no potential for alteration of the existing soil profile, soil compaction, discovery of potentially contaminated soil, run-off, erosion, and sediment transportation that could result from grading, surface and subsurface ground disturbance, and vegetation removal. Existing rates of soil erosion and surface runoff would continue. Although the Project would result in less-than-significant soils impacts, the potential for such impacts would be lower under the No Project/No Action Alternative. However, because soils impacts are less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to soils on the Project Site are discussed in Section 5.9, Soils.

6.2.10 Traffic and Transportation

The transportation network within the Project study area is composed of a mix of interstate highways, county highways, and local roadways. The circulation system plays a major role in the movement of farm products originating from the San Joaquin Valley, Kern County, and outlying agricultural communities that require access and rely on the state and county roadways. The Project study area is primarily served by Interstate 5 (I-5) to the east. The primary local north-south roadways near the vicinity of the Project include Tupman Road, Dairy Road, and Morris Road. Station Road and Adohr Road provide local east-west access adjacent to and north of the Project Site.

All study intersections are currently operating at acceptable Level of Service (LOS) C or better, with the exception of State Route (SR) 119/Tupman Road, which is operating at LOS F during the p.m. peak hour; similar LOS for study intersections are forecast under Year 2016 No Project/ No Action conditions. Consultation with Kern County Roads Department indicated that there are no anticipated roadway and circulation improvements in the Project study area.

Under the No Project/No Action Alternative, no workers would travel to the Project Site during construction or operation. Further, no heavy equipment or construction deliveries would be brought to the Project Site. Project-related planned improvements, as outlined in Section 5.10, would not be made. There would be no increase in vehicle trips under the No Project/No Action Alternative. Although the Project would have less-than-significant transportation and traffic impacts with the implementation of mitigation measures, such impacts would be lower under the No Project/No Action Alternative. However, because transportation and traffic impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to traffic and transportation at the Project Site are provided in Section 5.10, Traffic and Transportation.

6.2.11 Visual Resources

The Project Site lies in the southwestern portion of San Joaquin Valley, which stretches from the Sacramento–San Joaquin Delta in the north to the Tehachapi Mountains to the south. Various California coastal ranges line the valley to the west (including the Diablo and Santa Ynez), and the Sierra Nevada act as the eastern valley boundary. The climate is dry, with hot summers and mild winters, and there is a persistent haze generally characteristic of the air quality in the area that impairs the clarity of distant views. The general area is characterized as relatively flat, with extensive current and previous soil disturbance associated with farming activities and ongoing oil field operations. The Project Site is generally flat, allowing for open, panoramic, and expansive views of the valley to the north, northwest, and east. The closest notable topography is Hillcrest Point, over 5 miles away.

Land within 1 mile of the Project Site is primarily used for farming purposes. The western border of the Tule Elk State Natural Reserve is approximately 1,700 feet to the east of the Project Site. The nearest single-family dwellings are approximately 1,400 feet to the east; 3,300 feet to the southeast; and 4,000 feet to the north. The EHOF is 1 mile south of the Project Site. Several

semi-urban/urban areas surround the Project region, from 2 to 15 miles away from the Project Site. Other than a few locations on the outskirts of Tupman Road, none of these areas have direct views to the Project Site.

Landscapes within the visual sphere of influence (VSOI) were classified as having low scenic integrity. The Project Site is in areas characterized by low distinctive or diverse natural amenities, or lacking substantial positive cultural modifications. There are a number of existing cultural modifications (e.g., cultivated farmlands, industrial facilities, existing power transmission lines, a former fertilizer manufacturing plant adjacent to the Project Site, and oilfield activities and associated structures/storage tanks, etc.) within the VSOI. Although the Project is expected to change the existing character of the site, significant impacts to the scenic attractiveness of the VSOI as a whole are not anticipated due to adjacent industrial scenery.

Under the No Project/No Action Alternative, the Project would not be constructed or operated, and the Project Site would be maintained in its present state. Visual resources impacts resulting from the Project would not occur under the No Project/No Action Alternative. However, because visual resources impacts would be less than significant under the Project (during construction and operation) with the implementation of mitigation, the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to visual resources are provided in Section 5.11, Visual Resources.

6.2.12 Hazardous Materials Handling

Under the No Project/No Action Alternative, hazardous materials associated with construction and operation of the proposed Project would not be brought onto the Project Site. Limited hazardous materials handling (e.g., fertilizers) associated with agricultural use of the Project Site would continue. Although the Project would have less-than-significant hazardous materials handling impacts, the potential for such impacts would be lower under the No Project/No Action Alternative. However, because hazardous materials handling impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to hazardous materials management at the Project Site are provided in Section 5.12, Hazardous Materials Handling.

6.2.13 Waste Management

Under the No Project/No Action Alternative, waste associated with construction or operation of the Project would not be generated. Assessment and management of existing waste (as described in Section 6.2.9) that may be present on the Project Site would not be conducted as they would be under the Project. However, because waste management impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional detail pertaining to waste management at the Project Site is provided in Section 5.13, Waste Management.

6.2.14 Water Resources

The Project Site is located in the Kern County subbasin of the San Joaquin Valley groundwater basin. On a regional scale, the development of irrigated agriculture in the western San Joaquin Valley has significantly altered the groundwater flow system. The dominant recharge source in the subbasin is applied irrigation water. Water supply in Kern County is provided by groundwater, the Kern River, and other surface water imports, which include deliveries by the California State Water Project via the Friant–Kern Canal and the federally operated Central Valley Project via the California Aqueduct.

Groundwater in the vicinity of the Project is generally considered to be of relatively low quality due to the presence of water-soluble deleterious minerals in the parent rocks. Shallow groundwater presents problems for agriculture in the vicinity of the Project, with high concentrations of Total Dissolved Solids, sodium chloride, and sulfate.

Under the No Project/No Action Alternative, there would be no potential for discharges from the Project that could degrade surface or groundwater quality, and no impacts related to subbasin water balance, potable water supply demand, and groundwater level drawdown would occur. However, beneficial impacts of the Project on local groundwater quality would not be realized under this alternative, and water resource impacts from agricultural use of the site would continue. Although the Project would have less-than-significant water resources impacts, the potential for such impacts would be lower under the No Project/No Action Alternative. However, because water resources impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to water resources for the Project Site are discussed in Section 5.14, Water Resources.

6.2.15 Geologic Hazards and Resources

The Project is located along the northeastern face of the Elk Hills, which are the surface manifestation of an anticlinal uplift along the western side of the San Joaquin Valley. The Elk Hills are composed of sands, conglomerates, mudstones, and shales derived from the Coast Ranges to the west. The Elk Hills are being dissected by numerous streams that redeposit the eroded materials on an apron of small coalescing fans along the northeastern flank of the hills, which abut the much larger Kern River fan to the north.

The Project, like most of California, is in a seismically active region. A review of geologic literature did not identify the presence of any known active or potentially active faults at the Project Site or crossing the Project linears. The closest known faults classified as active by the State of California Geologic Survey are the San Andreas Fault, approximately 21 miles to the west; the White Wolf Fault, approximately 23 miles to the southeast; and the Pleito Thrust, approximately 27 miles south of the Project Site. There are no known significant mineral resources present on the Project Site.

Under the No Project/No Action Alternative, development of a low-carbon polygeneration facility at the Project Site would not occur; therefore, impacts related to geologic hazards and

resources would not occur. Although the Project would result in less-than-significant geologic hazards and resources impacts, the potential for such impacts would be lower under the No Project Alternative. However, because geologic hazards and resources impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to geologic hazards and resources at the Project Site are discussed in Section 5.15, Geological Hazards and Resources.

6.2.16 Paleontological Resources

Two stratigraphic units would be potentially impacted during Project construction activities: Quaternary alluvium, and Tulare Formation. Although no fossils were previously reported to directly underlie the Project Site, numerous fossil localities nearby in the Quaternary alluvium and the Tulare Formation have been reported in both the published scientific literature and museum records. In addition, numerous previously unrecorded fossil localities were identified during the field surveys of the Project Site and linear facility rights-of-way (ROWs). Many of these previously reported and unreported localities occur within 1 mile of the HECA linear facilities and the OEHI CO_2 pipeline.

Some current uses of the site and surrounding area adversely affect paleontological resources through disturbance, including agricultural activities and oil and gas development. Impacts as a result of these existing uses would likely continue under the No Project/No Action Alternative. In addition, the natural processes of water and wind erosion and abrasion from blowing sand may degrade exposed paleontological resources, as well as revealing additional specimens.

Under the No Project/No Action Alternative, no potential would exist for land disturbance associated with construction or operation of the Project to cause loss or degradation of paleontological resources. Although the Project would have less-than-significant paleontological resources impacts with the implementation of mitigation, the potential for adverse paleontological resources impacts would be lower under the No Project/No Action Alternative. However, because paleontological resources impacts would be less than significant under the Project, the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details regarding paleontological resources for the Project Site are provided in Section 5.16, Paleontological Resources.

6.3 SITE AND LINEAR FACILITIES LOCATION ALTERNATIVES

In determining if an alternative site or linear facilities location would feasibly attain the Project objectives, HECA used the following site evaluation criteria:

- Environmental impacts;
- Safety (proximity to residents, schools, day-care centers, etc.);
- Proximity to sensitive receptors (population and sensitive species);
- Environmental justice considerations;
- Economic feasibility;

- Site acreage (300+ acres), topography, lowest elevation (to maximize power generation);
- Proximity to CO_2 customer for CO_2 EOR and sequestration;
- Minimize impacts on transportation corridors;
- Feasibility of land acquisition;
- Proximity to infrastructure to minimize impacts from Project Site access and linear facilities;
- Proximity to raw water supply.

6.3.1 Proposed and Alternative Sites

The Project Site is in an agricultural area in Kern County, California, near the EHOF. The Project Site is contiguous land bounded by agricultural land and Adohr Road to the north, Tupman Road to the east, agricultural land and an irrigation canal to the south, and the Dairy Road ROW to the west. The Project Site is in a sparsely populated area. There are only a few homes within a mile of the Project Site, and the unincorporated community of Tupman is approximately 2 miles from the site. Primary access for truck deliveries will be from I-5, to Stockdale Highway west, to Morris Road, south to Station Road, then west to the entrance on Tupman Road. The topography of the Project Site is flat. The geology at the Project Site has been determined suitable for facility construction.

The Project Site was selected based upon, among other considerations, the available land; proximity to a CO_2 storage reservoir; and the existing natural gas transportation, electric transmission, brackish groundwater supply, rail, and roadway infrastructure that could support the Project. The geology in the vicinity of the Project Site makes it one of the premier locations in the United States for CO_2 EOR and Sequestration.

HECA's initial AFC (08-AFC-8) was submitted to CEC on July 30, 2008, which proposed the Project on a different site. The Project was subsequently moved when it was discovered that previously undisclosed sensitive biological resources existed at the prior site. As a result, HECA was required to conduct an alternative site analysis that was not merely theoretical, but was in fact necessary to identify an alternative site for the Project, which has now become the Project Site. HECA filed a Revised AFC in May 2009. In the process of selecting this Project Site, several alternative sites in the vicinity of the unincorporated communities of Buttonwillow and Tupman were considered. However, the alternative sites were rejected for various reasons, including (1) topography, (2) distance from the proposed CO_2 custody transfer point, (3) lengths of linear facilities, (4) sensitive environmental receptors, and/or (5) land availability. These sites and their relevant information are presented in Table 6-1, Alternative Sites Reviewed and Status.

Figure 6-1, Alternative Sites, shows the locations of these alternative sites.

Based on this analysis, no alternative sites were identified that were environmentally superior to the Project Site, and would allow attainment of most of the Project objectives. Thus, the Project Site was selected.

6.3.2 Linear Facilities

- The Project Site employs several strategies to minimize or avoid impacts from linear facilities. The Project maximizes the use of existing ROWs for linear facilities, while

minimizing the number of private land owners involved. In addition, to the degree feasible, the Project has co-located linear facilities in the same ROW to minimize impacts. Moreover, all linear facilities have been sited to limit the number of miles traversed, and were thoroughly reviewed to limit environmental impacts. Six linear facilities have been proposed to support the Project. The electric transmission line will interconnect the Project to a future Pacific Gas and Electric Company (PG&E) switching station approximately 2 miles east of the Project Site.

- For drinking and sanitary use, the Project will use potable water supplied by West Kern Water District approximately 1 mile east of the Project Site. The potable water pipeline will be co-located within the 100-foot electric transmission line permanent ROW for the entirety of its route.

- The industrial railroad spur will run from the San Joaquin Valley Railroad (SJVRR) to the Project Site in order to facilitate feedstock and equipment delivery and nitrogen-based product export.

- A natural gas line will interconnect with a PG&E natural gas pipeline located north of the Project Site. The natural gas line will be co-located in the permanent railroad spur ROW for the entire railroad spur route.

- The process water supply pipeline will be in an existing ROW owned by Buena Vista Water Storage District (BVWSD).

- Construction of a CO_2 pipeline to transfer the CO_2 captured during gasification from the Project Site to OEHI.

6.3.2.1 Electrical Transmission Line and Potable Water Line

The Project evaluated interconnections to both PG&E's Midway Substation north of the Project Site, as well as to a future PG&E switching station east of the site. Numerous routing options were evaluated in detail to the Midway Substation, including routes presented in the 2009 Revised AFC. However, the PG&E Midway Substation was eventually eliminated from consideration based on the following: (1) Midway had identified congestion in and around the substation; and (2) PG&E's switching station represents the shortest and most direct interconnection point available to the site, and Midway required a substantially longer line length.

For selecting the currently proposed route to the PG&E switching station, the following factors were considered:

- **Feasibility of land acquisition.** This route involves a minimum number of land owners. Negotiations with these land owners have been successful in gaining agreements for the transmission line ROWs.

- **Safety and proximity to potential sensitive receptors.** There are no residences or other occupied buildings (i.e., residences, schools, day-care centers, etc.) along the entire proposed route.

- **Overall economic feasibility.** Due to the close proximity of the interconnection point with the Project Site, the identified route provides the shortest and most direct transmission line available.

Other transmission features that were evaluated included the following:

- Transmission structure types;
- Conductor sizes and conductor families;
- Circuit bundle configurations;
- Ground wires;
- Insulators;
- Construction methods.

Potable water will be supplied by West Kern Water District (WKWD) for drinking and sanitary purposes. Numerous routing options for the potable water linear were evaluated in detail, including the route presented in the 2009 Revised AFC. However, the current potable water linear alignment is several miles shorter than the previously proposed route; it will be placed in the electrical transmission corridor ROW over the entire route, which will minimize environmental impacts. In 2010, HECA considered the use of a potable well that would be located either on or adjacent to the Project Site. However, the water from the potable well would have required treatment. HECA has selected the currently proposed potable water supply from WKWD because the source is relatively close to the Project Site and the water would not require treatment prior to use.

6.3.2.2 Industrial Railroad Spur and Natural Gas Line

The Project is proposing two alternatives for transporting coal to the Project Site. Alternative 1 represents the construction of an approximately 5-mile industrial railroad spur installed from the SJVRR to the Project Site; Alternative 2 is discussed in Section 6.4. Several railroad spur routing options were evaluated in the area; however, based on the following considerations, the currently proposed route was selected:

- **Main line.** The route ties into the SJVRR main railroad line.

- **Land availability.** HECA has been in discussions with landowners, and the proposed route represents the most feasible alignment, based on land availability and discussions with landowners.

- **Safety and proximity to potential sensitive receptors.** The proposed route is sited in less-populated areas, and there are minimal occupied buildings (i.e., residences, schools, day-care centers, etc.) along the entire proposed route.

The PG&E natural gas pipeline will be co-located with the railroad spur. The natural gas supply pipeline will tap into PG&E's main supply pipeline. Several natural gas pipeline routing options were considered. However, the current pipeline route was selected to ensure that it would be co-located with the railroad spur. Therefore, the above considerations for the railroad spur routes were also applied to the natural gas pipeline routes. In addition, the remaining portion of the natural gas pipeline that is not co-located with the railroad spur location was selected based on the location of the PG&E main supply pipeline.

6.3.2.3 Process Water Line

The process water source for the Project runs in a northwesterly direction from the Project Site for approximately 15 miles, and will consist of brackish groundwater supplied by the BVWSD, which would be treated on site to meet Project standards. The process water pipeline route runs from Seventh Standard Road to the Project Site, along the existing BVWSD road on the northwestern side of the West Side Canal.

Alternatives to the proposed process water linear route were analyzed, and supporting decision criteria for the proposed route are provided in Section 6.7, Alternative Water Supplies.

6.3.2.4 CO_2 Pipeline

An approximately 3-mile CO_2 pipeline will transfer the CO_2 captured during gasification from the Project Site south to the OEHI CO_2 Processing Facility. There are limited options for CO_2 sequestration available to the Project in order to meet the Project's stated objectives. As mentioned above, the Project Site was selected based upon, among other considerations, proximity to a high-quality CO_2 storage reservoir. In previous AFC submittals, oil fields in the Ventura Basin and the southern end of the San Joaquin Basin were evaluated for their sequestration and EOR potential. The EHOF was determined to be the preferred field, due to its closer proximity to the HECA Project Site, shorter CO_2 supply line length, results of previous CO_2 pilot studies, and decreased construction time and requirements (URS, 2009). The proposed CO_2 pipeline alignment has been sited to minimize impacts to resource areas, as is further discussed in Appendix A of this AFC Amendment.

6.4 COAL TRANSPORTATION

HECA is currently considering the following two alternatives for the transportation of coal to the Project Site:

- **Alternative 1, rail transportation.** An approximately 5-mile new industrial railroad spur that would connect the Project Site to the existing SJVRR–Buttonwillow railroad line. This railroad spur would also be used to transport some of the HECA products to customers.

- **Alternative 2, truck transportation.** Truck transport would be via existing roads from an existing coal transloading facility northeast of the Project Site. The truck route distance is approximately 27 miles.

Environmental sections presented in Section 5 of this AFC Amendment evaluate the environmental impacts of each of these alternatives.

6.5 ALTERNATIVE GENERATING TECHNOLOGIES AND CONFIGURATIONS

HECA was formed to develop a material business consisting of the production of low-carbon baseload electricity by capturing CO_2 and transporting it for use in CO_2 EOR and sequestration (storage). The Project also includes an integrated Manufacturing Complex that will produce low-carbon, nitrogen-based products. These particular Project objectives drove the generation technology selection. Accordingly, the (IGCC technology was selected because of its unique ability to produce low-carbon H_2-rich fuel for baseload power generation as well as for its superior carbon-capture features. The technology selection was driven by the following objectives: (1) proving commercial scale IGCC-with carbon-capture operability, and (2) proving associated economic viability. A key aspect is delivering a high-reliability operating plant within a minimum period after initial start-up. Other generating technologies, such as solar, wind, geothermal, hydroelectric, and nuclear, were not selected because they fundamentally fail to achieve the Project objectives**.**

6.5.1 Mitsubishi Heavy Industries Gasification Technology

IGCC with carbon capture is the only technology which meets the goal of the Project to generate low-carbon power using H_2-rich fuel produced from a solid feedstock. Other technologies such as pulverized coal technology and oxyfuel technology do not meet this goal. Furthermore, pulverized coal technology with carbon capture is an unproven technology at the Project's scale; it has lower efficiency, higher water usage, and higher emissions.

Mitsubishi Heavy Industries' (MHI) gasification technology forms the initial section of the IGCC Project. Other gasification technology options were considered, including those of GE, Shell and ConocoPhillips. MHI's oxygen blown gasification process was selected for the following reasons:

- The two-stage gasification process provides for greater than 99 percent carbon conversion, resulting in a gasification solids by-product having virtually no carbon content.
- Dry feed system translates into reduced water consumption, as well as reduced size and cost of the wastewater treatment facility (no black water)
- Water wall design versus refractory design provides thermal protection for greater reliability and plant availability (less down time) and reduces maintenance costs.
- Increased efficiency as a result of reduced oxygen and coal/petcoke demand for producing a given amount of syngas. Also, MHI's technology produces high pressure superheated steam in the syngas cooler, which enhances power production.
- Lower overall emissions and higher CO_2 production (for enhanced oil recovery and sequestration) than other competing gasification technologies.

Based on the above reasons, MHI is the selected technology supplier

6.5.2 Acid Gas Removal System

Two important design criteria for the acid gas removal (AGR) system were: (1) removal of sulfur in the H_2-rich fuel to a target of less than 5 ppm by volume (ppmv) total sulfur (a level compatible with state-of-the-art art selective catalytic reduction technology); and (2) production of a high-purity CO_2 stream that contains over 90 percent of the total carbon in the raw syngas. There are numerous AGR technologies available, but only a few have found widespread acceptance for gasification projects. The three most commonly selected technologies are methyldiethanolamine (MDEA), Selexol®, and Rectisol®.

For the reasons discussed below, Rectisol® was selected because of its ability to meet the Project's target levels for sulfur removal and purity of the CO_2 stream. All three of these solvents are capable of selective removal of hydrogen sulfide from a sour syngas stream. However, the sulfur slip (H_2S + COS) in the treated syngas is highest for methyldiethanolamine (MDEA) (an order of magnitude higher than the desired target level). For this reason, MDEA did not meet the requirements of the Project.

Selexol® is commonly selected for IGCC applications where the gasifier pressure is relatively high and where the depth of sulfur removal is sufficient to allow the use of conventional selective catalytic reduction catalysts in the heat recovery steam generators (HRSG). There are several Selexol® units in commercial operation treating syngas. However, Selexol® loses its capital cost advantage when either very deep sulfur removal or high-purity CO_2 capture is required. As previously stated, both are required. Furthermore, as compared with Rectisol®, only one Selexol® plant is understood to be operating at sulfur levels less than 5 ppmv in the H_2-rich fuel at a scale smaller than that required for the Project. There is sufficiently more of an experience base showing that Rectisol® is more likely to achieve the Project's design criteria for sulfur recovery.

Additionally, Rectisol® is the more common selection when the syngas is used for chemical manufacturing and when very deep sulfur removal is required. Rectisol® solvent is often used in the production of commercial grade methanol; it is low cost and is available from multiple suppliers. Rectisol® is commercially proven with 50 Rectisol® plants in operation, and with many power plants demonstrating sulfur removal at, or better than, the design criteria for the Project. Another important factor in the selection of Rectisol® is its ability to remove trace contaminants, such as carbonyl sulfide (COS), hydrogen cyanide (HCN), ammonia (NH_3), mercaptans, mercury (Hg), iron (Fe) and nickel (Ni) carbonyls; and mixtures of benzene, toluene, and xylene (BTX).

As a result of the extensive evaluation performed by HECA, it chose Rectisol® for the Acid Gas Removal (AGR) system. With its significant sulfur removal capability, proven operating experience demonstrating sulfur removal consistent with the Project's design criteria, and removal of trace contaminants, Rectisol® was deemed superior to Selexol® for the Project.

6.5.3 MHI 501 GAC® Combustion Turbine

MHI's 501GAC® combustion turbine was selected as the combustion turbine for the following reasons:

- MHI's proven experience with high (greater than 90 percent) H_2 fuel.
- Highest efficiency of all "G" class machines, particularly with the air-cooled model.
- Single-shaft design reduces capital costs (one versus two generators) and equipment footprint (plot space requirements).
- Rapid ramp rate for the MHI 501GAC machine, versus competing turbine technologies.

6.5.4 Conclusion

In conclusion, a thorough review of alternative generation technologies and configurations was conducted. Based on this review, none of the alternatives satisfied the basic Project Objectives, as described above, without resulting in increased adverse impacts to the environment or impaired project feasibility as compared to the proposed Project. As a result, the alternative generation technologies and configurations were rejected in favor of the proposed Project's generation technology.

6.6 MANUFACTURING COMPLEX ALTERNATIVES AND TECHNOLOGY SELECTION

The Project was studied both with and without a Manufacturing Complex component. A number of benefits are achieved by the addition of the Manufacturing Complex, including the following:

- Greater capability for the plant to vary power output in response to planned daily changes in power demand. The Project uses gasification with carbon capture and storage to produce H_2, a clean, carbon free, high energy carrier for electricity and nitrogen-based product production. In contrast to power markets where demand is variable, the H_2 and carbon capture production equipment operate best at steady conditions thereby offering limited electrical output flexibility. The key to overcoming this limitation is addressed through HECA's ability to produce and store nitrogen-based products. When maximum power output is indicated, the production of nitrogen-based products is reduced while the H_2 production rate remains unchanged. Similarly, when lower power output is indicated, H_2 is diverted to producenitrogen-based products. This flexibility is an important power generation characteristic to facilitate grid stability and higher penetrations of other clean low carbon generation technologies such as intermittent renewable energy.

- The Manufacturing Complex will provide nitrogen-based products manufactured locally, important to the California agriculture industry, with a low carbon footprint, and the avoidance of transportation supply chain GHG emissions.

- The combination of a Manufacturing Complex and power plant results in greater co-production energy efficiencies than achieved by a standalone power plant of the same design.

- The Manufacturing Complex enhances economic viability of the Project by adding another revenue stream.

6.7 ALTERNATIVE WATER SUPPLIES

Several potential alternative water supplies were studied for the Project, as well as potential technologies for reducing water demand.

The water supply options considered included:

- Ocean water
- Brackish water
  - Industrial wastewater
  - Semitropic Water Storage District
  - Buena Vista Water Storage District
- Inland Wastewaters
  - Municipal effluent
  - Agricultural wastewater
- Other inland waters
  - State Water Project
  - Fresh groundwater
  - Municipal water supply

In addition to evaluating the ability of the alternatives to feasibly attain the general Project objectives, HECA used the following water supply specific criteria as a means of evaluating potential water supply alternatives:

- Environmental impacts
- Beneficial impact to local groundwater quality and agriculture
- Economic feasibility
- Feasibility of land acquisition
- Proximity to raw water supply
- Minimization of the parasitic electrical demand

In addition, the analysis took into consideration California State Water Resources Control Board Resolution No. 75-58,[1] referred to as the California Water Policy, which addresses the use and disposal of inland waters used for power plant cooling.

6.7.1 Water Supply Alternatives Decision Analysis

The following hierarchy of tests was applied to each water supply alternative:

[1] Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling, Resolution 75-58, State Water Resources Control Board, June 19, 1975.

Test 1. Is the alternative water supply feasibly available at the Project Site? (If not, then disregard this alternative. If yes, proceed to Test 2.)

Test 2. Will the subject water supply alternative satisfy California Water Policy? (If not, then disregard this alternative. If yes, proceed to Test 3.)

Test 3. Is the subject water supply alternative technologically sufficient (quantity and quality) to guarantee high safety and reliability (98 percent availability?) (If no, then disregard this alternative. If yes, proceed to Test 4.)

For water supply alternatives passing Tests 1 through 3, apply Tests 4 through 6:

Test 4. Rate other impacts associated with each water supply alternative, including transportation, biological, energy, health and safety, etc. (high, medium, and low).

Test 5. Rate relative capital costs of each remaining water supply alternative (high, medium, and low).

Test 6. Rate relative operation and maintenance (O&M) costs of each of the remaining water supply alternatives (high, medium, and low).

Tests 1 through 3 address "fatal flaw" criteria. Alternatives that did not pass Test 1, 2, or 3, were not evaluated further. For alternatives passing Tests 1 through 3, the evaluations from application of Tests 4 through 6 were evaluated for each water supply alternative, with the alternative with the highest evaluation being selected.

6.7.2 Wastewater Being Discharged to the Ocean

The Project Site is located approximately 75 miles from a significant source of ocean disposed wastewater. Although this supply is large, and technology for its successful use proven, the capital cost for transporting and treating the wastewater from this option is high (>$500 million). This alternative water supply failed Test 1, because it is not feasibly available at the Project Site. This alternative was eliminated from further consideration.

6.7.3 Ocean Water

The Project Site is approximately 75 miles from the Pacific Ocean. Although this supply is limitless, and technology for its successful use proven, the capital cost for transporting, treating, and disposing of this option is high (>$500 million). This alternative water supply failed Test 1, because it is not feasibly available at the Project Site. This alternative was eliminated from further consideration.

6.7.4 Brackish Water

6.7.4.1 Industrial Wastewater

Industrial wastewater in the form of produced water is available from the oilfields within 10 miles of the Project Site. Produced water refers to water that is "co-produced" from the many

oil wells in the Kern County region. Produced water is an industrial wastewater that is separated from crude oil in the oil production process. Kern County oil well output is often 8 parts water to 1 part oil, leading to a large excess of produced water that the local oil producers must dispose of. The produced water is currently disposed by re-injection and discharge to evaporation ponds. There are approximately 15 million gallons per day (mgd) of produced water available when drawn from multiple locations within a radius of 10 miles of the Project Site. Producers of these waters indicated they were willing to provide this water to the Project. However, they are reluctant to guarantee specific quantities of future water supply. The business purpose of these organizations is oil production—not water production—and they are unwilling to complicate the former for the sake of the latter. Commercial discussions determined that a reliable produced water supply is not readily available; therefore, this alternative failed Test 1. Under the test hierarchy, previously described, this conclusion ends consideration of this alternative. Nevertheless, for the purposes of this analysis, the ability of this alternative to meet subsequent tests was evaluated.

Because inland wastewaters are identified in California State Water Resources Control Board Resolution No. 75-58 as a preferred alternative source of water supply, the produced water is consistent with the California Water Policy. Therefore, this supply does pass Test 2.

The produced water exhibits Total Dissolved Solids concentrations ranging from 10,000 to 40,000 milligrams per liter; it has elevated concentrations of potentially problematic ionic species, including silicon (Si), strontium (Sr), and barium (Ba); and it possesses significant oil and grease issues. Given the quality and ionic constituents of these supplies, the optimal technology for processing this raw water to Project standards is a “thermal process.” The thermal process uses a mechanical vacuum pump and heat input to boil the water and recover a good quality stream sufficient for utility purposes. This utility water stream must then be treated further with reverse osmosis and demineralization to achieve the Project demineralized water standard. Produced water will require significant treatment prior to use. This treatment is not unprecedented, but only one such example is known to HECA. This provides a higher level of technology risk than the Project is comfortable with. However, such treatment does appear to be technologically feasible, so this supply passed Test 3.

It is estimated that the capital cost to construct a water plant to process this raw water supply could be $200 million. The costs to operate this water plant are anticipated to be high, and could result in a nearly 15 MW additional parasitic load over use of brackish groundwater (due to the steam turbine cycle to operate the water plant). These capital and operating costs are substantial and they negatively impact the Project’s economics.

The thermal treatment technology will produce a concentrated brine waste stream. Based upon quality data already obtained, it is possible that this reject stream will have constituents at sufficient levels to trigger classification of the brine waste stream as hazardous waste. This waste generation would conflict with the intent of the Project design to minimize the production of hazardous waste to the extent feasible.

Although oilfield-produced water appears to be technologically possible as a water supply to the Project, it is not the preferred option, due to availability, environmental, waste disposal, and cost considerations.

6.7.4.2 Semitropic Water Storage District

The Semitropic Water Storage District (Semitropic) is in northwest Kern County. It has a groundwater storage capacity of 1.65 million acre-feet, with 650,000 acre-feet of capacity remaining.

Agriculture in a portion of the Semitropic District is impacted by shallow, brackish groundwater conditions resulting from agricultural irrigation. This impacted area is approximately 10 miles to the west/northwest of Wasco and affects an area of roughly 10 square miles.

Similar to the BVWSD, use of this water supply alternative is consistent with the California Water Policy in that the ultimate water supply will be brackish groundwater; it passed Test 2. However, in conversations with Semitropic, they were unable to verify the water supply quantity and composition; they were therefore unable to provide a firm water supply commitment for this Project. Therefore, Tests 1 and 3 could not be performed, and this alternative was rejected.

6.7.4.3 Buena Vista Water Storage District

The Project Site is in the southern portion of the BVWSD. The brackish groundwater will be supplied from Buena Vista Water Storage District (BVWSD), as part of BVWSD's Brackish Groundwater Remediation Project (BGRP), which is designed to remediate brackish groundwater that is considered to be unsuitable for agricultural or drinking uses. Implementation of the BGRP, which includes Project-specific pumping, is seen as a benefit to BVWSD in that it remove salts from the aquifer, impedes eastward flow of poor-quality groundwater, and enhances westward flow of good-quality groundwater. Project consumption of these impaired sources will beneficially affect local agriculture.

The District has stated that it will be able to provide brackish groundwater to the Project for the estimated life of the Project (see BVWSD/HECA contract in Appendix N-1, Water Resources Information). Because there is sufficient brackish groundwater available to meet the needs of the Project, this alternative passed Test 1. The use of brackish groundwater is consistent with the California Water Policy, and it passed Test 2.

The District's brackish water supply system will include a "picket fence" of wells to intercept the brackish water plume entering the District from the west. Because it is technologically feasible to obtain and treat the brackish groundwater to Project standards, this alternative passed Test 3.

As discussed in Section 5.14, Water Resources, this alternative does not result in any significant adverse environmental impacts. The relative capital costs and O&M costs associated with this water supply alternative are not insignificant; however, this option is economically feasible. Based on this evaluation, brackish water provided by BVWSD has been identified as the preferred process water supply for the Project.

6.7.5 Inland Wastewaters

6.7.5.1 Municipal Effluent

The Project Site is located approximately 17 miles northeast of the city of Bakersfield Wastewater Treatment Plant #3. This plant treats a large portion of the municipal effluent generated from the city of Bakersfield.

Previously, the Project had discussions with the city regarding their interest and availability in supplying water to the Project. Currently, the city is selling its treated effluent to local farmers for irrigation purposes. They do not have excess capacity outside of existing contracts, which can supply the Project with its total water needs. They do have some excess production (approximately 1 mgd), which is expected to increase in the intervening time between Project permit submission and start-up. This growth rate is estimated at approximately 0.25 mgd per year, resulting in another 1 mgd available by start-up in 2014. This amount is insufficient for Project needs, and would have to be augmented by an additional water supply.

Given that this supply is insufficient for Project needs, it failed Test 1, and was not selected as the preferred process water supply for the Project.

6.7.5.2 Agricultural Wastewater

Agricultural wastewater (i.e., tile drainage) is excess water from irrigation practices. This wastewater is not available in sufficient quantities in the vicinity of the Project Site, nor is it sufficiently reliable for use at the Project due to water quality variability. Therefore, this alternative failed Tests 1 and 3, and was eliminated from further consideration.

6.7.6 Other Inland Waters

6.7.6.1 State Water Project

The State Water Project's California Aqueduct is approximately 1,900 feet south of the Project Site. This source failed Test 1, because the Project does not have an allocation for the use of water from the State Water Project. In addition, it is anticipated that this source would fail to pass Test 2, because the availability of other viable sources of water would make use of this freshwater source inconsistent with the California Water Policy (State Water Resources Control Board Resolution No. 75-58). Direct use of water from the State Water Project was therefore eliminated from further consideration.

6.7.6.2 Fresh Groundwater

Fresh groundwater is found in the vicinity of the Project Site. Because this alternative water supply is feasibly available to the Project, it passed Test 1. Given the availability of other viable sources of water, use of this freshwater supply would be inconsistent with the California Water Policy, and this alternative water supply failed Test 2. It was, therefore, eliminated from further consideration.

6.7.6.3 Municipal Water Supply

Given the availability of other viable sources of water, use of a municipal freshwater supply would be inconsistent with the California Water Policy. This alternative water supply failed Test 2 and was eliminated from further consideration.

6.8 ALTERNATIVE WASTEWATER DISPOSAL OPTIONS

Following is a summary of the wastewater disposal alternatives that were evaluated:

- **Zero Liquid Discharge (ZLD) system.** A mechanical system using evaporation and crystallization to effectively reduce liquid wastes to a dry waste for landfill disposal.
- **Evaporation pond.** Large, lined surface impoundment for disposal of wastewater via atmospheric drying, resulting in a sludge that must be disposed of in a landfill system.
- **Class I non-hazardous injection well.** Disposal of wastewater via well discharge to a geologic formation that is unsuitable for potable water production and isolated from drinking water aquifers.
- **Disposal to wastewater treatment plant.** Discharge to a treatment works for removal of pollutants.
- **Surface discharge.** Discharge of wastewater to the ground or receiving waters, including lakes, rivers, and streams.
- **Off-site treatment.** Routing of the wastewater to a facility in another location employing one or more of several technologies by a contracted service company.

6.8.1 Wastewater Disposal Alternatives Decision Analysis

The following hierarchy of tests was applied to each alternative:

Test 1. Is the wastewater disposal alternative feasibly available at the Project? (If not, then disregard this alternative. If yes, proceed to Test 2.)

Test 2. Will the subject alternative satisfy applicable laws, ordinances, regulations, and standards? (If not, then disregard this alternative. If yes, proceed to Test 3.)

Test 3. Is the subject alternative technologically sufficient to guarantee high safety and reliability (98 percent availability? If no, then disregard this alternative. If yes, proceed to Tests 4 through 6.)

Tests 1 through 3 address “fatal flaw” criteria. Alternatives that did not pass Test 1, 2, or 3, were not evaluated further. For alternatives passing Tests 1 through 3, Tests 4 through 6 were applied and scored as high, medium, or low:

Test 4. Rate other environmental impacts, including transportation, biological, energy, health and safety, etc.

Test 5. Rate relative capital costs of each remaining alternative.

Test 6. Rate relative O&M costs of each remaining alternative.

The ratings from application of Tests 4 through 6 were evaluated for each alternative, with the highest rated alternative selected.

6.8.2 ZLD System

A ZLD system is a mechanical system using a mechanical vapor compression evaporator and crystallization to effectively reduce liquid wastes to a dry solid waste for landfill disposal. ZLD enables water to be reused within the plant, and it eliminates wastewater. Although this option is technologically feasible, it is energy-, operational-, and capital-intensive.

6.8.3 Evaporation Pond

An evaporation pond would consist of a large, lined surface impoundment for disposal of wastewater via atmospheric drying, resulting in a sludge that must be disposed in an approved landfill. A very large evaporation pond would be required for disposal of the large volume of wastewater produced by the Project. Due to space, economic, and environmental considerations, this alternative was determined to not be feasible. Therefore, this alternative was eliminated from further consideration.

6.8.4 Injection Disposal Well

This alternative includes the disposal of wastewater via wells that discharge to a geologic formation that is unsuitable for potable water production and is isolated from aquifers. The following geologic conditions protective of underground source of drinking water are required to obtain a permit to construct a Class I Non-hazardous Injection Well:

- A thick sequence of permeable sediments capable of accepting the injected wastewater.
- A thick sequence of impermeable sediments that will confine the injected wastewater and prevent migration towards underground source(s) drinking water.
- The injection operation should not facilitate the fracturing of the rocks or the integrity of the injection well.

Deep-well injection (DWI) is used widely on the western side of Kern County. Local subsurface strata are well understood, and large amounts of geologic data are available to define the appropriate wastewater disposal system. DWI for the rates expected would require a network of approximately 15 disposal wells (with five additional wells for redundancy), with multiple high-head booster pumps to enable injection. This infrastructure would be expensive to build and operate. Constructing this infrastructure either on site or off site would involve significant commercial negotiations. Because lengthy commercial discussions may disrupt the Project

timeline, and considering that the ZLD was available at similar cost with no negative schedule impact, this DWI option was not selected.

6.8.5 Disposal to Wastewater Treatment Plant

The city of Bakersfield wastewater treatment plant is approximately 17 miles south of the Project Site. This alternative failed to pass Test 1 due to the distance and insufficient capacity at the wastewater treatment plant.

6.8.6 Surface Discharge

This alternative would involve the discharge of wastewater to the ground or receiving waters, including lakes, rivers, and streams. This method failed to pass Test 2, because the quality of the wastewater will not meet state and federal discharge limitations for direct discharge to surface waters. This alternative was eliminated from further consideration.

6.8.7 Off-Site Treatment

This alternative would involve the transport of the wastewater produced by the Project to an off-site facility for treatment and/or disposal. This wastewater disposal alternative failed to pass Test 1, because it is not feasibly available at the Project Site due to the volume of wastewater produced, and the absence of a treatment or disposal facility in the vicinity.

The evaluations from application of Tests 4 through 6 were totaled for each alternative, and the alternative with the highest evaluation was selected. Wastewater disposal options are evaluated in Table 6-2, Evaluation of Wastewater Disposal Options.

Lifecycle costs for ZLD are roughly similar to a DWI system. However, ZLD is more straightforward from a commercial perspective in comparison to DWI. On the basis of similar costs, and ease of commercial arrangements, the Project includes a ZLD system for disposal of water treatment wastes and cooling tower blowdown.

6.9 NEPA Additional Alternatives Considered

NEPA requires that an EIS evaluate the range of reasonable alternatives to an agency's proposed action. The range of reasonable alternatives encompasses those alternatives that would satisfy the underlying purpose and need for agency action. The purpose and need for the Proposed Action is set forth in Section 6.1.3. Given the CCPI programmatic purpose and need, the reasonable alternative prior to selection of this Project would have been to select another project that applied to and met the eligibility requirements of the CCPI program. The range of reasonable alternatives in competitions for grants, loans, and other financial support is defined in large part by the range of responsive proposals DOE receives. Unlike projects undertaken by DOE itself, DOE cannot mandate what outside entities propose, where they propose to do them, or how they propose to do them, beyond establishing requirements in the funding opportunity announcement that further the CCPI Program objectives. DOE's decision is limited to selecting among the applications submitted by project sponsors that meet CCPI Program goals.

Recognizing that the range of reasonable alternatives in the context of financial assistance and contracting is in large part determined by the number and nature of the proposals submitted, Section 216 of DOE NEPA regulations requires the Department to prepare an "environmental critique" that assesses the environmental impacts and issues relating to each of the proposals that DOE considers for an award (see 10 CFR 1021.216). DOE considers these impacts and issues, along with other aspects of the proposals (such as technical merit and financial ability) and the CCPI Program objectives, in making awards. In October 2010, DOE prepared a critique of the proposals that were deemed suitable for selection in this round of awards for the CCPI program, titled Environmental Synopsis CCPI Round 3.

DOE received 11 applications in response to the initial Funding Opportunity Announcement (issued August 11, 2008) for Round 3 of the CCPI, all of which were determined to have met the mandatory eligibility requirements listed in the FOA. The applications covered a wide geographic range, including sites in 14 different states representing nearly every region of the country. In response to the reopened announcement (issued June 9, 2009), DOE received 38 applications, of which 25 were determined to have met the mandatory eligibility requirements listed in the announcement. The 25 applications offered projects involving sites in 19 different states representing nearly all geographic regions of the country. The applications were evaluated against technical, financial, and environmental factors. By broadly soliciting proposals to meet the programmatic purpose and need for DOE action and by evaluating the potential environmental impacts associated with each proposal before selecting projects, DOE considered a reasonable range of alternatives for meeting the purpose and need of the CCPI solicitation.

Once DOE selects a project for an award, the range of reasonable alternatives becomes the project as proposed by the applicant; any alternatives still under consideration by the applicant or that are reasonable within the confines of the project as proposed (e.g., the particular location of the generating plant within the HECA Project Site or ROWs for linear facilities), and a No Action alternative.

Under the No Project/No Action Alternative, DOE would not provide funding to HECA. In the absence of DOE funding, DOE assumes HECA could reasonably pursue two options. HECA could build the Project without DOE funding, and the impacts of this option would be essentially the same as those of the DOE Proposed Action. Or, HECA could choose not to pursue its Project, and there would be no impacts from the Project, as discussed in Section 6.2. The No Project/No Action Alternative would not contribute to the goal of the CCPI Program, which is to accelerate commercial deployment of advanced coal technologies that provide the United States with clean, reliable, and affordable energy. However, as required by NEPA, DOE analyzes the option of HECA not building the Project in the absence of DOE funding as the No Action Alternative, in order to have a meaningful comparison between the impacts of DOE providing financial assistance and DOE withholding that assistance.

In summary, DOE currently plans to analyze the Project as follows:

- As proposed by HECA (with and without any mitigating conditions that DOE may identify as reasonable and appropriate);

- Project-specific alternatives that HECA is still considering (e.g., construction of the railroad spur or the use of the Wasco facility for transportation of coal to the site); and the no-action alternative; and
- The No Action Alternative of HECA not building the Project in the absence of DOE funding.

Project-specific alternatives considered by HECA in developing the Project are described in Chapter 2, Project Description, and their comparative impacts are presented in Chapter 5, Environmental Consequences. HECA analyzed several alternative sites and determined that the only reasonable site alternative was the proposed site based on, among other things, the absence of sensitive resources; the availability of land; and the site's proximity to the brackish groundwater supply, to electric transmission and natural gas facilities, and to a CO_2 storage reservoir.[2]

6.9 REFERENCES

CARB (California Air Resources Board) *Aerometric Data Analysis & Management (ADAM), 2012. Top 4 Air Quality Data Summaries*, http://www.arb.ca.gov/adam/topfour/topfour1.phpl. Accessed April 13, 2012.

Council on Environmental Quality (CEQ), 1983. Guidance Regarding NEPA Regulations. 40 CFR Part 1500.

URS Corporation (URS), 2009. Revised Application for Certification for Hydrogen Energy California; Kern County, California. Vol. 1. May.

USEPA (U.S. Environmental Protection Agency), 2012. *AIRS Air Quality Monitoring Data Reports*, http://www.epa.gov/airdata/. Accessed April 13, 2012.

[2] HECA initially selected another site; it subsequently decided to move the HECA Project when it discovered the existence of sensitive biological resources at the initial site.

Table 6-1
Alternative Sites Reviewed and Status

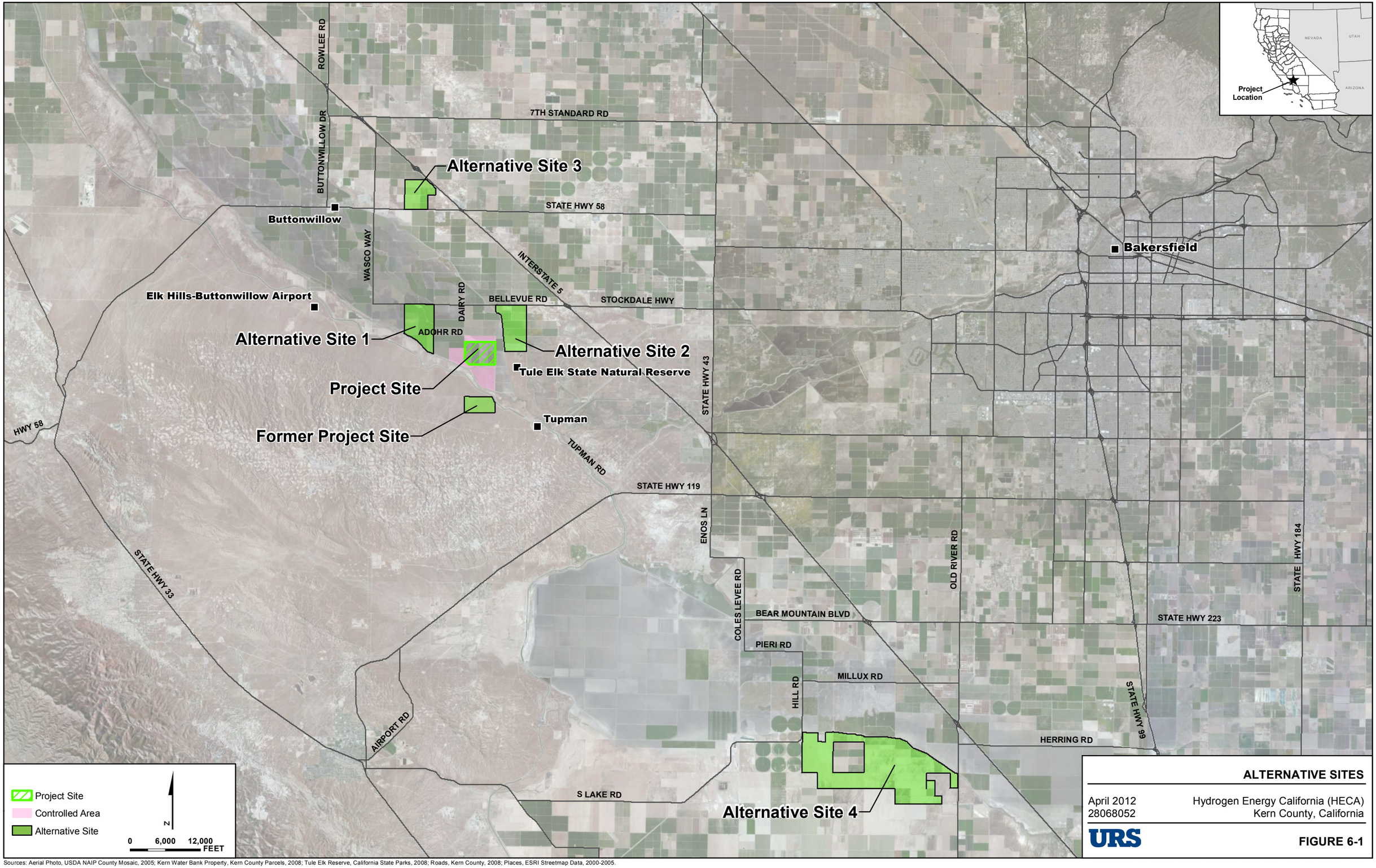
Property	Status
Project Site	Project Site—submitted in the 2009 Revised AFC and in this 2012 AFC Amendment
Former Project Site	Eliminated—due primarily to concentration of California threatened species identified
Alternate 1	Eliminated—owner not willing to sell
Alternate 2	Eliminated—sold to another buyer
Alternate 3	Eliminated—less desirable due to close proximity to I-5
Alternate 4	Eliminated—due primarily to length of linears and number of private land owners involved

Table 6-2
Evaluation of Wastewater Disposal Options

Wastewater Option	Test 1 Availability (pass?)	Test 2 Satisfy LORS? (pass?)	Test 3 Technologically Feasible? (pass?)	Test 4 Environmental Impacts	Test 5 Relative Capital Costs	Test 6 Relative O&M Costs
ZLD	Yes	Yes	Yes	Low	High	High
Evaporation pond	No	N/A	N/A	N/A	N/A	N/A
Deep injection well	Yes	Yes	Yes	Low	High	High
WWTP	No	N/A	N/A	N/A	N/A	N/A
Surface discharge	No	N/A	N/A	N/A	N/A	N/A
Off-site treatment facility	No	N/A	N/A	N/A	N/A	N/A

Source: HECA Project

Notes:
LORS = laws, ordinances, regulations, and standards
N/A = not applicable, because the alternative failed fatal flaw test
O&M = operation and maintenance
WWTP = wastewater treatment plant
ZLD = zero-liquid discharge



ALTERNATIVE SITES

April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 6-1

Sources: Aerial Photo, USDA NAIP County Mosaic, 2005; Kern Water Bank Property, Kern County Parcels, 2008; Tule Elk Reserve, California State Parks, 2008; Roads, Kern County, 2008; Places, ESRI Streetmap Data, 2000-2005.