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Alternatives

This section identifies and evaluates a range of reasonable alternatives to the proposed PRP. An SPPE application must include "[a] discussion of proposed alternatives to the power plant, including the alternative of no power plant, and any mitigation measures proposed to reduce environmental impact." (Title 20, Cal. Code Regs., App. F (f).) Generally, the range of alternatives required to be considered includes alternatives that would "feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project…." (Cal. Code Regs. Title 14 Section 15126.6.) Because PRP does not result in any significant impacts to the environment, there are no alternatives that would lessen significant environmental impacts. The following analysis is nonetheless provided pursuant to Cal. Code Regs. Title 20 Section 1704(b)(5) and Appendix F(f) of the CEC Siting Regulations.

Since PRP will replace the existing San Gabriel Facility, consistent with the requirements of Cal. Pub. Res. Code Section 25540.6(b), alternative sites will not be addressed in this SPPE Application. A "no project" alternative, as well as alternative configuration, technologies, and linear features, are evaluated below.

This section includes the following:

- **Section 5.1—Project Objectives.** Describes basic objective of developing PRP.
- **Section 5.2—No Project Alternative.** Provides information on what would occur if the No Project alternative is selected, which would not include developing a new power generation facility
- **Section 5.3—Power Plant Site Alternatives.** Provides information on why alternative sites were not evaluated
- **Section 5.4—Alternative Linear Facilities.** Provides information on the linear facilities (electric, natural gas, and water)
- **Section 5.5—Alternative Water Supply.** Provides information on use of potable versus non-potable water supply
- **Section 5.6—Alternative Technologies.** Provides information on the other technologies considered using the selection methodology
- **Section 5.7—References.** Provides references used in preparation of Section 5

5.1 Project Objectives

Applicant's project objectives are described in more detail in this SPPE application. Some of Applicant's basic project objectives include the following:

- To safely and economically construct, operate and maintain an efficient, reliable, and environmentally-sound nominal 100-MW (net), natural-gas-fired, simple-cycle generating facility to replace the aging 44.5 MW San Gabriel Facility.
- Develop a nominal 100-MW (net) project that provides efficient operational flexibility with rapid-start and steep ramping capability to allow for the efficient integration of renewable energy sources into the California electrical grid.
- Reuse existing electrical, water, wastewater, and natural gas infrastructure and land to minimize terrestrial resource and environmental justice impacts by developing on a brownfield site.

- Serve southern California energy demand with efficient and competitively priced electrical generation.
- Site the project to serve the eastern Los Angeles Basin load center without constructing new transmission facilities.
- Assist the State in developing increased local generation projects, thus reducing dependence on imported power.
- To provide power capable of providing grid support by offering power generation that is flexible and delivered to the grid operator through communications with a scheduling coordinator.
- To contribute to the diversification of the area’s economic base by providing a reliable low-cost power source.
- Ensure potential environmental impacts can be avoided, eliminated, or mitigated to less-than-significant levels.

5.2 No Project Alternative

5.2.1 Description

Under the No Project Alternative, the proposed facility site would not be developed and would remain in its present condition with operation of the San Gabriel Facility (San Gabriel Facility). Peaking energy that would have been produced by the proposed 100 MW PRP facility would need to be generated by the 30-year-old 44.5 MW San Gabriel Facility. Continued use of older peaking generation facilities consume more natural gas and release larger quantities of air pollutants. In addition, under this alternative, California and the Western Interconnection would have less peaking capacity, and therefore, a less reliable electric system, especially with the current State policy setting a goal of 50 percent renewable power.

In summary, the No Project Alternative would not serve the growing needs of Southern California and California’s businesses and residents for economical, reliable, and environmentally sound generation resources. New power generation facilities are needed to meet customer load and provide ancillary services to the power grid. With the increased use of renewables, additional peaking power support is needed. In addition, the No Project Alternative does not meet AltaGas’ business plans for repowering its aging San Gabriel Facility.

5.2.2 Potential Environmental Impacts

Development of PRP would have three beneficial environmental impacts: (1) It would consume less fuel for each MW-hour generated when compared with the existing San Gabriel Facility, (2) it would discharge fewer air emissions, and (3) it will use recycled water in the cooling tower, reducing the use of potable water.

Potential environmental impacts from the No Project Alternative would result in greater consumption of potable water and greater fuel consumption and air pollution because new peaking generating facilities, including PRP, would not be brought into operation to displace production from older, less efficient, higher air emission peaking power plants.

5.3 Power Plant Site Alternatives

Because PRP would replace the existing San Gabriel Facility, a discussion of site alternatives is not included in this SPPE application. Cal. Pub. Res. Code Section 25540.6 (b) reads, in part:

> (b) The commission may also accept an application for a non-cogeneration project at an existing industrial site without requiring a discussion of site alternatives if the commission finds that the project has a strong relationship to the existing industrial site and that it is therefore reasonable not to analyze alternative sites for the project.

PRP has a strong relationship to the existing industrial site. The new facilities will provide the same service in the same location as the existing facilities, using the City of Pomona's existing potable and recycled water and sanitary wastewater connections that support the existing San Gabriel Facility. While the existing facility does not use recycled water, there is an existing onsite connection to the City's recycled water system. PRP would use the SCE 66-kV Ganesha-Simpson transmission line and Ganesha substation, and the existing Southern California Gas Company high-pressure, high-volume, natural gas pipelines that serves the existing facility. No new offsite development would be needed, other than upgrading a short section (about 0.2 mile) of the 66-kV electric transmission system. The land use designation of the site is consistent with power plant development, and development of new facilities on the existing site would create no new significant impacts to public health or the environment.

Because PRP will have a strong relationship to the existing industrial site, and will provide needed electric reliability service in a densely populated load pocket, it is reasonable not to analyze alternate sites in this application. Furthermore, if a suitable brownfield site were identified, it is unlikely that such a site would provide the necessary infrastructure already available at the proposed PRP site. Therefore, an alternative site will likely not reduce or avoid any impacts associated with the proposed PRP site, which, as the analysis in this application shows, are already below significant levels. Further, development on alternative sites could result in greater impacts than present with development of the proposed site.

5.3.1 Proposed Project Site

The proposed site for PRP is located at the site of the existing San Gabriel Facility, 1507 Mt Vernon Avenue, Pomona, California. The existing site's location is shown in Figure 2-1. The existing San Gabriel Facility is zoned Light Industrial (M1) with a Supplemental (S) Overlay. Although power production facilities and power plants are not specifically cited as a permitted or conditionally permitted use, public utility transmission substations are an explicitly permitted use. However, public utilities and distributing plants are consistent in nature with the allowable land uses listed within this designation.

The site would have no significant, unmitigated, environmental impacts. The PRP site:

- Is located adjacent to a high-pressure natural gas supply pipeline, existing potable and recycled water lines, and sanitary and wastewater disposal lines
- Is located near an existing high-voltage switchyard
- Is located within the Los Angeles Basin Local Reliability Area, adjacent to an area where local capacity is needed to meet NERC reliability criteria
- Has feasible mitigation of potential environmental impacts

5.3.2 Summary and Comparison

Based on the following site selection criteria, it is clear the siting of a power plant is feasible at the proposed site. Following is a summary of site selection factors:

- **Site control feasible –** Site control has been achieved at the PRP site, which was acquired by AltaGas in January 2015.
- **Located on a brownfield site –** The new PRP facilities would be at the same location as an existing power generation facility that will be demolished as part of the project.

- **Location near electrical transmission facilities –** The PRP site is already served by 66-kV transmission lines connecting the facility to the SCE electrical transmission grid through the existing SCE Ganesha substation, located nearby.
- **Location near natural gas supply –** The existing San Gabriel Facility is presently served by a high-pressure, high-volume, natural gas pipeline owned by the Southern California Gas Company.
- **Power plant is an Allowed Use under existing zoning –** The existing San Gabriel Facility is presently an allowed use under the City of Pomona's zoning.
- **Parcel or adjoining parcels of sufficient size for the site –** The PRP site is adequately sized to allow for the project site, with additional construction and laydown areas located nearby.
- **Location near the centers of electrical demand –** The site is located in eastern Los Angeles County, where electrical demand is high due to dense development of residential, commercial, and industrial facilities. In addition, because of the dense residential, commercial and industrial density in the region, there is also the lack of space for a development of a new power generating facilities.
- **Mitigation of potential impacts is feasible –** As documented in this application, mitigation of potentially significant environmental impacts from the PRP to a less-than-significant level is feasible.

5.4 Alternative Linear Facilities

Linear facilities required for PRP include a 0.2 mile electric subtransmission line upgrade on existing monopoles; an existing natural gas pipeline; and potable, non-potable, recycled, wastewater discharge, sewer, and stormwater pipelines. The proposed linear facilities are presented in Section 2, *Project Description,* and Section 3, *Transmission System Engineering*. In addition, the environmental impacts of the proposed linear facilities are discussed in the various environmental sections. Because of the existing San Gabriel Facility, these linear facilities are existing onsite. The only upgrade required is the reconductoring of a 0.2 mile segment of the 66-kV Ganesha-Simpson transmission line using the existing monopoles. Because the linear facilities are onsite, or short in length, identifying alternative linear routes that have less environmental impacts is virtually impossible. Therefore, no alternative linear facilities are being proposed due to the short length of the existing linear facilities and absence of feasible alternatives that would lessen or reduce their environmental impacts.

5.5 Alternative Water Supply

The CEC studied use of water for power plant cooling in its 2003 Integrated Energy Report Proceeding. The proceeding produced the following policy (CEC, 2003):

> Consistent with the Board Policy[70] and the Warren-Alquist Act, the Energy Commission will approve the use of fresh water for cooling purposes by power plants which it licenses only where alternative water supply sources and alternative technologies are shown to be "environmentally undesirable" or "economically unsound".

The most relevant and primary underpinning of this section of the 2003 IEPR is SWRCB Policy 75-58 (Policy 75-58). To comply with the 2003 IEPR and Policy 75-58, an evaluation of potential water supply sources that are available now or may be available in the future was conducted.

From a cooling water perspective, two features distinguish the proposed project from a typical power plant facility. First, as a peaking facility, operation will occur only during periods of peak demand and will be intermittent; thus, there may be long periods of time during which the facility will not operate. Second, because the peaking facility is only expected to have an annual capacity factor of between

[70] This reference is to the SWRCB Policy 75-58.

20 and 43 percent and the cooling water is used for gas turbine intercooling, the water consumption resulting from the cooling process is significantly less than that required by a combined-cycle plant. Thus, the review of water supply alternatives was conducted with the objective of evaluating sources suitable for supplying a peaking facility with a flexible operating profile, which may include long periods of time when the plant does not operate. Consideration of the following key factors was used to assess the water supply alternatives:

- Type/source of water
- Quantity available (peak and average)
- Water quality (i.e., variability, impact on plant metallurgical requirements, impact on discharge limitations, pre-treatment requirements)
- Water provider's commitments to serve others
- Jurisdictional constraints/ability to serve
- Environmental impacts associated with construction of new infrastructure
- Economic considerations

Evaluation of PRP concluded that, as proposed, PRP will comply with the CEC's water policy through the use of recycled water in the cooling tower, and other plant functions for which it is appropriate and suitable.

5.5.1 Proposed Use of Recycled Water

The PRP is in the service territory of the City of Pomona. In addition to potable water, the city has the interest and capacity to provide recycled water to the project. There is already an existing 8-inch recycled water pipeline at the PRP site, so no offsite linear construction would be required.

5.5.2 Dry Cooling Technology

Dry cooling technology was evaluated as an alternative to the use of recycled water for cooling purposes. It is important to note that the use of dry cooling technology will not eliminate the use of water at the site, but will only reduce the amount of water used at the site by approximately 60 percent.

Dry cooling technology would replace use of the cooling tower for cooling the gas turbine intercooler, which is a unique feature of the GE LMS100 gas turbine technology. The intercooling system reduces the temperature of the compressed air in the gas turbine compression cycle, increasing cycle efficiency. The cycle efficiency benefit is reduced when the cooling medium to the intercooler exceeds 90°F, with proportionally greater performance impacts at higher temperatures. Because the cooling medium is the ambient air in dry cooling technologies, the cooling medium temperature is limited by the ambient dry bulb temperature. Therefore, dry cooling technologies will necessarily result in performance impacts at ambient temperatures above 90°F compared to wet cooling technologies for which the cooling medium can be designed to never exceed 90°F.

At 97°F, use of dry cooling would result in a performance loss of approximately 4 MW for a single turbine, with a heat rate impact of approximately 0.5 percent. Since the primary purpose of a peaking plant is to provide electricity during periods of peak electricity demand, which typically occur during times of high ambient temperature, these performance impacts are considered significant. Further, use of dry cooling systems result in a significantly larger cooling structure with a highly visible profile and would likely generate more noise than a conventional cooling tower. In addition, the 2-acre plant site is too small to accommodate the larger dry cooling system.

5.6 Alternative Technologies

Other technologies were considered using the selection methodology described below, but were rejected in favor of the natural gas-fired, simple-cycle technology, which is the basis of this application.

5.6.1 Selection Methodology

Technologies considered were primarily those that could provide peak or intermittent power. The reason for using this screening criterion was that with the increased emphasis in California on developing renewable power, increased demand for peaking support would be required. Two intermittent technologies with no fuel cost, solar and wind, were also examined to see if they might be economically viable.

The selection methodology included a stepped approach with each step containing a number of criteria. The selected technology would have to pass Steps 1 and 2 and provide the lowest or near lowest cost in Step 3. The steps are as follows:

Step 1. Commercial Availability—The technology had to be proven commercially practical with readily available, reliable equipment at an acceptable cost.

Step 2. Implementable—The technology had to be implementable; specifically, it could meet environmental, public safety, public acceptability, fuel availability, financial, and system integration requirements.

Step 3. Cost-effective—The technology had to be cost-effective. Cost includes both capital as well as operation and maintenance costs, which would translate into a busbar cost represented in cents per kilowatt-hour.

The methodology was applied to a number of peaking electrical generation technologies in the following subsections.

5.6.2 Technologies Reviewed

The technologies reviewed can be grouped according to the fuel used. Fuels included were oil and natural gas, coal, nuclear reactions (usually using radioactive materials as fuel), water (hydro, ocean conversion, and geothermal), biomass, municipal solid waste, solar radiation, and wind generation. However, due to the type of generating facility (a peaking facility) that the Applicant is proposing, and the location and size of the site, several technologies were immediately rejected due to the infeasibility of these technologies to provide cost-effective peaking electricity. These technologies were steam generator boilers that generated electrical power by passing steam through a steam turbine (including natural gas fired, coal fired, oil fired, biomass, and nuclear), hydroelectric, and ocean energy.

5.6.2.1 Oil and Natural Gas

These technologies use oil or natural gas and include combustion turbines in various configurations, and fuel cells. The description of these technologies includes the proposed alternative of a simple-cycle combustion turbine.

Simple-cycle Combustion Turbine. This technology uses a gas or combustion turbine to drive a generator. Air is compressed in the compressor section of the combustion turbine, passes into the combustion section where fuel is added and ignited, and the hot combustion gases pass through a turbine, which drives a generator and the compressor section of the combustion turbine. The combustion turbines have a relatively low capital cost with efficiencies approaching 43 percent in the larger units. Because the combustion turbines are fast starting and have a relatively low capital cost, they are used primarily for meeting high-peak demand (about 3,800 hours per year), when their relatively low efficiency is not as great a concern. Applying the review methodology, this technology is commercially available, and could be implemented. The cost of generation is higher than combined-cycle plants. However, this technology typically is used to generate electrical power during peak-demand periods, when electricity costs are typically higher. Therefore, this technology satisfies Steps 1, 2, and 3.

Conventional Combined-cycle. This technology integrates combustion turbines and steam turbines to achieve higher efficiencies. The combustion turbine, which drives a generator, would normally exhaust its hot combustion gas to the atmosphere. However, in the combined-cycle technology, the exhaust gas is passed through a heat recovery steam generator creating steam that is used to drive a steam turbine/generator. The resulting efficiency for the system is 50 to 60 percent, which is considerably greater than most other alternatives. For these reasons, the system is considered the benchmark against which all other base-load technologies are compared. Applying the review methodology, this technology is commercially available, but cannot be implemented due to the small site and the long startup periods required to preheat the steam transfer equipment and steam turbine. Therefore, this technology fails Step 2 and was rejected from further consideration.

Kalina Combined-cycle. This technology is similar to the conventional combined-cycle, except a mixture of ammonia and water is used in place of pure water in the steam cycle. The Kalina cycle could potentially increase combined-cycle thermal efficiencies by several percentage points. This technology is still in the development phase and has not been commercially demonstrated; therefore, it was eliminated from consideration by failing to satisfy Step 1.

Internal Combustion Engines. Internal combustion engine designs are also available for small peaking power plant configurations. These are based on the design for large marine diesel engines, fitted to burn natural gas. Advantages of internal combustion engines are that they use very little water for cooling because they use a closed-loop coolant system with radiators and fans; provide quick-start capability (online at full power in 10 minutes); and are responsive to load-following needs because they are deployed in small units (for example, 10 to 14 engines in one power plant) that can be started up and shut down at will. Disadvantages of this design include higher emissions than comparable combustion turbine technology and more land area. Therefore, it fails Steps 2 and 3.

Advanced Gas Turbine Cycles. There are numerous efforts to enhance the performance and/or efficiency of gas turbines by injecting steam, intercooling, and staged firing. These include the steam-injected gas turbine (SIGT), the intercooled steam-recuperated gas turbine, the chemically recuperated gas turbine, and the humid air turbine cycle. With the exception of the SIGT, none of the technologies are commercially available, and therefore, fail to pass Step 1 of the review methodology. The SIGT is marginally commercially available and does not pass Steps 1 and 2. Consequently, this technology was eliminated from consideration.

Fuel Cells. This technology uses an electrochemical process to combine hydrogen and oxygen to liberate electrons, thereby providing a flow of current. Fuel cells can be used with natural gas or CH_4. The types of fuel cells include phosphoric acid, molten carbonate, solid oxide, alkaline, and proton exchange membrane. With the exception of the phosphoric acid fuel cell and possibly the molten carbonate fuel cell, none of these technologies are commercially available, and therefore, fail Step 1. The phosphoric acid fuel cell has been operated in smaller-size units, and the molten carbonate fuel cell has completed testing. However, currently neither of these technologies are cost-competitive with conventional simple-cycle technology, and therefore, fail Step 3 of the review methodology.

5.6.2.2 Water

These technologies use water as “fuel.” Water technologies hydroelectric and ocean energy conversion were excluded due to the inherent limitations in them to provide peaking electrical generation and the inability to locate them at this site. Therefore, only geothermal is considered here.

Geothermal. This technology uses steam or high-temperature water (HTW) obtained from naturally occurring geothermal reservoirs to drive steam turbine/generators. Vapor-dominated resources (dry, super-heated steam) and liquid-dominated resources (HTW) use a number of techniques to extract energy from the HTW. Geothermal is a commercially available technology. However, geothermal resources are limited, and most, if not all, economical resources have been discovered and developed in California. None are available at the proposed PRP site. Therefore, this technology fails Steps 2 and 3.

5.6.2.3 Solar Radiation

Solar radiation (sunlight) can be collected directly to generate electricity with solar thermal and solar photovoltaic technologies.

Solar Thermal. Most of these technologies collect solar radiation, heat water to create steam, and use the steam to power a conventional steam turbine/generator. The primary systems that have been used in the United States capture and concentrate the solar radiation with a receiver. The three main receiver types are mirrors located around a central receiver (power tower), parabolic dishes, and parabolic troughs. Another technology collects the solar radiation in a salt pond and then uses the heat collected to generate steam and drive a steam turbine/generator. While two of these technologies are considered to be commercial (power tower and parabolic trough), the others are still in the experimental stage.

All of these technologies require considerable land for the collection receivers and are best located in areas of high solar incidence. In addition, power is only available while the sun shines; therefore, unless the projects include energy storage (see Section 5.6.4), they cannot supply power when clouds obscure the sun or from early evening to late morning. These factors translate into high cost, which is well above the future projected market price for peaking power. Although these systems may be commercially available (Step 1), they are not implementable due to land unavailability and/or the ability to finance (Step 2). They also may fail in being cost-effective (Step 3), and therefore, were eliminated from consideration.

Photovoltaic. This technology uses photovoltaic “cells” to convert solar radiation directly to DC electricity, which is then converted to AC. Panels of these cells can be located wherever sunlight is available. This technology is environmentally benign and is commercially available, because panels of cells can theoretically be connected to achieve any desired capacity. While this technology may have a bright future, and cost per kilowatt-hour has been dropping, to meet the objective of 100 MW would require substantially more land area than 2 acres. Therefore, this technology fails Step 2 (Implementable) and maybe Step 3 (Cost-effectiveness), and therefore, was eliminated from consideration.

5.6.2.4 Wind Generation

This technology uses a wind-driven rotor (propeller) to turn a generator and generate electricity. Only certain sites have adequate wind to allow for the installation of wind generators. Most of the sites that have not been developed are remote from electric load centers. Capacity from this technology is not always available because even in prime locations the wind does not blow continuously. In California, the average wind generation capacity factor has been 15 to 30 percent. In addition, the technology cannot be depended upon to be available at system peak load because the peak may occur when the wind is not blowing. The technology is commercially available but requires large land area and is not implementable at the proposed site. The technology has environmental concerns especially with visual impacts, noise, land consumption, and avian mortality. The cost of generation is higher than the preferred alternative. Therefore, this technology fails Step 2 (Implementable) and maybe Step 3 (Cost-effectiveness), and therefore, was eliminated from consideration.

5.6.3 NO_x Control Alternatives

The following combustion turbine NO_x control alternatives were considered.

- Water injection (capable of 25 ppm NO_x)
- Steam injection (capable of 25 ppm NO_x)
- Dry low NO_x combustors (capable of 25 ppm NO_x)

To minimize NO_x emissions, the CTG will be equipped with water injection and SCR using 19 percent aqueous ammonia as the reducing agent. Steam injection was rejected due to a reduction in efficiency compared water injection, with no reduction in NO_x. Use of dry low NO_x combustors was rejected because there was added cost and no reduction in NO_x compared to water injection.

Two post-combustion NO_x control alternatives were considered:

- SCR
- $SCONO_x$

SCR is a proven technology and is commonly used in combustion turbine electrical generating applications. Ammonia is injected into the exhaust gas upstream of a catalyst. The ammonia reacts with NO_x in the presence of the catalyst to form nitrogen and water.

$SCONO_x$ consists of an oxidation catalyst, which oxidizes CO to CO_2 and nitric oxide to NO_2. The NO_2 is adsorbed onto the catalyst, and the catalyst is periodically regenerated.

The level of emission control effectiveness between the $SCONO_x$ and SCR technologies is approximately equivalent. However, the $SCONO_x$ technology does not use ammonia to reduce air emissions. The CEC summarized in the USEPA opinion (CEC, 2007) “that $SCONO_x$ is no more effective for reducing air quality impacts than selective catalytic reduction…, and it also found $SCONO_x$ to be significantly more expensive and arguably less reliable, particularly for larger facilities.” Therefore, $SCONO_x$ was not considered for use at PRP.

The following reducing agent alternatives were considered for use with the SCR system:

- Anhydrous ammonia
- Aqueous ammonia
- Urea conversion

Anhydrous ammonia is used in many combustion turbine facilities for NO_x control, but is more hazardous than diluted forms of ammonia. Aqueous ammonia (an ammonia-water solution) is proposed for the PRP because of its safety characteristics.

Urea conversion technology uses solid urea (prill) in a reactor with steam to convert the urea to aqueous ammonia. Therefore, urea conversion works best in a combined-cycle facility. The aqueous ammonia is typically stored in a tank for use by the SCR system during upsets in the process and during plant start-up activities. Furthermore, the urea conversion process has a higher energy demand over an aqueous ammonia system as a result of consuming steam as part of the process. Finally, the urea process has proven to have poor reliability and slow response times, and it produces an inconsistent concentration of ammonia. The PRP power block is designed to be fast-start and fast-ramp, which requires precise control of ammonia concentrations for emissions control. Therefore, urea conversion was considered and rejected for use at PRP.

5.6.4 Energy Storage

Energy storage options currently available include electrochemical energy storage, thermal energy storage, hydrogen production, and mechanical energy storage. Electrochemical storage includes several types of batteries and capacitors that meet specific needs and requirements in certain applications; however, to date, these energy technologies would not be able to meet the project’s objectives of providing 100 MW for an extended period of time to meet local grid reliability requirements. Furthermore, an energy storage project capable of 100 MW is not feasible within the proposed footprint.

Thermal energy storage primarily is limited to heat energy storage from solar thermal applications for later use, such as steam for power production during evening hours, or for water or building heating purposes, and therefore would not meet the PRP objectives. Hydrogen production involves "storing" energy by using inexpensive or surplus energy (for example, off-peak energy from all sources, or surges of wind power during the night) to create hydrogen through hydrolysis, and then use the hydrogen to create energy for other purposes, including on-peak generation, as well as transportation purposes. However, hydrogen production has not yet been demonstrated as a cost-effective alternative to generation services that the PRP would provide.

Compressed air technology also stores energy by using inexpensive or surplus electrical energy to operate compressors that store high-pressure air for later release through an air-powered turbine, while flywheel technology uses off-peak power to accelerate large rotors (flywheels) to very high speeds, and then use the energy stored as angular momentum to spin a generator during on-peak power periods. While promising, compressed air and flywheel technology have not yet been demonstrated to be cost-effective methods for storing energy on a large scale.

The only utility-scale energy storage technology currently in use in California is pumped-storage hydroelectricity, in which energy is stored by pumping water from a lower reservoir to a higher reservoir when inexpensive or surplus energy is available, and then released through a turbine-generator when additional generating capacity and energy is needed. These projects require two reservoirs at significantly different elevations, plus a pumping/generating station and connecting penstock, and therefore have very specific siting requirements not generally found in the population centers of the greater Los Angeles Basin (CEC, 2011). Because of the very limited ability to site cost-effective energy storage facilities that are able to provide reliable electric power services to the Los Angeles Basin, energy storage technologies were considered but rejected for the PRP.

5.6.5 Conclusions

All feasible technologies that might be available for peaking load operation in California were reviewed using a methodology that considered commercial availability, ability to implement, and cost-effectiveness. Although some technologies, other than the simple-cycle burning natural gas, were commercially available and could be implemented, most would not result in fewer environmental effects than the natural gas-fired, simple-cycle technology. In addition, for all alternatives commercially available, implementable technologies were less cost-effective than the simple-cycle. Consequently, the conventional simple-cycle technology using natural gas as fuel is the best available technology for a peaking plant and the one that should be employed for PRP.

5.7 References

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