5.0 ALTERNATIVES

5.1 INTRODUCTION

A reasonable range of alternatives that could feasibly attain some of the basic objectives of the Proposed Grayson Repowering Project (Project) are identified and evaluated in this section.

5.1.1 Project Objectives

Pursuant to Section 15124(b) of the California Environmental Quality Act (CEQA) Guidelines, the description of the Project must contain "a clearly written statement of objectives" that would aid the lead agency in developing a reasonable range of alternatives to evaluate in the Environmental Impact Report (EIR), and to aid decision makers in preparing findings, and, if necessary, a statement of overriding considerations.

Within the context of the City's overarching need to ensure a reliable year round supply of power to its residents and customers under various planning contingencies[15], the primary objective of the Project is to replace the aged, less efficient, less flexible, and unreliable generation units at the Grayson Power Plant with approximately 262 megawatts (MW) net of modern power generation that is efficient, reliable, operationally flexible, and can easily integrate into the City of Glendale's existing power system. This Project would ensure system reliability, facilitate and balance renewable imports, and supply the balance of the City's power needs when transmission imports are insufficient, curtailed, or not available to serve its electrical load[16]. In addition, the Project will be able to integrate and accept increasingly available renewable energy resources.

[15] Required planning contingencies include a generating unit suddenly going off line and no longer generating power, the loss of a transmission system (100 MW), or the loss of the source of power being imported over a transmission system. These types of planning contingencies have in fact occurred. Also, while not a required planning contingency, during the Sylmar earthquake the City lost its outside electricity supplies and was islanded (not connected to an off-site power supply through the transmission grid) with only internal generation available.

[16] The City's ability to import power is limited by the capacity of two existing transmission systems, which combined are less than the full load demands of the City. The transmission lines are subject to curtailments (partial or full reductions in capacity). For example, the capacity of the Pacific DC Intertie (100 MW) was reduced for six months in 2004 and then was completely out of service for an additional three months.

The Project objectives are:

1. Integrate with local and remote distributed renewable energy resources to provide sufficient capacity and energy to ensure reliable service at all times for the City and to support the City's compliance with California's Renewable Portfolio Standards.

2. Utilize current and reliable technology and control systems to provide reliable, cost effective, and flexible generation capacity for the City to serve its customer load.

3. Provide a local generation resource sufficient to meet resource adequacy requirements, and the City's obligations within the Balancing Area[17] to balance load and resource at the interconnection with the BA, in accordance with industry standards including North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) requirements; thus, providing local reliability and contributing to grid stability within the Los Angeles Basin.

4. Provide sufficient locally controlled generation to minimize the City's reliance on importing power from remote generation locations through a congested transmission grid system subject to planned and unplanned outages and de-rates, making the delivery of energy to serve load less reliable than local generation.

5. Replace the aged, unreliable, less efficient, high maintenance steam boilers with new, efficient, and less environmentally impactful generation technologies that meet South Coast Air Quality Management District (SCAQMD) Rule 1304(a)(2).

6. Locate the proposed Project at existing City property already permitted and used for generation to minimize the need for major infrastructure improvements such as fuel supply, water, wastewater, recycled water and transmission facilities, or the need to purchase additional property.

7. Provide generation that is highly efficient to maintain reasonable cost of generation to minimize the impact on customer electric rates and help manage costs of delivering energy to the City's customers.

8. Support water conservation efforts by eliminating the use of potable water for generation purposes.

9. Reduce the per megawatt-hour (MWH) creation of emissions and consumption of water.

[17] A geographic area defined by the interconnected transmission/distribution systems. The boundaries of the Balancing Area are defined by the points of interconnection to other Balancing Areas. The generation within a Balancing Area must be constantly adjusted so that the sum of the power generated within the Balancing Area, plus power imported into the Balancing Area, less the power exported from the Balancing Area, less the load within the Balancing Area is maintained at zero, e.g., in balance. For the Grayson project, the Balancing Area is composed of Los Angeles Water and Power, Glendale Water & Power, and Burbank Water & Power.

5.1.2 Significant Impacts of the Project

No unavoidable significant impacts from implementation of the proposed Project have been identified in this Draft EIR.

5.1.3 Requirements for Alternatives Analysis

CEQA requires an evaluation of project alternatives based on the comparative merits 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 effects of the project, and evaluate the comparative merits of the alternatives" (Title 14, CCR, 15126.6(a)). Thus, the focus of the alternatives analysis should be on alternatives that "could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more significant effects" (14 CCR 15126.6(c)). Feasible is defined to include the consideration of economic, environmental, social, legal, and technological factors and includes site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, jurisdictional boundaries, and whether the proponent can reasonably acquire, control, or otherwise have access to alternative sites.

The analysis must also address the "no project" alternative (Title 14, CCR, Section 15126.6(e)). The CEQA Guidelines further state that the range of alternatives is governed by the "rule of reason," which requires consideration only of those alternatives necessary to permit a reasoned choice and to foster informed decision making and public participation (CCR, Title 14, Section 15126.6 (f) (3)).

5.1.4 Selection of Alternatives to be Evaluated in EIR

5.1.4.1 Overview of Alternatives Selected for Further Analysis

In addition to a No Project Alterative, the following alternatives, which meet some of the project goals and objectives, are analyzed in this section.

- **No Project Alternative**: Running the existing power plant to failure and not proceeding with repowering of the Grayson Power Plant.

- **Energy Storage Project Alternative**: Replace Units 1 – 8 at the existing Grayson Power Plant with a battery energy storage facility. Use of existing City Unit 9 electrical generation, the City's allotment from the Magnolia Power Plant, and transmission capacity to serve the City's electrical load and charge batteries when excess capacity is available. Energy stored in the batteries would then be discharged to serve the electrical load when demand exceeds available transmission and generation resources.

- **Alternative Energy Project Alternative**: A project with some combination of photovoltaic or wind power production with energy storage and transmission lines.
- **150 MW Project Alternative**: A reduced size power project located on the existing project site with a new transmission interconnection.
- **200 MW Project Alternative**: A reduced size power project located on the existing project site with a battery energy storage system.

5.1.4.2 Overview of Alternatives Not Selected for Further Analysis

Section 15126.6, subdivision (c) of the CEQA Guidelines describes selection of a reasonable range of alternatives and the requirement to include those that could feasibly accomplish most of the basic project objectives while avoiding or substantially lessening one or more of the significant effects. The analysis should identify any alternatives that were considered by the lead agency but were rejected as infeasible. CEQA requires a brief explanation of the reasons underlying the lead agency's determination to eliminate alternatives from further analysis.

A number of alternatives were considered but eliminated from further consideration. The alternatives that were not evaluated further include alternative sites, and a variety of alternative technologies (generation technology, fuel technology, and alternative power plant cooling). These alternatives are more fully discussed in Section 5.3.

5.2 ANALYSIS OF ALTERNATIVES

5.2.1 No Project Alternative

5.2.1.1 Description

Under the No Project Alternative, the existing Grayson Power Plant would not be repowered. Old, less efficient equipment built between 1941 and 1977 would continue to operate as long as maintenance is still feasible and economic. The feasibility of maintaining aging units is declining, and the cost of maintenance would continue to increase, as would the likelihood of future electrical power outages. At some point, when maintenance is no longer practical, the units would be shut down. This is referred to as the "run to fail" option.

As of December 2012 (Source – SNL Energy) the average retirement age of fossil fuel plants is forty-one (41) years for combustion turbines and fifty-four (54) years for steam turbines. All the existing generating units, except for Unit 9 (a simple cycle combustion turbine-generator) which is not being replaced, were built between 1941 and 1977 and are at least 40 years old. Except for Unit 9, all the units are at or past the end of their design lives and are increasingly difficult to maintain feasibly and economically.

The No Project Alternative would result in a total Grayson Power Plant generating capacity of up to 48 MW (net) from Unit 9, with the remaining electrical energy to meet Glendale's customer load being supplied from the Magnolia Power Plant (39 MW[18]), and electricity imports over transmission systems from outside of the City (200 MW). This would provide the City a maximum total supply of 287 MW, which is less than the City's summer time (June-September) peak loads[19], and only 187 MW with the loss of the single largest contingency. This reduced capacity would come at a significantly increased risk to reliability potentially culminating in the inability to serve load at all times of the year without blackouts. Since 2009, the City's electric system load was more than 187 MW an average of eight-one (81) days per year. Additionally, at these minimum levels of generation/supply, the City would not meet its NERC reliability obligations to the Balancing Authority. Thus, the No Project Alternative does not provide a viable means to serve the electric load of the City's residents and customers.

5.2.1.2 Potential Environmental Impacts

Following are the potential environmental impacts that would result from the No Project Alternative.

Potential Environmental Impacts Less than Those of the Project

Emissions, noise, and traffic associated with Project demolition and construction would be avoided with the No Project Alternative. As generation units are retired and only Unit 9 remains operating, there would be a reduction in emissions, noise, and traffic from plant operation. Potential air quality, greenhouse gas emissions, noise, and traffic and transportation impacts of the No Project Alternative would be less than those of the Project.

Potential Environmental Impacts Similar to Those of the Project

The Grayson Power Plant would continue to operate, with older generation units being retired until only Unit 9 remains in operation. The existing power plant facility would remain to have a similar aesthetic impact to that of the Project's. The No Project Alternative would also have similar impacts as the Project to agriculture and forestry resources, biological resources, cultural resources, environmental justice, geology and soils, hazards and hazardous materials, hydrology and water quality, land use and planning, mineral resources, population and housing, public services, recreation, socioeconomics, tribal cultural resources and utilities and service systems as the land use would be consistent and restricted to the same site.

[18] Glendale's allocation of Magnolia is 46 MW, however 7 MW of that amount is only available when Magnolia utilizes the supplementary gas-fired burners to increase the combustion turbine exhaust energy in order to produce more steam and hence increase the steam turbine output. However, the supplementary burners are typically not used, and thus 39 MW is a more realistic value.
[19] The all-time peak load was 346 MW.

Potential Environmental Impacts Greater than Those of the Project

The No Project Alternative would not have any potential environmental impacts greater than those of the Project.

5.2.1.2 Objectives Consistency Evaluation

A primary objective of the Project is to provide efficient operational flexibility with quick-start high ramp rate generation to facilitate increasing the contribution of renewable energy (such as wind and solar) into the City's electrical grid and to support California's Renewable Portfolio Standards. The No Project Alternative would significantly challenge the City's ability to integrate renewable resources because only Unit 9 would remain available to balance the intermittency of renewable imports.

As a result of the continued challenges in maintaining reliable operation of old units as well as their less efficient operation, the unavailability of additional transmission capacity for increased electrical imports, the City's customers would not gain the reliability, financial and environmental benefits a new efficient power plant would offer, and would be subjected to degraded system reliability, including likely rolling blackouts under peak load or contingency conditions.

One of the main objectives of the Project is to ensure continued reliability of the City's generation and transmission systems' ability to serve the City's full load for any period of time. Due to transmission constraints, this requires that local generation be available to meet the City's load and reserve requirements in combination with the ability to optimize its transmission rights to import energy from external sources, including renewable energy to meet the Renewable Portfolio Standards.

Even if the City were able to construct new high voltage transmission lines, which is economically and environmentally challenging, local generation would still be required to meet the Balancing Authority's needs to provide reserve margins and regulation, and to serve the City's load when external sources are curtailed or not available. Thus, the No Project Alternative would not provide the level of reliability mandated by NERC/WECC reliability standards or meet the Project's objectives.

The No Project Alternative would fail to fulfill the City's objectives, the City would not be able to meet the State's Renewable Portfolio Standards, and the City would not ensure a reliable and continuous electric supply for the City.

The No Project Alternative does not feasibly meet many of the Project objectives or meet them as well as the Project. Specifically, the No Project Alternative:

1. Would only be able to integrate with local and remote distributed renewable energy resources to a limited and declining extent as units are shut down. This declining resource would not be sufficient to provide enough capacity and energy to ensure reliable service at all times for the City, and to support the City's compliance with California's Renewable Portfolio Standards.

2. Would not be using current and reliable technology and control systems to provide reliable, cost effective, and flexible generation capacity for the City to serve its customer load.

3. Would provide a local generation resource, but that source would diminish with time and would not be sufficient to meet resource adequacy requirements, and the City's obligation within the Balancing Area to balance load and resource at the interconnection with the BA, in accordance with industry standards including NERC/WECC requirements; thus, would not provide local reliability or contribute to grid stability within the Los Angeles Basin.

4. Would provide a locally controlled but declining source of generation. The No Project Alternative would not be sufficient to minimize the City's reliance on importing power from remote generation locations through a congested transmission grid system subject to planned and unplanned outages and de-rates making the delivery of energy to serve load less reliable than local generation.

5. Would not replace the aged, unreliable, less efficient, high maintenance steam boilers with new efficient and less environmentally impactful generation technologies that meet SCAQMDs Rule 1304(a)(2).

6. Would be located at the existing City property already permitted and used for generation, and would, due to units eventually coming off line, minimize the need for major infrastructure improvements such as fuel supply, water, wastewater, recycled water, and for the construction of transmission facilities, or need to purchase additional property.

7. Would not provide generation that is highly efficient to maintain reasonable cost of generation to minimize the impact on the rates and help manage costs of delivering energy to the City's customers.

8. Would not support water conservation efforts by eliminating the use of potable water for generation purposes, until most of the aging units are depowered.

9. Would not reduce the per megawatt-hour (MWH) creation of emissions and consumption of water.

5.2.1.3 Summary

The No Project Alternative would involve running the existing power plant to failure and not proceeding with repowering of the Grayson Power Plant. The No Project Alternative would result in reduced environmental impacts over time as the units are shut down and would have less potential environmental impacts than those of the Project.

However, the No Project Alternative is not a viable alternative in that it would not serve the needs of the City as the City could no longer meet its obligations as a load serving entity for its residents and customers, placing them at significant risk for decreased electrical system reliability and availability. Moreover, the No Project Alternative would not satisfactorily meet the Project objectives and would fail to comply with Federal and State reliability standards.

5.2.2 Energy Storage Project Alternative

5.2.2.1 Description

If the City does not replace the existing generation facilities, the City would need to either build additional transmission capacity or build "time shifting" energy storage systems to provide the requisite capacity. Given the significant difficultly in locating suitable right-of-ways and permitting new large capacity transmission connections due to the dense urban development in the Los Angeles basin, as well as the potential for significant environmental impacts from the development of new transmission facilities, a Project alternative involving large capacity energy storage system at the Grayson site was deemed a reasonable Project alternative worthy of further evaluation.

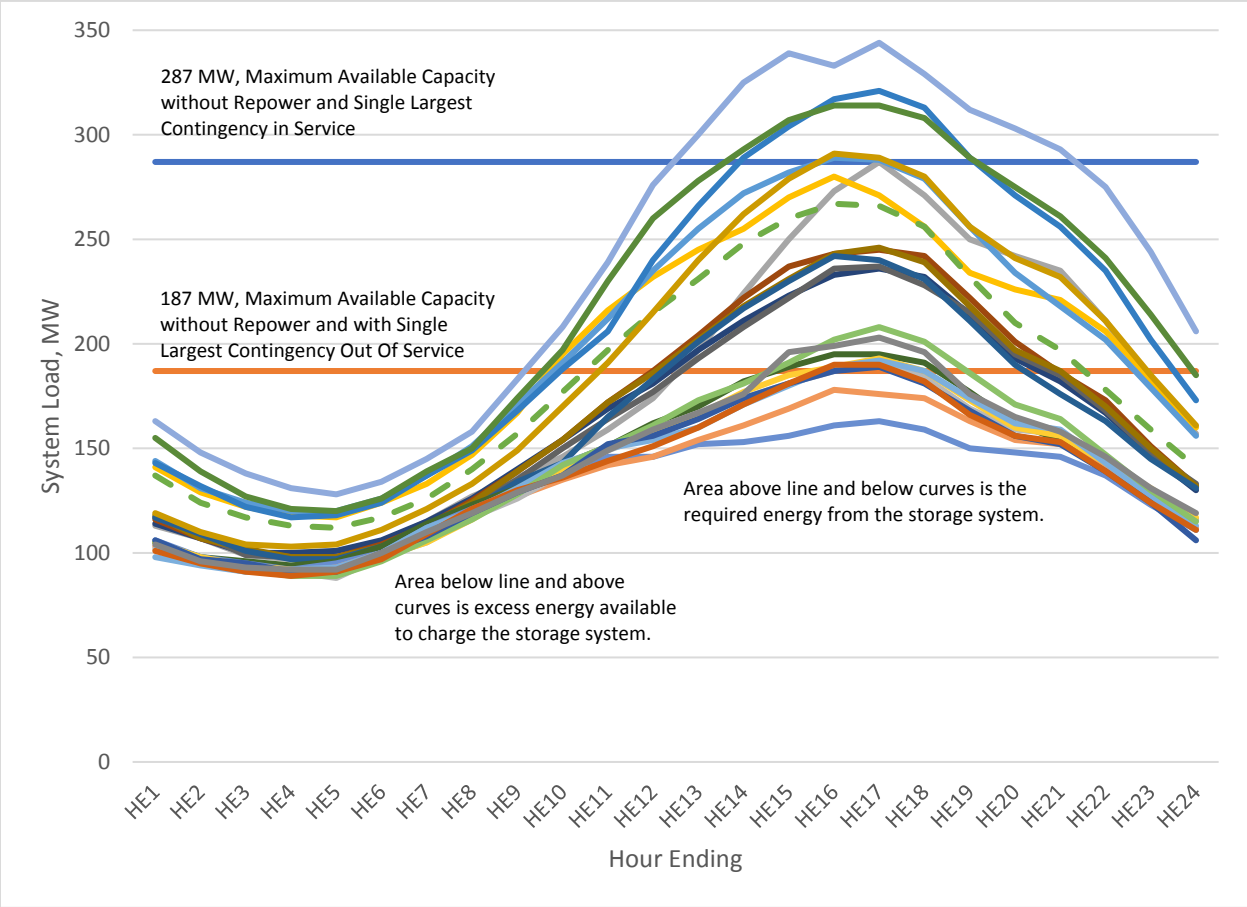
The Energy Storage Project Alternative involves an energy storage system that would be charged during times of the day when there is available transmission capacity not needed to serve the City's load. The available energy would be stored and "time shifted" to be used during high load periods when the available transmission capacity is inadequate to serve the City's load.

In this Alternative, which presumes all units but Unit 9 will ultimately be shut down, the City would use the available 48 MW (net) from Unit 9, 39 MW from the Magnolia Power Plant, and 200 MW imported over transmission lines from outside of the City. This would provide the City a total supply of 287 MW, which is less than the City's peak loads[20]. With the NERC required planning assumption that the single largest source of power will unexpectedly cease to be available (an event known in the power industry as "the loss of the single largest contingency") which would be losing the 100 MW delivered to Glendale over the Pacific DC Intertie transmission line), available capacity would fall to 187 MW increasing the shortfall in capacity.

[20] The City had yearly peak loads of 329 MW, 329 MW, and 346 MW in 2015, 2016, and 2017 respectively. Prudent system planning would typically include some reserve above the peak load.

Figure 5.1 below illustrates the City's daily load profiles for Mondays through Fridays in August 2017 (each of the curves is a different day). Each day, energy generated during the late night and early morning hours when the system load is less than the available electrical supply capacity would be available to be stored. Later in the day, when system load is greater than the available electrical supply, energy would be discharged from the energy storage system to serve load.

Figure 5-1 August 2017 Monday Through Friday Daily Load Profiles



With Unit 9's output, Glendale's share of the Magnolia Power Plant, and transmission imports, there would be sufficient excess energy available to store and time shift to serve the peak load hours. However, if one of these sources of power were to be lost, this is no longer possible for the higher load days as the amount of excess energy that could be supplied during late evening early morning hours is less that what would be consumed from mid-morning into the evening hours.

To serve peak load and accommodate the NERC required consideration that the single largest source of power could be lost unexpectedly, this Alternative would require a storage system with a minimum usable power capacity of 160 MW (346 MW peak load less 187 MW available capacity equals 159 MW). For the purposes of this evaluation the August 4th load curve was used (the dashed line) as it was the highest load day where energy available for storage exceeded demand. On that day, approximately 633 MWH would have been available for storage to supply a demand of 522 MWH for a surplus of 111 MWH. The next higher load curve day was August 28 and had a deficit of approximately 69 MWH, with the highest load curve (August 31) having a deficit of approximately 1,170 MWH (one-third of the load curves had more demand than excess energy). Of necessity, since solar energy is not available during late evening early morning hours when excess energy was available, transmission imports would come from non-solar resources as well as energy from Unit 9 and Magnolia.

Energy storage options currently available include battery systems, thermal energy storage, hydrogen production, and mechanical energy storage.

- Battery storage systems include several types of batteries and capacitors which meet specific needs and requirements in certain application.
- Thermal energy storage utilizes a source of heat, such as solar thermal, to generate steam for power production during evening hours. However, this technology is not feasible at Grayson or within the City because inadequate available space exists on site to develop a solar array facility for this purpose, and there are no feasible options in Glendale on property owned by the City, including rooftops.
- Hydrogen production involves “storing” energy by using surplus energy to generate hydrogen through hydrolysis, and then burning the hydrogen (in a turbine) to generate electricity. While small projects have been built, large scale electricity production solely fueled with hydrogen has not been commercially demonstrated. Thus, this option was not considered feasible for the Energy Storage Project Alternative.
- Compressed air technology also stores energy by using surplus electrical energy to operate compressors that store high-pressure air for later release through an air-powered turbine. Flywheel technology utilizes surplus energy to accelerate large rotors (flywheels) to very high speeds, and then uses that stored rotational energy to spin a generator when power is needed. While promising, compressed air and flywheel technology have not yet been demonstrated to be cost-effective methods for storing energy on a large scale, a scale sufficient to store enough energy to meet peak load. The site does not have any capability or capacity to store compressed air for the purpose of shifting load.

- Pumped-storage hydroelectricity entails storing surplus energy by pumping water from a lower reservoir to a higher reservoir, and then releasing it through a turbine-generator when additional generation 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), let alone in Glendale.

Based on the above, a Battery Energy Storage System (BESS) was considered the only feasible energy storage technology that can be sited at Grayson and is therefore the energy storage system analyzed in this Alternative. The BESS could utilize either Lithium ion rechargeable battery or reduction-oxidation flow battery technologies.

In sizing a BESS, several factors must be taken into consideration:

- The full capacity of the battery is not available for use (the battery cannot be fully discharged each time without seriously compromising its lifetime).
- The "round trip efficiency" is less than 100% (all of the energy sent into the battery is not available for use).
- The capacity of a battery slowly degrades over time. The amount of degradation is dependent on how much energy is used during a discharge cycle, and how fast the battery is charged or discharged.
- Batteries need to be in modular groups to avoid large scale cascade failures.

To provide an additional 522 MWH of usable capacity over a reasonable battery life considering typical allowable depth of discharge (80%), a capacity degradation of 20% over its lifetime (2% per year for a ten-year lifetime), and assuming a round trip efficiency of 100% (no losses) would necessitate a BESS of approximately 815 MWH storage capacity. Note that if the highest load curve was used the storage requirement would escalate to over 1,800 MWH. A battery life of 10 years was assumed (this is the higher end of expected lifetimes) subject to reasonable cycling duty and specific battery technology and chemistry.

If adequate storage capacity could be achieved through a BESS, the Energy Storage Project Alternative using the BESS method would meet most of the Project objectives. However, the BESS presents some challenges that place its ultimate feasibility in question. For example:

- While sufficient energy would be available during the winter months to charge the batteries over the transmission system, during the summer months, sufficient energy will not be available during all days because all transmission capacity will be needed most of the time to serve load. Consequently, this Alternative does not assure that the City will be able to reliably serve its customers at all times.

- The scale of the required BESS is much larger than other BESS projects that have been built to date, with the largest existing BESS project being a 30 MW 120 MWH project[21]. A BESS system at Grayson would require five times the power delivery and seven to fifteen times the energy storage.
- The initial installed cost of the BESS is estimated at approximately $500,000/MWH based on recently completed, albeit much smaller, projects (tens of MWH of storage). For 815 MWH of storage, this translates to more than $320,000,000 if we allow a twenty percent reduction in the estimated cost per MWH due to economy of scale (although this is not certain). Actual costs will be higher as these costs do not include the cost of demolition of the Grayson site, as well as security and fire protection improvements.
- Additionally, the batteries have a finite life requiring periodic replacement every 5-10 years (depending on usage) with current battery replacement costs of $200,000/MWH for the batteries alone. While these costs have been declining, the rate of decline has slowed. For 815 MWH of storage the replacement cost could be over $160,000,000.
- The above costs are for storage that would only have been adequate for two-thirds of the days in August and would provide for no reserve. Energy storage system costs could double to provide adequate storage for all days.
- These costs do not include the cost to produce and transmit the energy to charge the batteries.

5.2.2.2 Potential Environmental Impacts

Following are the potential environmental impacts that would result from the Energy Storage Project Alternative.

Potential Environmental Impacts Less than Those of the Project

The Energy Storage Project Alternative would involve less construction and have a lower intensity of structures and heights on the site and would therefore contribute to less of a short-term and long-term aesthetic impact compared to the Project. Construction and operation air emissions, noise and traffic would be lower due to less construction activity and the sites long-term use for energy storage rather than generation (which has fewer sources of noise and requires fewer personnel to operate). The Energy Storage Project Alternative would consume less water than the Project and generally involve the use of fewer types and volumes of hazardous materials such as liquid petroleum hydrocarbons that could contribute to off-site stormwater pollution. Potential aesthetics, air quality, greenhouse gas emissions, hydrology and water quality, noise, and traffic and transportation impacts of the Energy Storage Project Alternative would be less than those of the Project.

[21] A project built for San Diego Gas and Electric by AES Energy Storage.

Potential Environmental Impacts Similar to Those of the Project

The Energy Storage Project Alternative would have similar impacts as the Project to agriculture and forestry resources, biological resources, cultural/tribal cultural resources, environmental justice, geology and soils, hazards and hazardous materials, land use and planning, mineral resources, population and housing, public services, recreation, socioeconomics and utilities and service systems as the land use would be consistent and restricted to the same site. While the Energy Storage Project Alternative would not involve the use of hazardous materials common to the power plants, it would result in the need for battery replacement and battery disposal every five to ten years.

Potential Environmental Impacts Greater than Those of the Project

The Energy Storage Project Alternative would not have any potential environmental impacts greater than those of the Project.

5.2.2.3 Objectives Consistency Evaluation

The Energy Storage Project Alternative does not feasibly meet many of the Project objectives or meet them as well as the Project. Specifically, the Energy Storage Project Alternative:

1. Would integrate with local and remote distributed renewable energy resources, but based on the above discussion, sufficient energy would not be available to charge the BESS during high load periods, and thus the BESS would not to provide sufficient energy to ensure reliable service at all times for the City and would therefore not support the City's compliance with California's Renewable Portfolio Standards.

2. Would utilize current technology and control systems, but the quantity and required integration would require a very significant upscaling compared to existing projects.

3. Would provide a local source of energy if sufficient excess energy is available to charge the batteries. However, sufficient excess energy is not available, particularly during high load periods, therefore the Energy Storage Project Alternative will not provide a local power resource sufficient to meet resource adequacy requirements, and the City's obligation within the Balancing Area to balance load and resource at the interconnection with the Balancing Authority in accordance with industry standards including NERC/WECC requirements. Thus, the Energy Storage Project Alternative would not provide local reliability that would also contribute to grid stability within the Los Angeles Basin.

4. Would provide sufficient locally controlled source of power as long as sufficient excess energy is available (this Alternative provides storage of excess Unit 9, Magnolia, and off-site generation). However, as the bulk of the energy needed to charge the battery system would be imported over the transmission systems, this Alternative would not minimize the City's reliance on importing power from remote generation locations through a congested transmission grid system subject to planned and unplanned outages and de-rates that make the delivery of energy to serve load less reliable than local generation.

5. Would replace the aged, unreliable, less efficient, high maintenance steam boilers with no local air emissions. To the extent that non-greenhouse gas free excess energy power is imported during low load times to charge the batteries (such as at night), air emissions would be created elsewhere.

6. Would be located at existing City property already permitted and used for generation and thus would minimize the need for major infrastructure improvements to the fuel supply, water, wastewater, recycled water and transmission facilities, or the need to purchase additional property.

7. Would not provide generation (only provides storage of Unit 9, Magnolia, and off-site generation) that is highly efficient to maintain reasonable cost of generation to minimize the impact on the rates and help manage costs of delivering energy to the City's customers.

8. Would support water conservation efforts by eliminating the use of potable water for generation purposes.

9. Would reduce the per megawatt-hour (MWH) creation of emissions and consumption of water because there would not be any new generation facilities on the site that create new emissions and which consume water.

5.2.2.4 Summary

The Energy Storage Project Alternative would involve replacing Units 1 – 8 at the existing Grayson Power Plant with a battery energy storage facility. Use of the City's existing Unit 9 electrical generation, the City's allotment from the Magnolia Power Plant, and transmission capacity to serve the City's electrical load and charge batteries when excess capacity is available. Energy stored in the batteries would then be discharged to serve the electrical load when demand exceeds available transmission and generation resources.

The Energy Storage Project Alternative's potential for local air quality, greenhouse gas emissions, hydrology and water quality, noise, and traffic and transportation impacts are less than those of the Project. More distant impacts due to the additional night-time generation needed to charge the batteries, when renewable solar energy will not be available, are potentially

increased. Additionally, during the summer season, it is not possible to import enough electricity to charge the batteries to serve the daytime load. For these reasons, this Alternative was not selected because it does not feasibly meet the Project objectives to the same extent as the Project.

5.2.3 Alternative Energy Project Alternative

5.2.3.1 Description

The Alternative Energy Project Alternative evaluates the feasibility of both photovoltaic (PV) solar and wind powered production alternative energy options.

PV power production requires approximately 4 – 6 acres per MW of electricity depending on the specific PV technology used (e.g., crystalline vs thin film) and configuration of the solar array tracker system (single or dual axis). The Project site is approximately 10 acres in size, and would support PV power production up to 2.5 MW. In order to generate power equivalent to the Project, the Alternative Energy Project Alternative would need to acquire an approximately 1,310-acre site that is capable of development as a utility-scale PV solar project.

The City does not own or control 1,310 acres that are developable as a PV solar project. Glendale is predominantly urbanized with open space reserved within its existing parks and mountainous areas, much of which is preserved open space, designated as significant ecological areas, in a high fire danger area, or too steep for any form of development. Therefore, development of a utility-scale PV solar project to provide an equivalent power source as the Project within the City of Glendale is not feasible. Therefore, the only path to using an alternative energy in place of the Project is to construct a new transmission line to access solar, wind, and geothermal resources outside the Los Angeles basin. However, building such a transmission system is in its own right a significant undertaking that brings about its own potential environmental impacts stemming from such large-scale development.

Additionally, PV solar only generates power during daylight hours and can be substantially curtailed during cloudy days or rain events. Therefore, solar PV by itself would not provide a reliable source of power for the City of Glendale's power customers.

Distributed solar PV deployed on residential and commercial rooftops is not considered a feasible alternative to the Project because the adoption and implementation of solar PV projects on privately owned property is voluntary and would not ensure a reliable power supply commensurate with the amount of power needed and with the reliability associated with utility-scale projects.

For reasons, similar to those affecting the feasibility of developing solar resources, siting a wind farm within Glendale is not considered a feasible option because Glendale does not have the land needed for such a project and does not have adequate wind resources. The existing site has room for a few wind turbines depending on their size. In the same way that solar resources are limited to day-time generation, Glendale does not have adequate wind resources to justify wind farm development as an alternative to the Project.

Given the lack of an available wind farm site within Glendale, the only means to employ an alternative energy source is to locate it outside of Glendale and import the energy over a new transmission line. This creates impacts due to both the large site needed to build a project of sufficient generating capacity, and the additional transmission line or lines that would need to be built. As discussed within the PV option for an Energy Storage Project Alternative, building additional transmission capacity involves additional significant investment, land acquisition challenges and new environmental impacts stemming from project development.

Due to the intermittent nature of electrical generation from solar or wind resources, energy storage would need to be a component of the Alternative Energy Project Alternative. Storage is required to cover the "gaps" due to the intermittency of renewable generation as well as at night when solar resources are not available. A portion of this energy storage could be located at Grayson, but would most likely require some form of energy storage located outside the city of Glendale dependent on what type of energy storage is selected (See Section 5.2.2.1 for a description of various energy storage alternatives). Energy storage is not a generation source itself and relies upon excess available electricity that can be stored and then used to supply load over an extended period of time. The main function of energy storage is to provide various ancillary services and some load shifting. The Alternative Energy Project Alternative would need to include an energy storage component to be used to serve load during times of the day when the alternative energy source may not be available.

5.2.3.2 Potential Environmental Impacts

Following are the potential environmental impacts that would result from the Alternative Energy Project Alternative.

Potential Environmental Impacts Less than Those of the Project

The Alternative Energy Project Alternative and Project would involve large construction efforts with short-term air emissions, noise and potential water quality impacts. However, long-term operation phase emissions associated with the renewable energy facility and transmission system would be less than those of the Project. The Alternative Energy Project Alternative would also consume less water operationally than the Project and generally involve the use of fewer types and volumes of hazardous materials such as liquid petroleum hydrocarbons that could contribute to off-site stormwater pollution. Renewable energy facilities such as PV solar, transmission lines, and energy storage systems do not contribute as much to community noise

levels during operation compared to thermal generation power plants in an urbanized area such as the Project. Potential air quality, greenhouse gas emissions, hydrology and water quality, and noise impacts of the Alternative Energy Project Alternative would be less than those of the Project.

Potential Environmental Impacts Similar to Those of the Project

Similar to the Project, construction, operation and maintenance would involve the use of hazardous materials. These facilities would be required to be in conformance with applicable LORS related to the transport, handling, use, storage, and disposal of hazardous materials. Considering the Project has been issued will serve letters for public services (Appendix B), would be limited to an existing 10-acre power plant site not used for mineral resource production, and does not require off-site utility extensions, potential impacts of the Alternative Energy Project Alternative to mineral resources, public services, recreation, socioeconomics, and utility and service systems would not be less than those of the Project. Construction traffic from the Alternative Energy Project Alternative would likely be similar or greater than that of the Project due to the size difference (1,300 acres plus a long, new transmission line vs. 10 acres). Operation and maintenance of the Alternative Energy Project Alternative would also involve a similar level of traffic as the Project. The Alternative Energy Project Alternative would have similar potential impacts as the Project to hazards and hazardous materials, mineral resources, public services, recreation, socioeconomics, transportation and traffic, and utilities and service systems.

Potential Environmental Impacts Greater than Those of the Project

The Alternative Energy Project Alternative would involve development of approximately 1,300 acres of off-site land for renewable energy generation and the construction of an extensive new transmission line to import the electricity into the City. While a specific location for this Alternative has not been identified, utility scale renewable energy and transmission line development projects would have the potential to create new impacts on agriculture and forestry resources, biological resources, cultural/tribal cultural resources, environmental justice, geology and soils, land use and planning, and population and housing compared to the Project. The Project would be developed on the existing 10-acre industrial site that is already permitted as a power plant, is developed, and operated as a power plant, and which does not contain agriculture lands, sensitive biological resources, or cultural/tribal cultural resources. Project development would also involve less earthwork compared to this Alternative. The Alternative Energy Project Alternative would also have greater off-site aesthetic, agriculture and forestry resources, biological resources, cultural/tribal cultural resources, environmental justice, geology and soils, land use and planning, and population and housing impacts than those of the Project.

5.2.3.3 Objectives Consistency Evaluation

The Alternative Energy Project Alternative does not feasibly meet many of the Project objectives or meet them as well as the Project. Specifically, the Alternative Energy Project Alternative:

1. Would integrate with local and remote distributed renewable energy resources, but would not provide sufficient capacity and energy to ensure reliable service at all times for the City in order to support the City's compliance to California's Renewable Portfolio Standards without the construction of additional transmission systems.

2. Would utilize current technology and control systems, but the technology and control systems would not provide reliable, cost effective, and flexible generation capacity for the City to serve its customer load.

3. Would not provide a local generation resource sufficient to meet resource adequacy requirements, and the City's obligation within the Balancing Area to balance load and resource at the interconnection with the Balancing Authority, in accordance with industry standards including NERC/WECC requirements. Thus, the Alternative Energy Project Alternative would not provide local reliability and would not contribute to grid stability within the Los Angeles Basin.

4. Would not provide a sufficient locally controlled source of generation to minimize the City's reliance on importing power from remote generation locations through a congested transmission grid system subject to planned and unplanned outages and de-rates making the delivery of energy to serve load less reliable than local generation.

5. Would replace the aged, unreliable, less efficient, high maintenance steam boilers, with an energy source that does not create operational air emissions.

6. Would be able to locate only a small portion of the needed capacity at the existing site, which is already permitted and used for generation. It would require major infrastructure improvements such as new transmission facilities as well as additional property for solar or wind farms to meet existing power demands.

7. Would not provide generation that is highly efficient to maintain reasonable cost of generation to minimize the impact on the rates and help manage costs of delivering energy to the City's customers because of the need to acquire land for additional solar or wind generation facilities and associated transmission.

8. Would support water conservation efforts by eliminating the use of potable water for generation purposes.

9. Would reduce the per megawatt-hour (MWH) creation of emissions and consumption of water.

5.2.3.4 Summary

The Alternative Energy Project Alternative would involve some combination of photovoltaic or wind power production with energy storage and transmission lines. While the Alternative Energy Project Alternative reduces local potential air quality, greenhouse gas emissions, hydrology and water quality, and noise impacts local to the Grayson Power Plant site, it increases off-site impacts to aesthetics, agriculture and forestry resources, biological resources, cultural/tribal cultural resources, environmental justice, geology and soils, land use and planning, and population and housing impacts due to the need for increased transmission as well as the large area needed for a wind farm or solar field.

Because of the very limited ability to site solar or wind resources within the City, combined with the energy storage considerations discussed in the preceding Energy Storage Project Alternative, as well as the complications associated with building a new transmission line to import alternative energy, the Alternative Energy Project Alternative was not considered an adequate replacement for the power that would be generated by the Project. Additionally, the Alternative Energy Project Alternative does not feasibly meet the Project objectives to the same extent as the Project.

5.2.4 150 MW Project Alternative

5.2.4.1 Description

This Alternative would consist of three simple cycle combustion turbines at the Grayson Power Plant and a new transmission line to import additional electricity into the City. A 150 MW Project Alternative was selected because it was one of the alternatives studied within the 2015 Integrated Resource Plan study[22]. However, due to the reduction in generating capacity, this Alternative consequently also requires additional transmission and energy imports into Glendale to provide sufficient capacity. An additional consideration is that being simple cycle units, the available operating hours would be much less than what is available from the combined cycle units that are a part of the Project.

Although feasible to develop, the 150 MW Project Alternative would not provide sufficient capacity or generate sufficient energy under all required planning scenarios necessary to meet load demands and reliability requirements. In addition, this Alternative would not be able to meet the spinning reserve[23] requirements set forth by NERC/WECC. Thus, the 150 MW Project

[22] In addition to a 200 MW and a 250 MW option that were also studied.
[23] "Spinning reserve" refers to generators on line and able to immediately respond to the loss of another generator or transmission import up to the single largest contingency. Simple cycle units, because they are less efficient than combined cycle units, are limited by their air permit in how many hours they can operate on an annual basis.

Alternative would require additional import capacity (transmission capacity) for the City to meet load and reliability criteria.

The City has explored participating with LADWP in the development of new transmission; however, LADWP would not consider building new transmission to the Victorville area at this time which is required for Glendale to access additional generation, particularly new generation from renewable resources.

Connection to the California Independent System Operator (CAISO) system through interconnection to Southern California Edison is also not a viable option because the City is within the LADWP Balancing Area and cannot connect to another Balancing Area other than as an emergency source. The other option would be for the City to become part of the CAISO balancing authority in place of being part of Los Angeles Department of Water and Power's balancing authority. There is no existing transmission corridor for Glendale to connect to the CAISO system without new development. The cost for a new interconnection – which is different than the much more significant new transmission line discussed in the Alternative Energy Project Alternative - is significant itself (estimated at $66 million in the 2015 Integrated Resource Plan). Such a new interconnection to CAISO and dropping out of the Los Angeles Department of Water and Power Balancing Authority will result in significant electric transmission system impacts exacerbating some existing issues (circulating currents) in the LADWP/CAISO electrical system design and if feasible, would require further mitigation and result in considerable financial impacts, and probable significant opposition from the current Balancing Authority.

Building and owning new transmission capacity carries several significant risks and uncertainties, costs, and potentially significant environmental impacts associated with transmission system development that may require mitigation and additional Project upgrade costs. There is also uncertainty with respect to the reliability of a new connection to the CAISO system, which would increase Glendale's single largest contingency because of expanded reliance on imported power transmission that a new large transmission interconnection presents. The City requires local generation because the available transmission into the City from the Pacific DC Interconnection transmission line and the Southwest A/C Transmission System are congested, subject to curtailments, and would not be able to fully serve the City's load at all historical levels of load.

While the 150 MW Project Alternative offers local generation (all simple cycle units), and as discussed on 5.2.4.2 below, will reduce certain Project impacts, these units are less efficient than the combination of simple and combined cycle generating units offered by the Project.

5.2.4.2 Potential Environmental Impacts

Following are the potential environmental impacts that would result from the 150 MW Project Alternative.

Potential Environmental Impacts Less than Those of the Project

The 150 MW Project Alternative and Project would involve large construction efforts with short-term air emissions and noise, however, long-term operation phase emissions and noise associated with this Alternative would be less than those of the Project due to the reduction in the number of generation units and capacity. Potential air quality, greenhouse gas emissions, and noise impacts of the 150 MW Project Alternative would be incrementally less than those of the Project.

Potential Environmental Impacts Similar to Those of the Project

Similar to the Project, construction, operation and maintenance would involve the use of hazardous materials. These facilities would be required to be in conformance with applicable LORS related to the transport, handling, use, storage, and disposal of hazardous materials. Even with a reduction in generating capacity at the Grayson Power Plant, the 150 MW Project Alternative would have similar on-site impacts as the Project with respect to hydrology and water quality, mineral resources, public services, recreation, socioeconomics, and utility and service systems. The construction of an extensive new off-site transmission line only increases the potential for impacts to these resource categories and potential impacts would not be less than those of the Project. Construction traffic from the 150 MW Project Alternative would likely be similar or greater than that of the Project due to addition of the off-site transmission line component. Operation and maintenance of the 150 MW Project would also involve a similar level of traffic as the Project. The 150 MW Project Alternative would have similar impacts as the Project to hazards and hazardous materials, hydrology and water quality, mineral resources, public services, recreation, socioeconomics, transportation and traffic, and utilities and service systems.

Potential Environmental Impacts Greater than Those of the Project

Both the 150 MW Project Alternative involve comparable demolition, construction and operating electrical generation facilities at the at the Grayson Power Plant site. The 150 MW Project Alternative includes construction of an extensive new transmission line to import additional electricity into the City to serve the City's load. Long transmission line development projects commonly have the potential to impact agriculture and forestry resources, biological resources, cultural/tribal cultural resources, environmental justice, geology and soils, land use and planning, and population and housing. Comparatively, the Project would be developed on the existing 10-acre industrial site that is already permitted, developed and operated as a power plant.

Further development on the Grayson Power Plant site will not impact agriculture lands, sensitive biological resources, or cultural/tribal cultural resources. The 150 MW Project Alternative also requires substantially more earthwork related to the transmission line development than the Project. Because of the transmission line component, the 150 MW Project Alternative would have greater off-site potential aesthetic, agriculture and forestry resources, biological resources, cultural/tribal cultural resources, environmental justice, geology and soils, land use and planning, and population and housing impacts than those of the Project.

5.2.4.3 Objectives Consistency Evaluation

The 150 MW Project Alternative does not feasibly meet many of the Project objectives or meet them as well as the Project. Specifically, the 150 MW Project Alternative:

1. Would integrate with local and remote distributed renewable energy resources but would not provide sufficient capacity and energy to ensure reliable service at all times for the City and to support the City's compliance to California's Renewable Portfolio Standards.

2. Would utilize current technology and control systems, but the technology and control systems would not provide reliable, cost effective, and flexible generation capacity for the City to serve its customer load.

3. Would provide a local generation resource, but not one that is sufficient to meet resource adequacy requirements, and the City's obligation within the Balancing Area to balance load and resource at the interconnection with the Balancing Authority, in accordance with industry standards including NERC/WECC requirements. Thus, the 150 MW Alternative would not provide local reliability and would not contribute to grid stability within the Los Angeles Basin to the same extent as the Project.

4. Would provide a locally controlled source of generation, but the amount of generation would not be sufficient to minimize the City's reliance on importing power from remote generation locations through a congested transmission grid system subject to planned and unplanned outages and de-rates making the delivery of energy to serve load less reliable than local generation. This Alternative would need additional transmission capacity to adequately respond to and serve customer load.

5. Would replace the aged, unreliable, less efficient, high maintenance steam boilers, with new generation, but this new generation would create emissions that are not likely to comply with SCAQMDs Rule 1304(a)(2).

6. Would be able to locate at the existing City property already permitted and used for generation, but it would not minimize the need for major infrastructure improvements such as fuel supply, water, wastewater, recycled water and transmission facilities.

7. Would not provide generation that is highly efficient to maintain at a reasonable cost of generation (due to the inherently poorer efficiency of simple cycle units as compared to combined cycle units) to minimize the impact on the rates and help manage costs of delivering energy to the City's customers because the amount of power generated would require supplementation for new transmission sources that are limited both in terms of negotiating their development with applicable agencies, but in terms of the ability to physically develop these sites.

8. Would support water conservation efforts by eliminating the use of potable water for generation purposes.

9. Would reduce the per megawatt-hour (MWH) creation of emissions and may reduce the water consumption

5.2.4.4 Summary

The 150 MW Project Alternative would involve a reduced size power project located on the existing project site with a new transmission interconnection. While the 150 MW Project Alternative would have incrementally less potential air quality, greenhouse gas emissions and noise impacts than those of the Project, the potential impacts at the Grayson Power Plant site are generally similar.

However, the 150 MW Project Alternative also includes construction of a new transmission line that has the potential to result in greater potential impacts to aesthetics, agriculture and forestry resources, cultural/tribal cultural resources, environmental justice, geology and soils, land use and planning, and population and housing. In addition to the potential environmental impacts, the 150 MW Project Alternative does not feasibly meet many of the Project objectives or meet them as well as the Project.

5.2.5 200 MW Project Alternative

5.2.5.1 Description

A 200 MW Project Alternative would consist of two simple cycle units and one combined cycle unit. A 200 MW Project Alternative was selected because it was one of the alternatives studied within the 2015 Integrated Resource Plan study[24]. Because 200 MW of generation alone does not provide sufficient capacity that meet required planning scenarios, this Alternative would require either additional transmission capacity or "time shifting" energy storage via a BESS to provide the requisite capacity and energy to serve load.

[24] In addition to a 150 MW and a 250 MW option that were also studied.

Given the amount of required additional capacity, and the difference in necessary activities to implement the two options, an energy storage system is preferred over transmission because:

- Developing a new transmission connection presents property siting and acquisition challenges and new environmental impacts.
- The source of power to be imported over the new transmission system would necessarily be located outside of the City and create a new contingency.
- Having the 50 MW source located within the City is preferred.

For energy storage, a BESS is the only available storage technology that can be sited at Grayson. The BESS could utilize either Lithium ion rechargeable battery or reduction-oxidation flow battery technologies.

The BESS would be charged during times of the day when there is available energy not needed to serve the City's load. That energy would be stored within the BESS and "time shifted" to be used during high load periods when the available transmission capacity is inadequate to serve the City's load. Energy to charge the BESS would come from either electricity imported through the transmission systems, or on-site generation if the transmission capacity is fully utilized or unavailable. During periods of consecutive high-load days when the BESS would need to be fully charged each evening and the amounts of renewable energy being produced are reduced, on-site generation would likely be used to charge the BESS. For the reasons previously discussed in the Energy Storage Project Alternative (usable capacity, battery degradation, round trip efficiency), to provide an additional 50 MW of usable capacity for four (4) hours would necessitate a BESS of approximately 300 MWH of storage capacity.

When comparing the benefit of 50 MW of BESS versus 50 MW of generation, 50 MW of generation from the project is preferred because:

- 50 MW generation provides dispatchable capacity beyond the time that the BESS storage capacity would be exhausted.
- The scale of the required BESS is larger than other battery energy storage systems that have been built to date, with the largest project being a 30 MW 120 MWH project[25]. This Alternative would require a BESS project with two times the power delivery and three times the energy storage as the largest existing BESS project.
- The initial cost of the BESS is as at least as great as 50 MW of generation.
- The batteries have a finite life requiring periodic replacement every 10 years (or earlier) with current battery replacement costs of $200,000/MWH for the batteries alone. While these costs have been declining, the rate of decline has slowed. For 300 MWH of storage the replacement cost could be over $50,000,000.

[25] A project built for San Diego Gas and Electric by AES Energy Storage.

- These costs do not include the cost of energy to charge the batteries (the functional equivalent to the natural gas fuel for the proposed project).

Although feasible to develop, the 200 MW Alternative would not be as cost-effective or reliable as the Project.

5.2.5.2 Potential Environmental Impacts

Following are the potential environmental impacts that would result from the 200 MW Project Alternative.

Potential Environmental Impacts Less than Those of the Project

The 200 MW Project Alternative and Project would involve large construction efforts with short-term air emissions and noise, however, long-term operation phase emissions and noise associated with this Alternative would be less than those of the Project due to the reduction in the number of generation units and capacity. Potential air quality, greenhouse gas emissions, and noise impacts of the 200 MW Project Alternative would be incrementally less than those of the Project.

Potential Environmental Impacts Similar to Those of the Project

Similar to the Project, the 200 MW Project Alternative involves electrical generation at the same 10-acre urban industrial site already permitted, developed, and operated as a power plant. The primary difference is that the 200 MW Project Alternative includes a 50 MW BESS in lieu of one of the two combined cycle generation units associated with the Project. As a result, the 200 MW Project Alternative would have similar environmental impacts as the Project on aesthetics, agriculture and forestry resources, biological resources, cultural/tribal cultural resources, environmental justice, geology and soils, hazards and hazardous materials, hydrology and water quality, land use and planning, mineral resources, population and housing, public services recreation, socioeconomics, transportation and traffic, and utilities and service systems.

Potential Environmental Impacts Greater than Those of the Project

The 200 MW Project Alternative would not have any potential environmental impacts greater than those of the Project.

5.2.5.3 Objectives Consistency Evaluation

The 200 MW Project Alternative meets most of the Project objectives, but not to the same extent as the Project. Specifically, the 200 MW Project Alternative:

1. Would integrate with local and remote distributed renewable energy resources and provide sufficient reliable capacity and energy to ensure reliable service at all times for the City and to support the City's compliance to California's Renewable Portfolio Standards.

2. Would utilize current technology and control systems, and the technology and control systems would provide reliable, cost effective, and flexible generation capacity for the City to serve its customer load. However, the battery storage portion of the project would require a very significant upscaling compared to existing BESS projects.

3. Would provide a local generation resource, but not one that is sufficient to meet resource adequacy requirements without a storage system. This Alternative would meet the City's obligation within the Balancing Area to balance load and resource at the interconnection with the BA, in accordance with industry standards including NERC/WECC requirements as well as the Project.

4. Would provide a locally controlled source of generation, but the amount of generation would not be sufficient to minimize the City's reliance on a storage system that is potentially more expensive to maintain, and would necessitate power imports from remote generation locations through a congested transmission grid system subject to planned and unplanned outages and de-rates making the delivery of energy to serve load less reliable than local generation. This Alternative would not respond to and serve customer load as efficiently or as well as the Project.

5. Would replace the aged, unreliable, less efficient, high maintenance steam boilers, with new generation that would comply with SCAQMDs Rule 1304(a)(2).

6. Would be able to be located at the existing City property already permitted and used for generation and would minimize the need for major infrastructure improvements such as fuel supply, water, wastewater, recycled water, and transmission facilities to the same extent as the Project.

7. Would provide generation that is efficient to maintain, but not at as reasonable a cost of generation as the Project such that this Alternative would not minimize the impact on the rates and help manage costs of delivering energy to the City's customers to the same degree as the Project.

8. Would support water conservation efforts by eliminating the use of potable water for generation purposes.

9. Would reduce the per megawatt-hour (MWH) creation of emissions and water consumption to the same extent as the Project.

5.2.5.4 Summary

The 200 MW Alternative would have reduced air and greenhouse gas emissions and noise from one less generation unit compared to the Project, with the reduction of one unit offset by the addition of a battery energy storage system (one that is smaller than the earlier alternative). The battery energy storage system adds the impact of the cost of periodic battery replacement as well as the need to dispose/recycle the batteries when they reach end of life. If sufficient transmission capacity were not available for charging the BESS, then the air emissions may not be reduced due to the need to operate additional unit(s) to charge the BESS.

For these reasons, the overall environmental impacts of a 200 MW Alternative are expected to be comparable to the Project, but at the expense of not having fully dispatchable generation capacity after exhaustion of the BESS as well as potentially greater cost.

5.2.6 Comparison of Alternatives

A comparison of the alternatives carried forward for analysis relative to the Project with respect to the alternative's ability to meet the Project objectives and relative environmental impacts is summarized in Table 5-1.

Table 5-1 Comparison of Alternatives

	Proposed Project	No Project Alternative	Energy Storage Project Alternative	Alternative Energy Project Alternative	150 MW Project Alternative	200 MW Project Alternative
Ability to Meet Project Objective						
1. Integrate with local and remote distributed renewable energy resources to provide sufficient capacity and energy to ensure reliable service at all times for the City and to support the City's compliance with California's Renewable Portfolio Standards	Yes	No	No	No	No	Yes
2. Utilize current and reliable technology and control systems to provide reliable, cost effective, and flexible generation capacity for the City to serve its customers load.	Yes	No	Yes	Yes	Yes	Yes
3. Provide a local generation resource sufficient to meet resource adequacy requirements, and the City's obligation within the Balancing Area to balance load and resource at the interconnection with the BA, in accordance with industry standards including NERC/WECC requirements; thus, providing local reliability and contributing to grid stability within the Los Angeles Basin.	Yes	No	No	No	No	Yes
4. Provide sufficient locally controlled generation to minimize the City's reliance on importing power from remote generation locations through a congested transmission grid system subject to planned and unplanned outages and de-rates making the delivery of energy to serve load less reliable than local generation.	Yes	No	No	No	No	No
5. Replace the aged, unreliable, less efficient, high maintenance steam boilers with new efficient and less environmentally impactful generation technologies that meet SCAQMD Rule 1304(a)(2).	Yes	No	Yes	Yes	Yes	Yes
6. Locate the proposed Project at existing City property already permitted and used for generation to minimize the need for major infrastructure improvements such as fuel supply, water, wastewater, recycled water, and transmission facilities, or need to purchase additional property.	Yes	Yes	Yes	No	Yes	Yes
7. Provide generation that is highly efficient to maintain reasonable cost of generation to minimize the impact on the rates and help manage costs of delivering energy to the City's customers.	Yes	No	No	No	No	No
8. Support water conservation efforts by eliminating the use of potable water for generation purposes.	Yes	No	Yes	Yes	Yes	Yes
9. Reduce the per megawatt-hour (MWH) creation of emissions and consumption of water.	Yes	No	Yes	Yes	Yes	Yes

		No Project Alternative	Energy Storage Project Alternative	Alternative Energy Project Alternative	150 MW Project Alternative	200 MW Project Alternative
Comparison of Potential Environmental Impacts to Project						
Aesthetics	Less than Significant Impact with Mitigation	Similar	Less	Greater	Greater	Similar
Agriculture & Forestry Resources	No Impact	Similar	Similar	Greater	Greater	Similar
Air Quality	Less than Significant Impact	Less	Less[26]	Less	Less	Less
Biological Resources	No Impact	Similar	Similar	Greater	Greater	Similar
Cultural Resources	Less than Significant Impact	Similar	Similar	Greater	Greater	Similar
Environmental Justice	No Impact	Similar	Similar	Greater	Greater	Similar
Geology & Soils	Less than Significant Impact	Similar	Similar	Greater	Greater	Similar
Greenhouse Gas Emissions	Less than Significant Impact	Less	Less	Less	Less	Less
Hazards & Hazardous Materials	Less than Significant Impact with Mitigation	Similar	Similar	Similar	Similar	Similar
Hydrology & Water Quality	Less than Significant Impact	Similar	Less	Less	Similar	Similar
Land Use and Planning	No Impact	Similar	Similar	Greater	Greater	Similar
Mineral Resources	No Impact	Similar	Similar	Similar	Similar	Similar
Noise	Less than Significant Impact with Mitigation	Less	Less	Less	Less	Less
Population & Housing	No Impact	Similar	Similar	Greater	Greater	Similar
Public Services	No Impact	Similar	Similar	Similar	Similar	Similar
Recreation	No Impact	Similar	Similar	Similar	Similar	Similar
Socioeconomics	No Impact	Similar	Similar	Similar	Similar	Similar
Transportation and Traffic	Less than Significant Impact with Mitigation	Less	Less	Similar	Similar	Similar
Tribal Cultural Resources	Less than Significant Impact	Similar	Similar	Greater	Greater	Similar
Utilities and Service Systems	Less than Significant Impact	Similar	Similar	Similar	Similar	Similar

5.2.7 Identification of the Environmentally Superior Alternative

CEQA requires that an EIR identify the environmentally superior alternative(s) of a project other than the proposed project or the "no project" alternative (CEQA Guidelines Section 15126.6 (e)(2)). As stated at the beginning of this chapter, the purpose of this alternatives analysis is to consider a reasonable range of alternatives that could feasibly attain most of the basic project objectives and avoid or substantially lessen significant program impacts.

[26] Does not include non-local air emissions resulting from generation of electricity to be imported to charge the BESS when renewables are not available.

The No Project Alternative would not satisfactorily meet the Project objectives and would fail to comply with Federal and State reliability standards. The No Project Alternative would result in the City needing additional transmission capacity if available, causing additional environmental impacts and necessitating power imports at a much higher cost to its customers.

The Energy Storage Project Alternative is completely dependent on excess energy being available to charge the batteries, primarily through daily imports over the transmission systems. During high load periods, there will not be sufficient excess capacity to charge the batteries thus compromising the ability of this Alternative to reliably serve the residents and customers of the City. While this Alternative, using batteries alone, does have reduced local environmental impacts, it does not meet several critical project objectives with regards to assuring reliability of supply at reasonable cost.

The Alternative Energy Project Alternative produces less potential air quality, greenhouse gas emissions, hydrology and water quality, and noise impacts than the proposed Project, but it would create greater impacts in several other resource categories because this Alternative requires additional development of transmission facilities on remote site(s); it requires a significantly greater amount of land to be disturbed in connection with development of new transmission line routes. In addition, as discussed and summarized in this Chapter, this Alternative would not meet most of the Project objectives.

The 150 MW Alternative would have incrementally lower potential air quality, greenhouse gas emissions, and noise impacts compared to the Project but this Alternative would not totally avoid or significantly lessen significant impacts of the Project. This Alternative would create greater impacts in several resource categories described above because it would require a significantly greater amount of land to be disturbed for the development of new transmission line routes. In addition, this Alternative would not meet most of the Project objectives.

The 200 MW Alternative would have incrementally lower potential air quality, greenhouse gas emissions, and noise impacts compared to the Project but it would not totally avoid or significantly lessen significant impacts of the Project. This Alternative would meet most of the Project objectives, but not to the same extent as the Project. However, this Alternative represents a higher cost option than the proposed Project.

As a result of this analysis, the proposed Project would meet all project objectives while resulting in the fewest impacts when compared to the feasible alternatives evaluated and is considered the environmentally superior alternative.

5.3 FINDINGS REGARDING ALTERNATIVES NOT SELECTED FOR FURTHER ANALYSIS

5.3.1 Power Plant Site Alternatives

The proposed Project would be located within the boundary of the existing power plant property (Glendale's Grayson Power Plant) with operating power plant units. Although the Project is not under the jurisdiction of the California Energy Commission (CEC) and is under the jurisdiction of the City of Glendale as the Lead Agency, the Project is being analyzed in a consistent manner to that applied by the CEC. The Public Resources Code 25540.6 (b) provides direction to the CEC that in part reads:

- 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.

Locating the new units at the existing Grayson site minimizes the environmental impact of the Project. Utilizing the same location as the existing facility would result in utilizing the same recycled and potable water as well as sanitary wastewater connection that support the existing Grayson Power Plant. In addition, the Project site would also use the same high-voltage electric transmission lines and the natural gas pipeline that serve the existing facility. The Project site has favorable geology and soils suitable for power plant development and has no significant engineering constraints. The land use designation of the site is consistent with power plant development and use.

However, as a part of preparing the EIR, a review of industrial zones with the lowest concentration of building was conducted and identified two locations that were reviewed. Neither site is owned by the City and would require the acquisition of new land by the City. One is at the corner of Western and Flower and the other is at 5426 San Fernando Road. The first site is approximately 13 acres and consists of four different parking lots and two buildings. Two vacant lots on the site are designated for a road widening project. A substantial portion of the property is owned by Disney. The second property is zoned Industrial/Commercial Mixed Use (IMU) and is approximately 9.5 acres, which is not sufficient for the Project. Both sites would require the construction of new transmission lines to connect with the ones currently at the Grayson site as well as the extension of the recycled water line, high pressure gas line, and waste line. Neither site presents an environmentally superior alternative to the existing site. As a result, no alternate sites are analyzed in this EIR and only the proposed site for the Project is discussed.

Locating the Project at a different site would also result in the loss of SCAQMD 'offset exemption for replacement in kind' per SCAQMD Rule 1304(a)(2) that are applicable as long as the Project is located at the current site.

5.3.1.1 Project Site

The Project would be located on the same site as the existing Grayson Power Plant at 800 Air Way, Glendale, CA 91201. The existing site consists of following generating units:

1. Unit 1 – 20 MW (gross) steam turbine-generator, built in 1941
2. Unit 2 – 20 MW (gross) steam turbine-generator, built in 1947
3. Unit 3 – 20 MW (gross) steam boiler turbine-generator, built in 1953
4. Unit 4 – 44 MW (gross) steam boiler turbine-generator, built in 1959
5. Unit 5 – 44 MW (gross) steam boiler turbine-generator, built in 1964
6. Unit 8-A – 32 MW (gross) combustion turbine-generator – combined cycle, built in 1977
7. Unit 8-BC – 55 MW (gross) combustion turbine-generator – combined cycle, built in 1977
8. Unit 9 – 50 MW (gross) combustion turbine-generator, simple cycle, built in 2003

With the exception of Unit 9, all the other units would be demolished and removed and replaced as part of the Project.

The existing Grayson Power Plant is designated and zoned as industrial, which allows for the construction and operation of the Project.

The Project site:

- Is located adjacent to a high-pressure natural gas pipeline
- Is located adjacent to an existing high voltage switchyard
- Is located adjacent to existing recycled water pipeline
- Minimizes construction impacts on existing residences and businesses
- Has good truck access
- Is owned by the City
- Is zoned for industrial use

5.3.2 Project Technology Alternatives

The Project configuration was selected from a wide array of technology alternatives. This includes generation technology alternatives, alternative fuel technology, and alternative power plant cooling alternatives.

5.3.2.1 Combustion Generation Technology Alternatives

Conventional boiler and steam turbine, large gas simple cycle combustion turbine, large combined cycle combustion turbine generator, and reciprocating engine generators were all considered as natural gas combustion generation technology alternatives and are discussed below in more detail.

Conventional Boiler and Steam Turbine

This technology burns fuel in the furnace of a conventional boiler to create steam. The steam is used to drive a steam turbine generator, and the steam is then condensed and returned to the boiler. This technology is less efficient and would not meet the California's SB 1368 Emission Performance Standard of less than 1,100 lbs of CO_2/MWh for new non-peaking generation. Because of these reasons, the conventional boiler and steam turbine generator technology was eliminated from consideration

Large Simple Cycle Combustion Turbine Generator

Large aero-derivative gas turbines, such as the 100 megawatt General Electric (GE) LMS-100, is an efficient simple cycle gas turbine with a 50% turn down ratio. However, its size is such that it is as big as the City's existing single largest contingency. This size of a unit would further complicate the planning reserve situation.

The LMS100 generates more power from a single turbine than is required by the City. As such, this turbine is too large to provide the required need for flexibility of operation that allows for integration of the startup and shut down of the unit, load following, or the efficient integration of renewable resources into the City's electric grid.

Furthermore, one of the Project objectives is for the City to provide its own economic spinning and non-spinning reserve required by the WECC. Large turbines do not meet this requirement.

Lastly, simple cycle turbines are restricted in their operating hours by the air permitting process as the regulatory perspective is that units with high utilization should be combined cycle, not simple cycle. With only large simple cycle turbines, the capacity would be available however the total energy may not. Because of the reasons stated above, large turbines like the GE LMS-100 were eliminated from consideration.

Large Combined Cycle Combustion Turbine Generator

Large combined cycle combustion turbine generator, including 2x1 and large Frame type combustion turbines, are an efficient source of generation. These units typically range in size from 150 to over 500 MW in capacity and are too large given the City's existing single largest contingency. This technology does not provide the required need for flexibility of operation nor allows for the efficient integration of renewable resources into the City's electric grid.

Furthermore, one of the project objectives is for the Project is to provide its own economic spinning and non-spinning reserve required by the WECC for system stability. Large combined cycle combustion turbine generators would be considered as a single generator for spinning reserve requirement and would need spinning for one-half of the combined cycle unit capacity and therefore could not meet the WECC requirement. Because of the reasons stated above, large combined cycle units were eliminated from consideration.

Reciprocating Engine Generators (REGs)

The project seriously considered REGs to supply part of the simple cycle generation because of the flexibility and good efficiency over the load range that multiple REGs offer. However, the REGs were eliminated from consideration due to the higher expected total project cost, increased maintenance, and air permitting concerns.

5.3.3 Alternative Fuel Technologies

Technologies based on fuels other than natural gas were eliminated from consideration because they do not meet the Project objectives. Additional factors rendering alternative fuel technologies unsuitable for the Project are as follows:

- No geothermal or hydroelectric resources are available within Glendale.
- Biomass fuels such as wood waste, digester or landfill gas are not locally available in sufficient quantities to make them practical as alternative fuels.
- Coal, nuclear, and oil technologies would not meet the environmental stewardship objective of the Project.

Distributed energy resources or microgrids are not practical for two reasons: 1) the City cannot mandate its customers to self-supply and 2) the City would still need to provide a reliable source of standby power to its customers.

5.3.4 Power Plant Cooling Alternatives

Heat rejection from the Project would be by a combination of dry and wet cooling. In dry cooling, air-cooled heat exchangers transfer heat directly to the ambient air. Fans move the air across finned heat exchanger tubes containing the fluid to be cooled. Dry cooling would be used for such applications as combustion turbine generator cooling, lube oil cooling, and compressor cooling.

Wet cooling is used for the combined cycle turbine generators and their auxiliaries. In wet cooling, the cooling water is cooled in cooling towers where a portion of the water is evaporated to carry away the rejected heat, lost due to drift (circulating water that is emitted with the exhaust air of the tower), and blown down to maintain water quality. Recycled water is used to replace the water lost by evaporation, drift, and blowdown.

Wet cooling using fresh or potable water uses an essential resource that has a much higher beneficial use other than use for power plant cooling and was therefore eliminated from consideration. Wet cooling using recycled water is acceptable under state policy and is available at the Project site in sufficient quantity required by the Project.

Dry cooling using an air-cooled steam condenser (ACSC) was considered as an alternative to the use of wet cooling. Air-cooled condensers use fans to draw air through a heat exchanger where the air is exposed to pipes carrying exhaust steam from a steam turbine. The steam condenses to water and is pumped back through the steam cycle in a closed loop. Air-cooled condensers require much more space on the site than a conventional wet cooling system using cooling towers. They also consume more electricity thereby reducing the efficiency of the power plant. There is also a performance penalty for using dry cooling in hot weather. Air-cooled condensers cannot produce as low a condensing pressure in hot weather as wet-cooled condensers. This results in higher steam turbine exhaust pressures and lower steam turbine output. According to a California Energy Commission report (Comparison of Alternate Cooling Technologies for California Power Plants, CEC, Sacramento 2002), the performance penalty for dry cooling can be between 5% and 20%. The report also finds that the capital cost is 1.5 to 3.0 times the cost of wet cooling. For these reasons, and since recycled water is available, dry cooling was not selected.

A third alternative that was considered was a hybrid of wet and dry cooling. These systems have the potential to offset the performance penalties of dry cooling while reducing the water consumption of wet cooling. There are several methods for implementing hybrid cooling. Some of these are currently being tested by the Electric Power Research Institute (EPRI). However, only two methods can be considered commercially available at this time.

The first of these methods is the plume abatement cooling tower. This is similar to a conventional cooling tower except that the hot cooling water return is first pre-cooled in an air-cooled heat exchanger before being fed to the cooling tower. This reduces the thermal load on the tower and consequently reduces the evaporation loss. The amount of water saved is roughly proportional to the amount of cooling duty done by the air-cooled exchanger. By locating the air cooling coils above the cooling tower fill, the cooling tower fans can serve both the air cooler and the cooling tower. According to the CEC report (see above) the capital cost of this Alternative is about the same as for dry cooling but the performance penalty is avoided. Since the cost of this Alternative is 1.5 to 3.0 times the cost of wet cooling, and commercial experience with these hybrid systems is limited, and there is available recycled water, this Alternative was not selected.

The second method is to have an ACSC and cooling tower in parallel service. When ambient air temperatures are low enough, only the ACSC is used. When the ambient temperature is high, the cooling tower is used to reduce the load on the ACSC. The water savings would depend on the operating profile of the power plant but would be between 20% and 80% per the CEC study. The parallel cooling method requires more land than any of the other options. According to the

CEC study, the capital costs for this Alternative are 3 to 5 times that of straight wet cooling. For these reasons, as well as the limited commercial experience with hybrid systems, this Alternative was not selected for detailed analysis.