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4.17 ENERGY

This section discusses the Project's operational energy requirements. For comparison, existing energy use of the Subregional System is described.

IMPACTS EVALUATED IN OTHER SECTIONS

The following items are related to the Energy Section but are evaluated in other sections of this document.

- Cost of Energy. The cost of energy during Project operation and maintenance is included in costs shown in Section 3.5 in the Description of Existing System and Alternatives (Project Description).

AFFECTED ENVIRONMENT (SETTING)

Laguna Plant Operations

The current total annual energy consumption of the Laguna Plant is 17.4 million kilowatt hours (kwh); annual natural gas use is 4.5 million cubic feet. Of the electrical use, about 10.7 million kwh are used for general plant operations while approximately 7 million kwh are used for the existing irrigation distribution. In addition, the plant can use digester gas which is a by-product of treatment; the annual digester gas use is 73 million cubic feet. (Because digester gas energy content equals 60 percent of natural gas, this represents the equivalent of 43.8 million cubic feet of natural gas.) Gas powers 26 percent of the total plant energy requirements, with natural gas making up 10 percent of the total gas use at the plant (Scott Stinebaugh, City of Santa Rosa, personal communication 1993).

Geysers Operations

The geysers is the largest developed geothermal reservoir in the world. In 1994, 23 power plants operated in the geysers with an installed capacity of approximately 1,896 megawatts (mw) (Geysers Geothermal Association 1995). Approximately 600 production and injection wells have been drilled; about 450 of these are currently in use (Doug Hackley, UNOCAL, personal communication, June 1995). Reservoir engineers recognize that providing additional water to the reservoir Project prolong the ability to generate steam and consequently produce increased power.

EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

Table 4.17-1

Evaluation Criterion with Point of Significance - Energy

Evaluation Criterion	As Measured by	Point of Significance	Justification
1. Will the Project require more energy than providers could deliver?	Report of energy providers	If energy providers indicate they cannot supply project	Requiring energy providers to construct new generating facilities to meet Project demand Project result in substantial energy use.

Source: Parsons Engineering Science, Inc. 1996.

METHODOLOGY

Implementation of the Project will involve energy expenditures for treatment plant and pump station operations. This energy analysis focuses on the amount of energy required to pump treated water from the Laguna Plant to storage reservoirs, irrigation areas, the geysers, or aquifer storage and recovery areas. Although each component may require small amounts of energy, the primary use of energy is for pumping. Therefore, all analysis is based on energy demand for pumping reclaimed water.

Tables 3.3-4 and 3.3-5 in Chapter 3 list the pump stations associated with each alternative. Pumping requirements were based on the distance and the amount of water to be transported. The technical memorandum *Energy Demand of Alternative Projects* (Parsons Engineering Science, Inc. 1995a) presents energy requirements for each pump summing them for each alternative. This section summarizes those calculations.

Construction energy is not calculated for each component, but measures have been adopted as part of the Project description to ensure that construction takes place in an energy-efficient way. Refer to Measure 2.2.25, Minimize/Reduce Fossil Fuel Consumption, in Chapter 2.

ENVIRONMENTAL CONSEQUENCES (IMPACTS) AND RECOMMENDED MITIGATION

No Action (No Project) Alternative

Table 4.17-2

Energy Impacts by Component - No Action (No Project) Alternative

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.1.1. Will the No Action Alternative require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	O&M	❍

Source: Parsons Engineering Science, Inc. 1996.

Notes: 1. Type of Impact:
O&M Operation and Maintenance

2. Level of Significance:
❍ Less than significant impact; no mitigation proposed

Impact: **17.1.1. Will the No Action Alternative require more energy than providers could deliver?**

Analysis: *Less than Significant; Alternative 1.*

Operation of the Subregional System will require continued expenditure of energy. Energy providers are able to supply necessary electric service and natural gas for operation (Gary Quast, PG&E, letter September 13, 1995 and Craig Kennedy, PG&E, letter dated September 29, 1995). Therefore, this impact is considered less than significant.

Mitigation: No mitigation is proposed.

Headworks Expansion Component

Table 4.17-3

Energy Impacts by Component - Headworks Expansion

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.2.1. Will the headworks expansion component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	C, O&M	❍

Source: Parsons Engineering Science, Inc. 1996.

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
❍ Less than significant impact; no mitigation proposed

Impact: **17.2.1. Will the headworks expansion component may require more energy than providers could deliver?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5.*

The expansion of the Laguna Plant headworks will result in increased energy. The increase will be an approximately 16 percent increase due to pumping requirements, raising energy use for general plant operations to approximately 12.4 million kwh and 5.2 million cubic feet of natural gas annually.

Energy providers are able to supply necessary electric service and natural gas for both construction and operation (Gary Quast, PG&E, letter September 13, 1995 and Craig Kennedy, PG&E, letter 29 September 1995). Therefore, this impact is considered less than significant.

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is proposed.

Urban Irrigation Component

Impact: **17.3.1. Will the urban irrigation component require more energy than energy providers could deliver?**

Analysis: *No Impact; All Alternatives.*

No new facilities need to be constructed to implement the urban irrigation component. Existing irrigation systems will use reclaimed water instead of their current source of water. Operation of the urban irrigation system does not require energy. The systems are dependent on the pumps to function; energy use of pumps is presented under pump station component later in this section.

Alternatives 1, 4, and 5 do not have an urban irrigation component.

Mitigation: No mitigation is needed.

Pipeline Component

Table 4.17-4

Energy Impacts by Component - Pipelines

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.4.1. Will the pipeline component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide None	C O&M	❍ ==

Source: Parsons Engineering Science, Inc. 1996.

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
❍ Less than significant impact; no mitigation proposed
== No Impact

Impact: **17.4.1. Will the pipeline component require more energy than providers could deliver?**

Analysis: ***Construction***

Less than Significant; Alternatives 2, 3, 4, and 5A.

Energy providers are able to supply necessary electric service and natural gas for both construction and operation (Gary Quast, PG&E, letter September 13, 1995 and Craig Kennedy, PG&E, letter September 29, 1995). Therefore, this impact is considered less than significant.

No Impact; Alternatives 1 and 5B.

Alternatives 1 and 5B do not have a pipeline component.

Operation and Maintenance

No Impact; All Alternatives.

Operation of the pipelines does not require energy because the pipelines are dependent on the pumps to function.

If a pipeline were to fail, no additional energy consumption will result. If the geysers pipeline were to rupture, steamfield injection will cease. Electricity generation at the geysers will not be impacted by a temporary (one year or less) interruption in injection.

Alternatives 1 and 5B do not have a pipeline component

Mitigation: No mitigation is proposed.

Storage Reservoir Component

Table 4.17-5

Energy Impacts by Component - Storage Reservoirs

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.5.1. Will the storage reservoir component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	C, O&M	❍

Source: Parsons Engineering Science, Inc. 1996.

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
❍ Less than significant impact; no mitigation proposed

Impact: **17.5.1. Will the storage reservoir component require more energy than providers could deliver?**

Analysis: *Less than Significant; Alternatives 2 and 3.*

Construction of the storage reservoirs will require energy. Operation of the reservoirs requires a small amount of energy for two functions: opening of the gate in the dam perhaps two to five times a year for maintenance and operating a small light near the ancillary facilities. Lights will not normally be on, but will be used if maintenance staff needed to visit the facility at night. This is estimated to require 40 kwh per year.

Energy providers are able to supply necessary electric service and natural gas for both construction and operation (Gary Quast, PG&E, letter 13 September 1995 and Craig Kennedy, PG&E, letter 29 September 1995). Therefore, this impact is considered less than significant.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have a storage reservoir component.

Mitigation: No mitigation is proposed.

Pump Station Component

Table 4.17-6

Energy Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.6.1. Will the pump station component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	C, O&M	❍

Source: Parsons Engineering Science, Inc. 1996.

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
❍ Less than significant impact; no mitigation proposed

Impact: **17.6.1. Will the pump station component require more power than providers could deliver?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5A.*

Construction of the pump stations will require energy. Operation of the pumps will also require energy as shown in Figure 4.17-1. The geysers pump stations will require the most energy consumption due to the distance (34 miles) and the elevation differential (3,200 feet).

At buildout, an average of 17.4 million gallons (MG) of reclaimed water would be pumped to the geysers daily. Over the course of a year, this would result in an annual average of 6,350 MG. Figure 4.17-1 indicates that it would take 103,100,000 kilowatt-hours (kwh) of energy annually or 282,500 kwh daily to transport this amount of reclaimed water to the geysers.

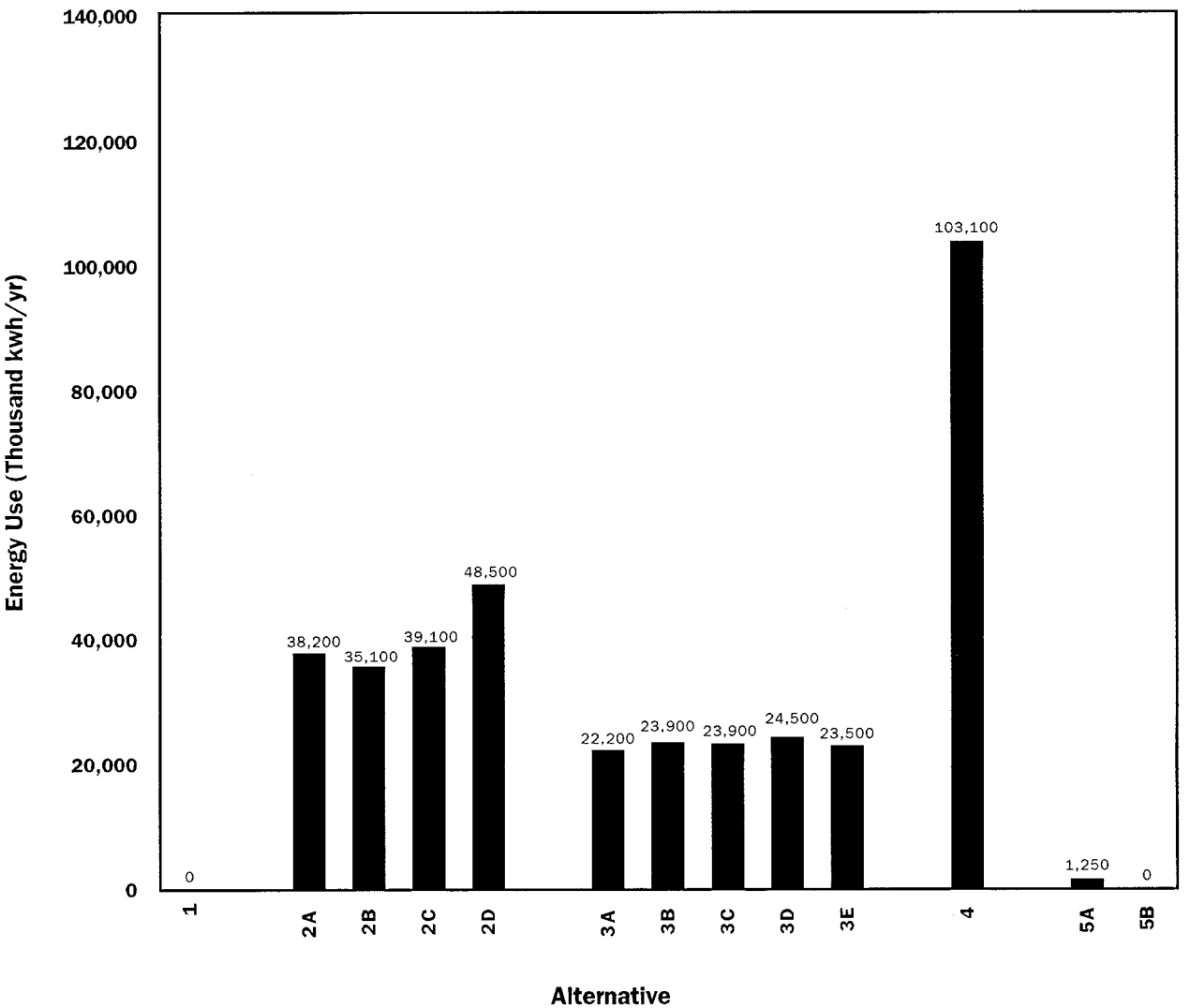
Preliminary engineering of the Project was performed to minimize energy use during operation. Measures to reduce energy use for pumping included a detailed analysis of transmission pipeline routes to reduce pumping distance and head. (Head refers to the elevation increase along a pipeline route; large increases in elevation along a pipeline require additional energy to pump the water up to the higher elevation). This analysis is discussed in the technical memorandum on *Transmission Pipeline Routes to Reservoir Sites* (Parsons Engineering Science, Inc. 1995b). Measures to reduce pumping include use of tunnels to reduce the amount of energy to pump water over high points in topography. The technical memorandum on *Transmission Pipelines to Storage, Tunnel Length Optimization Analysis* presents methods for determining when tunneling was warranted. Various pumping schedules were also evaluated to determine if off-peak pumping would be more energy efficient (see Technical memorandum on *Transport Pipeline Flowrate and Pumping Schedule Present Worth Analysis,* Parsons Engineering Science, Inc. 1995c). Measures to maximize energy efficiency have thus already been included in Project design.

Energy providers are able to supply necessary electric service and natural gas for construction and operation of the pump stations (Gary Quast 1995). Therefore, this impact is considered less than significant.

No Impact: Alternatives 1 and 5B.

These alternatives do not have a new pump station component.

Mitigation: No mitigation is proposed.



Source: Parsons Engineering Science

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UNITS OF PARSONS INFRASTRUCTURE & TECHNOLOGY INC.
PARSONS

Santa Rosa
Subregional Long-Term Wastewater Project

ENERGY CONSUMPTION for ALTERNATIVES

Figure 4.17-1

Agricultural Irrigation Component

Table 4.17-7

Energy Impacts by Component - Agricultural Irrigation

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.7.1. Will the agricultural irrigation component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	C, O&M	❍

Source: Parsons Engineering Science, Inc. 1996.

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
❍ Less than significant impact; no mitigation proposed

Impact: 17.7.1. Will the agricultural irrigation component require more energy than providers could deliver?

Analysis: *Less than Significant; Alternatives 2 and 3.*

Operation of the agricultural irrigation system will require a small amount of energy for small pumps on individual properties (these small pumps were not included in the analysis of major pump stations above) both under normal operations and under Contingency Plan operation. This impact is considered less than significant.

Energy providers are able to supply necessary electric service and natural gas for construction and operation (Gary Quast, Senior Industrial Power Engineer, PG&E, letter September 13, 1995). Therefore, this impact is considered less than significant.

If accidental irrigation runoff were to occur, no additional energy consumption will result.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have an agricultural irrigation component.

Mitigation: No mitigation is proposed.

Geysers Steamfield Component

Table 4.17-8

Energy Impacts by Component - Geysers Steamfield

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.8.1. Will the geysers steamfield component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide Can provide	C O&M	❍ +

Source: Parsons Engineering Science, Inc. 1996.

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
❍ Less than significant impact; no mitigation proposed
\+ Beneficial impact

Impact: **17.8.1. Will the geysers steamfield component may require more energy than providers could deliver?**

Analysis: ***Construction***

Less than Significant; Alternative 4.

Construction of this component will require energy. Energy providers are able to supply necessary electric service and natural gas for construction and operation (Gary Quast, Senior Industrial Power Engineer, PG&E, letter September 13, 1995). Therefore, this impact is considered less than significant.

No Impact; Alternatives 1, 2, 3, and 5.

These alternatives do not have a geysers steamfield component.

Operation and Maintenance

Beneficial; Alternative 4.

Operation of the geysers steamfield component will not require additional energy, since the holding tanks are placed at the highest elevation, and all pipelines and injections wells are gravity fed from the holding tanks. Injection of the reclaimed water will allow the geysers operators to continue

use of the steamfield for electric generation. The geysers operators estimate they can generate approximately 58,000 kwh per million gallons of water injected (Doug Hackley, UNOCAL, personal communication, June 1995). Using this relationship, reclaimed water from the Project will generate 368,000,000 kwh of electricity per year, assuming wastewater infusion 24 hours per day. Comparing the 103,100,000 kwh energy consumption for the geysers pump stations with the energy production results in a net gain of 265,000,000 kwh per year, a 3.6 to 1 ratio of electricity produced to electricity used.

The Geysers Alternative will be a net generator of energy. Therefore, this impact is considered beneficial.

No Impact; Alternatives 1, 2, 3, and 5.

These alternatives do not have a geysers steamfield component.

Mitigation: No mitigation is proposed.

Discharge Component

Table 4.17-9

Energy Impacts by Component - Discharge

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.9.1. Will the discharge component require more energy than providers could deliver?	If energy providers indicate they cannot supply project			
• Russian River		Can provide	C	❍
• Laguna		None	C	==
• Russian River or Laguna		None	O&M	==

Source: Parsons Engineering Science, Inc. 1996.

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
== No impact
❍ Less than significant impact; no mitigation proposed

Impact: 17.9.1. Will the discharge component require more energy than providers could deliver?

Analysis: ***Construction***

Less than Significant; Alternative 5A.

Construction of the discharge components will require energy. Energy providers are able to supply necessary electric service and natural gas for construction and operation (Gary Quast, Senior Industrial Power Engineer, PG&E, letter September 13, 1995). Therefore, this impact is considered less than significant.

No Impact; Alternatives 1, 2, 3, 4, and 5B.

No construction is required for discharge to the Laguna.

Operation & Maintenance

No Impact; All Alternatives.

Operation of the discharge component is dependent upon the pumps to function. Energy requirements were presented above under pump stations.

Mitigation: No mitigation is proposed.

CUMULATIVE IMPACTS

Only one impact has been identified in the Energy section:

Impact: 17.1C. Will the Project plus cumulative project require more energy than providers could deliver?

Analysis: Although energy demand will increase substantially over the life of the Project, providers will keep pace with demand by installing new facilities. Any secondary impacts of new facilities cannot be predicted at this time, so no analysis is provided.

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES

No significant impacts have been identified.

SUMMARY OF IMPACTS BY ALTERNATIVE

Table 4.17-10

Summary of Impacts by Alternative - Energy

Component	Alt 1	Alt 2A	Alt 2B	Alt 2C	Alt 2D	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 4	Alt 5A	Alt 5B
No Action (No Project) Alternative	❍	--	--	--	--	--	--	--	--	--	--	--	--
Headworks Expansion	--	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Urban Irrigation	--	==	==	==	==	==	==	==	==	==	--	--	--
Pipelines	--	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	--
Storage Reservoirs	--	❍	❍	❍	❍	❍	❍	❍	❍	❍	--	--	--
Pump Stations	--	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	--	--
Agricultural Irrigation	--	❍	❍	❍	❍	❍	❍	❍	❍	❍	--	--	--
Geysers Steamfield	--	--	--	--	--	--	--	--	--	--	+	--	--
Discharge	--	==	==	==	==	==	==	==	==	==	==	❍	==

Source: Parsons Engineering Science, Inc. 1996.

Notes: Level of Significance Codes

-- Not applicable

❍ Less than significant impact; no mitigation proposed

== No impact

\+ Beneficial impact

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