

## DOCKETED

<b>Docket Number:</b>	15-AFC-01
<b>Project Title:</b>	Puente Power Project
<b>TN #:</b>	210450
<b>Document Title:</b>	Synchronous Condenser Analysis
<b>Description:</b>	N/A
<b>Filer:</b>	Paul Kihm
<b>Organization:</b>	Latham & Watkins LLP
<b>Submitter Role:</b>	Applicant Representative
<b>Submission Date:</b>	2/18/2016 12:02:32 PM
<b>Docketed Date:</b>	2/18/2016



# Application for Certification (15-AFC-01)

**Puente Power Project (P3)**  
Oxnard, CA

## Synchronous Condenser Analysis



February 2016

Submitted to:  
**The California Energy Commission**



Prepared by:





---

<b>TABLE OF CONTENTS</b>		<b>Page</b>
1.0	INTRODUCTION .....	1
2.0	REVIEW OF PROJECT OBJECTIVES .....	1
3.0	OVERVIEW OF SYNCHRONOUS CONDENSERS .....	2
4.0	EVALUATION OF NEED FOR SYNCHRONOUS CONDENSERS IN THE PROJECT AREA.....	3
5.0	FEASIBILITY OF INSTALLATION .....	4
5.1	PHYSICAL ABILITY TO ACCOMMODATE CLUTCH TECHNOLOGY AT P3 .....	4
5.2	PROVEN USE/HISTORICAL USE OF CLUTCHES ON 7HA.01 MACHINES .....	5
5.3	COST TO INCLUDE CLUTCH TECHNOLOGY .....	5
6.0	ADVANTAGES OF CLUTCH TECHNOLOGY AT PUENTE .....	6
7.0	OTHER DISADVANTAGES OF CLUTCH TECHNOLOGY AT PUENTE .....	6
7.1	AIR QUALITY IMPACTS OF CLUTCH TECHNOLOGY EXPECTED AT PUENTE.....	6
7.2	INCREASED PROJECT FOOTPRINT .....	7
7.3	SCHEDULE IMPLICATIONS.....	8
8.0	CONCLUSION .....	8

## LIST OF ACRONYMS AND ABBREVIATIONS

AFC	Application for Certification
CAES	compressed air energy storage
CAISO	California Independent System Operator
CPUC	California Public Utilities Commission
CTG	combustion turbine generator
GE	General Electric
GHG	greenhouse gas
GT	gas turbine
kV	kilovolt
LA	Los Angeles
LCI	Load Commutating Inverter
LCR	local capacity requirement
MGS	Mandalay Generating Station
MW	megawatt
P3	Puente Power Project
RAPA	Resource Adequacy Purchase Agreement
rpm	revolutions per minute
SCE	Southern California Edison
SONGS	San Onofre Nuclear Generating Station
TPP	transmission planning process
OTC	once-through cooling

# PUENTE POWER PROJECT (15-AFC-01) SYNCHRONOUS CONDENSER ANALYSIS

## 1.0 INTRODUCTION

The Puente Power Project (P3) is a proposed 262-megawatt (MW) nominal natural-gas-fired power generating facility. P3 is intended to operate on a limited, as-needed basis to ensure reliability. P3 would act as a bridge from the current mix of electrical generation to a future that relies more heavily on renewable sources. Flexible and efficient natural-gas-fired generation, like P3, has and will continue to play a critical role in integrating renewable sources into the grid while ensuring a stable and reliable supply of electricity.

P3 consists of a new General Electric (GE) Frame 7HA.01 single-fuel combustion turbine generator (CTG) and associated auxiliaries. The generator output from P3 would be stepped up to 220-kilovolt (kV) transmission voltage from the GE 7HA.01 CTG operating in simple-cycle mode. The power block would provide peaking power and is expected to operate at up to approximately 28 percent capacity factor. Full-load output of the unit under expected operating and ambient (temperature/relative humidity) conditions would range from approximately 241 net MW to a peak of 271 net MW.

The new generating unit would tie into the existing Southern California Edison (SCE) Switchyard, using one of the breaker positions that would be vacated when Mandalay Generating Station (MGS) Units 1 and 2 are removed from service.<sup>1</sup>

Power produced by P3 would be sold into the wholesale energy market and serve electricity demand in Southern California. Peak-load operation would most likely occur during summer on-peak hours, and minimum-load operation during off-peak hours. The P3 design provides for a wide range of operating flexibility (i.e., an ability to start up quickly and operate efficiently during operating modes). Shutdown periods for annual maintenance would be scheduled during extended periods of low demand, which typically occur in the autumn or spring.

The Proposed project does not include clutch technology and is not intended to operate as a synchronous condenser.<sup>2</sup> Applicant has prepared an analysis, presented herein, demonstrating that clutch technology is neither needed nor economically feasible at this site.

## 2.0 REVIEW OF PROJECT OBJECTIVES

SCE issued the 2013 Local Capacity Requirements (LCR) Request for Offers for the Moorpark sub-area (Track 1) in September 2013. SCE sought to procure between 215 and 290 MW of electrical capacity in the Moorpark sub-area of the Big Creek/Ventura local reliability area to meet long-term LCRs by 2021.

As described in Executive Summary, Section 1.4, of the Application for Certification (AFC), the Applicant has identified the following eight basic objectives for the development of P3.

---

<sup>1</sup> To better coordinate commissioning, retirement, decommissioning, and demolition activities, the specific sequencing of events will be: retirement of MGS Unit 2 prior to completion of commissioning of P3; retirement of MGS Unit 1 by the applicable once-through cooling compliance deadline of December 31, 2020; and decommissioning and demolition of MGS Units 1 and 2 thereafter.

<sup>2</sup> As described herein, clutch technology could be used to enable operation of a facility as a peaking power generation unit or as a synchronous condenser.

- Objective #1: Fulfill the Applicant's obligations under its 20-year Resource Adequacy Purchase Agreement (RAPA) with SCE, requiring development of a 262-MW nominal net output of newer, more flexible and efficient natural-gas generation at the site of the existing MGS.
- Objective #2: Provide an efficient, reliable, and predictable power supply by using a simple-cycle, natural-gas-fired combustion turbine to replace the existing once-through cooling (OTC) generation.
- Objective #3: Support the local capacity requirements of the California Independent System Operator (CAISO) Big Creek/Ventura Local Capacity Reliability area.
- Objective #4: Develop a 262-MW nominal net power-generating plant that provides efficient, operational flexibility with rapid-start and fast-ramping capability to allow efficient integration of renewable energy sources in the California electrical grid.
- Objective #5: Have the project designed, permitted, built, and commissioned by June 1, 2020.
- Objective #6: Minimize environmental impacts and development costs by siting on an existing brownfield site and reusing existing transmission, water, wastewater, and natural-gas infrastructure.
- Objective #7: Site the project on property that has an industrial land use designation with consistent zoning.
- Objective #8: Safely produce electricity without creating significant environmental impacts.

Although there is no specific obligation in the Project's contract to include clutch technology, Applicant has evaluated the potential option to accommodate future needs. This analysis presents potential advantages and disadvantages of including clutch technology in P3.

### 3.0 OVERVIEW OF SYNCHRONOUS CONDENSERS

A synchronous condenser (sometimes called a synchronous capacitor or synchronous compensator) is a device identical to a synchronous motor, whose shaft is not connected to anything, but spins freely. Its purpose is not to convert electric power to mechanical power or vice versa, but to adjust conditions on the electric power transmission grid. Its field is controlled by a voltage regulator to either generate or absorb reactive power as needed to adjust the grid's voltage.

Synchronous clutch couplings are devices that allow generators to be synchronized to the grid and operated as synchronous condensers when they are not producing real power. The purpose of including a clutch on a simple-cycle unit is to offer additional value by providing grid reliability services for a unit that would not otherwise already be running (i.e., would not be providing real power to the grid). A simple-cycle unit is traditionally brought on (and subsequently shut off) to meet short-term, intermittent real power needs.

In principle, a synchronous clutch coupling would be installed between the generator and the gas turbine (GT) in lieu of a standard flexible or solid coupling, so that the generator could act as a synchronous condenser even when the generator is not needed for peaking electricity production. With smaller CTG units, the synchronous generator can be started either by using the combustion turbine to spin up and synchronize the generator to the grid, or by using a second clutch and pony motors. However, the proposed P3 unit uses the generator as the starting motor via a static start system (Load Commutating Inverter, or LCI). With this design, it would not be necessary to start the GT to accelerate the generator to synchronous speed. For synchronous condenser dispatch, the GT would be disconnected from the

generator via the synchronous clutch coupling. The generator would be brought to synchronous speed and connected to the grid via the same static start system ordinarily used to purge and start the complete GT-generator train. In the event that the GT was dispatched to operate as a peaking unit, it would be necessary to disconnect the generator from the grid, allow it to coast down, and then reconnect the GT to the generator via the clutch. The turbine would then be started via the generator and static start system in the normal fashion.

#### **4.0 EVALUATION OF NEED FOR SYNCHRONOUS CONDENSERS IN THE PROJECT AREA**

The California Public Utilities Commission's (CPUC's) Decision 13-02-015<sup>3</sup> (Track 1), authorized SCE to procure between 1,400 and 1,800 MW of electrical capacity in the West Los Angeles (LA) sub-area of the LA Basin local reliability area to meet long-term LCRs by 2021. For the defined portion of the LA Basin local area, at least 1,000 MW but no more than 1,200 MW of this capacity was to be procured from conventional gas-fired resources. At least 50 MW was to be procured from energy storage resources. At least 150 MW of capacity was to be procured through preferred resources consistent with the Loading Order in the Energy Action Plans.

Decision 14-03-004<sup>4</sup> combined Track 1 and Track 4 of the CPUC's long-term planning process, authorizing SCE to procure between 1,900 and 2,500 MW in the LA Basin. These decisions set forth the required technology procurements, requiring up to 60 percent of new local capacity in the LA Basin from preferred resources, and at least 50 MW from energy storage. SCE was also authorized to procure up to 600 MW of additional capacity from preferred resources and/or energy storage resources. In addition, SCE was required to continue to obtain resources that can be used in these local reliability areas through processes defined in the energy efficiency, demand response, renewable portfolio standard, energy storage, and other relevant dockets. SCE was also specifically authorized to procure between 215 and 290 MW in the Moorpark sub-area of the Big Creek/Ventura local reliability area.

As a result of these procurement authorizations, SCE issued the 2013 LCR Request for Offers for the Moorpark sub-area in September 2013, wherein SCE sought to procure between 215 and 290 MW of electrical capacity in the Moorpark sub-area of the Big Creek/Ventura local reliability area to meet the long-term LCRs by 2021.

In November 2014, the Applicant was awarded a contract with SCE for 262 MW (nominal net) of state-of-the-art, more flexible and efficient natural gas generation at the site of the existing MGS facility. The Applicant has entered into a 20-year RAPA with SCE. P3 has been designed to ensure continued reliability, and to help integrate renewable energy into the grid.

The CAISO has recognized the importance of the existing MGS location in providing energy and contingency reserve for the Moorpark sub-area of the Big Creek/Ventura local reliability area.<sup>5</sup> Specifically, this location provides essential electrical service to the existing SCE switchyard through a dedicated 220-kV transmission line connection. P3 would ensure the long-term viability of this existing critical generating location, and would provide essential electrical service to the residents of Ventura County and the City of Oxnard.

<sup>3</sup> See CPUC Decision 13-02-015, available online at: <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M050/K374/50374520.PDF>.

<sup>4</sup> See CPUC Decision 14-03-004, available online at: <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M089/K008/89008104.PDF>.

<sup>5</sup> *Report of the Statewide Advisory Committee on Cooling Water Intake Structures*, dated July 2015, at pp. 8-9. Available online at: [http://www.waterboards.ca.gov/board\\_info/agendas/2015/nov/110415\\_3\\_saccwis\\_rpt071415.pdf](http://www.waterboards.ca.gov/board_info/agendas/2015/nov/110415_3_saccwis_rpt071415.pdf).



In addition to its work supporting the CPUC long-term procurement plan proceeding, CAISO expanded its transmission planning process (TPP) to explore transmission alternatives for improving reliability. CAISO approved transmission upgrades and additions in its 2013/2014 TPP to address local reliability issues associated with the compliance schedule under the OTC Policy and the closure of the San Onofre Nuclear Generating Station (SONGS).<sup>6</sup> The timing of the CAISO-approved transmission projects and CPUC pending projects, as well as authorized procurement levels for SCE, will facilitate the compliance schedule of the OTC Policy. CAISO's analysis in the 2014/2015 TPP indicated that the authorized resources, forecast load, and previously approved transmission projects meet the needs in the LA Basin.<sup>7</sup> The Santiago Synchronous Condensers project (1 ´ 225 megavolt-ampere reactive), located in the Irvine area, was approved by CAISO to address reliability concerns related to the retirement of SONGS and the OTC generating facilities in the LA Basin.<sup>8</sup> It is of note, in connection with P3, that no such project has been identified or recommended for the Big Creek/Ventura local capacity reliability area.

The permanent shutdown of SONGS in 2013 resulted in the need for grid support in northwestern San Diego County and Orange County. This was an identified, short-term need in the Huntington Beach area after the retirement of SONGS, and was addressed through the conversion of two of the generating units at the Huntington Beach Generating Station to synchronous condensers. This action was taken to address a specific, unforeseen situation at a specific time and at a very specific and critical location, to ensure grid reliability. No need has been identified for grid support associated with the installation of synchronous condensers at the P3 location.

SCE has traditionally identified ways to meet grid reliability needs through transmission projects, and has met these needs (and will likely continue to do so) through either the installation of Static Volt-Ampere Reactive Compensator(s), Synchronous Condensers, or Static Synchronous Compensators. SCE is in the process of installing, or has recently installed, new reactive power support devices in and around the area to which SONGS previously provided reactive power support.<sup>9</sup>

In summary, the CPUC did not specify in its procurement authorizations a requirement for SCE to procure grid reliability services in the Big Creek/Ventura local capacity reliability area beyond the procurement of peaking generation (and the associated grid reliability support) of the kind provided by P3.

## 5.0 FEASIBILITY OF INSTALLATION

Although clutch technology may be technically feasible at P3, it is not economically feasible, as discussed in more detail in the following sections.

### 5.1 PHYSICAL ABILITY TO ACCOMMODATE CLUTCH TECHNOLOGY AT P3

If used at P3, a clutch assembly would presumably be inserted between the GT compressor end at the inlet plenum and the generator.

---

<sup>6</sup> *Report of the Statewide Advisory Committee on Cooling Water Intake Structures*, dated July 2015, at p. 9. Available online at: [http://www.waterboards.ca.gov/board\\_info/agendas/2015/nov/110415\\_3\\_saccwis\\_rpt071415.pdf](http://www.waterboards.ca.gov/board_info/agendas/2015/nov/110415_3_saccwis_rpt071415.pdf).

<sup>7</sup> *CAISO Board Approved 2014-2015 Transmission Plan*, dated March 27, 2015, at p. 149 (Table 3.2-8). Available online at: <http://www.caiso.com/Documents/Board-Approved2014-2015TransmissionPlan.pdf>.

<sup>8</sup> *IEPR Workshop Southern California Reliability: Transmission System Additions Panel*, dated August 20, 2014, at p. 4. Available online at: [http://www.energy.ca.gov/2014\\_energypolicy/documents/2014-08-20\\_workshop/presentations/08\\_Cabbell\\_SCE\\_8-20-14.pdf](http://www.energy.ca.gov/2014_energypolicy/documents/2014-08-20_workshop/presentations/08_Cabbell_SCE_8-20-14.pdf).

<sup>9</sup> *CAISO Board Approved 2012-2013 Transmission Plan*, dated March 20, 2013, at p. 364. Available online at: <http://www.caiso.com/Documents/BoardApproved2012-2013TransmissionPlan.pdf>.

The torque requirement for a clutch installed at P3 would be comparable to the SSS clutch at the Huntorf compressed air energy storage (CAES) plant in Germany. The proposed P3 unit is a GE 7HA.01 with an electrical generator rated at about 275 MW, equivalent to 537,806 pound-feet at 3,600 revolutions per minute (rpm). Currently, the largest clutch in service is a 300 MW unit on the Huntorf CAES plant in Germany, which is a 50-hertz, 3,000-rpm machine. The Huntorf coupling torque is 704,316 pound-feet at 3,000 rpm, equivalent to 586,930 pound-feet at 3,600 rpm. This clutch was installed in 1976.

The GE H machines (P3 will be a GE 7HA.01) use static start systems to enable the generator to serve as a start motor. Therefore, other than the clutch, the turbine generator package would include the facilities required to use the generator as a synchronous condenser.

A clutch would probably add about 40 feet to the package length. This assumes that the inlet filter house and ducting would stay in the same place, but that the generator will be moved approximately 40 feet farther away from the GT package to accommodate the clutch.

## 5.2 PROVEN USE/HISTORICAL USE OF CLUTCHES ON 7HA.01 MACHINES

There currently are no known clutch installations on GE 7HA.01 units that are operating in simple-cycle mode. The turbine manufacturer has never delivered these units with clutches, and the commercial terms under which the turbine manufacturer might offer clutches for these units are uncertain.

Because there are no clutch installations on GE 7HA.01 units operating in simple-cycle mode, the potential technology issues are unknown.

In other clutch installations, there have been issues related to lateral and/or torsional vibration associated with the addition of a clutch.

As discussed in Section 7.1, the presence of the clutch on the GT shaft would result in a small decrease in P3's rated plant output.

## 5.3 COST TO INCLUDE CLUTCH TECHNOLOGY

Although P3 potentially could be configured to allow a clutch installation, the cost of achieving any potential benefits, such as local voltage support and reactive power, depends on the costs of deploying the technology. The costs associated with configuring P3 with a clutch would include:

- engineering costs associated with the clutch, clutch component, and modifications to the turbine support system to support clutch operations;
- additional foundations required for the clutch and components;
- purchase of the clutch and components, either prior to initial construction or at a later date if and when the need arose for a synchronous condenser at this site; and
- installation and maintenance of the clutch and components.

Although it appears that a clutch assembly could be inserted between the GT inlet plenum and the generator without necessitating a major package redesign, GE will nevertheless require significant time and associated engineering costs to re-engineer the equipment train and ancillary systems.

The ability to secure a Power Purchase Agreement in California is a highly scrutinized and competitive process; the winners are selected on a least cost, best fit basis. There is no economic value assigned to providing reactive power support as a synchronous condenser when that type of service has not been requested by the serving utility.

The Project's RAPA with SCE does not provide compensation for the provision of reactive power. Because there is no mechanism in place to support the additional cost of the conversion or to provide compensation for providing reactive power, inclusion of a clutch is not economically feasible.

## **6.0 ADVANTAGES OF CLUTCH TECHNOLOGY AT PUENTE**

The only potential advantage of including clutch technology at P3 is that the unit could operate as a synchronous condenser to provide voltage support and reactive power when such services were required at this site. However, the need for a synchronous condenser at the P3 location has not been identified to date, and the potential need for such services at this site is speculative.

## **7.0 OTHER DISADVANTAGES OF CLUTCH TECHNOLOGY AT PUENTE**

In addition to the technical and cost considerations discussed above, there are other drawbacks to incorporating clutches into the GE 7HA.01 simple-cycle unit proposed for P3 to allow it to operate as a synchronous condenser.

### **7.1 AIR QUALITY IMPACTS OF CLUTCH TECHNOLOGY EXPECTED AT PUENTE**

There is no evidence that the use of clutch technology at the Project site would reduce air pollutant or greenhouse gas (GHG) emissions, and any such evidence would be speculative, at best. It is not speculative, but certain, that the use of clutch technology would result in a small increase in systemwide energy production due to the additional rotating mass associated with this technology. Whether this systemwide increase in energy production would result in a corresponding small increase in air pollutant and GHG emissions would depend on the source of this additional energy.

Reactive power is provided to the grid when the GTs are operating. The purpose of installing a clutch between the GT and the generator in a simple-cycle installation is to allow the generator and associated components to operate as a synchronous condenser. A synchronous condenser would enable the facility to provide reactive power when the GTs are not operating. However, synchronous condensers do not produce electrical energy; they consume small amounts of energy at each startup, and during operation to overcome the small amount of friction associated with the rotating mass. Accordingly, synchronous condensers do not displace energy produced at other locations. Rather, synchronous condensers can remotely enable the production of electricity at other sites, if that is desired for other reasons and if transmission of that remote energy is limited due to inadequate reactive power at the receiving end of that line.

In the case of the simple-cycle turbine at P3, a clutch would facilitate the use of a synchronous condenser at times when reactive power is needed for local grid reliability, but when the energy that would be produced by the simple-cycle turbine is not needed to meet demand. Under those conditions, the energy needed to meet demand would still have to be produced at another generating facility, and the production of that energy would likely have air pollutant and GHG emissions. The magnitude of those emissions would depend on the type of generating resource that produces the electricity. Predicting where that electricity would be generated, and how the emissions from that generation would compare with those of the P3 unit (or other possible operating units), is not possible without detailed, hour-specific modeling of the transmission system. This makes it impossible to predict whether, and to what extent, the use of the P3 unit as a synchronous condenser would result in reductions in either air pollutant or GHG emissions.

Synchronous condensing could be required at the P3 facility if the demand for electricity in the Big Creek/Ventura local capacity reliability area can be met with a combination of local and imported generation (excluding the P3 unit fitted with clutch technology), but the available and/or desired imported generation cannot be accommodated due to insufficient reactive power in the area. Under these conditions, the options would be to 1) decrease the amount of imported power to match the available

reactive power and increase local generation to make up for the energy lost as a result of reduced imports; or 2) use the P3 unit as a synchronous generator to accommodate the higher level of imported power.

The air quality and GHG impacts associated with these options depend on the emissions associated with the displaced imported power, compared with the emissions associated with the potential local power. If the marginal imported power that would be displaced was renewable energy, and the replacement local power was fossil energy, then the use of synchronous generators at P3 would result in an out-of-area reduction in air pollutant and GHG emissions to the extent that the renewable energy had lower air pollutant and GHG emissions. On the other hand, if the marginal imported power that would be displaced came from fossil sources, and the replacement local power was similarly from fossil sources, there might be a benefit or detriment from the use of synchronous generation depending on the relative air pollutant and GHG emission rates from the displaced and local generating sources. Note that this comparison does not and should not assume that the replacement energy would come from P3 unit; that would be the case only if all more-efficient local generating units had already been fully dispatched at the point where the displacement becomes relevant.

What is certain, however, is that the presence of the clutch on the GT shaft would result in a small decrease in P3's rated plant output which, in turn, could result in small increases in air pollutant and GHG emissions on the grid; although this would depend on the type of generating resource used to replace the slight decrease in P3's output. The decrease in plant output would result from the additional rotating mass on the GT shaft. This additional rotating mass requires energy to overcome the friction associated with its rotation, and the required energy comes from the fuel used by the turbine. Instead of being used to generate electricity, this energy would be lost to friction and rejected from the turbine as heat, likely in the clutch's lubricating system.

Although the decrease in plant output could, in theory, be offset by increasing the amount of fuel burned in the turbine, the maximum firing rate is temperature-limited by the design of the turbine. Consequently, when the turbine is operating at its maximum heat input, the impact of the increased rotating mass would be manifested as a decrease in electrical output. Because the overall demand for electricity is unaffected, the lost electrical output at P3 would be made up for by other generating units. Although it is impossible to predict with certainty exactly what generating unit(s) would make up for the reduced output at P3, it is likely that the power would be produced by units that are less efficient and higher emitting (per megawatt hour of electricity produced) than the P3 unit, due to the CAISO dispatch order. During periods when the P3 turbine is operating at less than its maximum rated load, the loss in electrical output would be compensated for by an increase in fuel consumption by the P3 unit to maintain the dispatched generation level. This additional fuel would, in turn, result in an increase in air pollutant and GHG emissions at the project site.

In summary, the use of clutch technology would not result in a direct decrease in air pollutant or GHG emissions at the P3 site. Whether there would be an indirect change in air pollutant or GHG emissions at other locations is speculative, and the magnitude (and direction) of any change could not be determined without understanding why and under what conditions there was a need for reactive power at the P3 site, and where the corresponding real power was being generated. Finally, the use of clutch technology at the P3 site would likely result in a small but real increase in air pollutant and GHG emissions associated with the energy required to rotate the clutch mechanism at all times when the P3 unit is operating.

## 7.2 INCREASED PROJECT FOOTPRINT

As discussed in Section 5.1, the clutch would increase the overall length of the CTG package by approximately 40 feet. Although there is sufficient space available at the project site to accommodate this increased length and corresponding increased footprint, there are cost implications as discussed above in Section 5.3. Notwithstanding the air quality and GHG implications analyzed above and responsiveness to RAPA/schedule implications discussed below, the increased overall length of the CTG package is not

anticipated to result in potential additional environmental impacts that were not already analyzed in the AFC and the corresponding supplemental information provided by the Applicant.

### **7.3 SCHEDULE IMPLICATIONS**

Adding clutch technology to the project would cause schedule delays due to additional time needed for specification development, contract negotiation, equipment design, manufacturing, and construction. The turbine manufacturer (GE) will require significant time to re-engineer the equipment train to accommodate the clutch. Installation of additional equipment will also increase the construction schedule.

### **8.0 CONCLUSION**

There is no compelling reason to incorporate clutch technology into the project design. Although it is theoretically possible to include clutch technology, it is considered to be economically infeasible because it represents a large cost increase to a fully contracted project with no method for recovery of that cost. Furthermore, the additional costs are not warranted for a technology that is not required by the contracting utility.

Based on the analysis described herein, this technology is not needed and is not economically viable.