



Greater San Francisco Bay Area Black Start Resources Selection Report

December 1, 2017

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1. INTRODUCTION

This report describes the competitive solicitation process conducted by the California Independent System Operator Corporation (ISO) for the procurement of black start capability to enhance the system restoration time in the greater San Francisco bay area. Based on its review of the timelines associated with the ISO's and utilities' system restoration plans, black start resources are needed to enhance the system restoration time in the greater San Francisco bay area to ensure that the area's service restoration following a widespread system outage is reasonably consistent with service restoration for other major population centers in the state.

The ISO conducted this competitive solicitation consistent with ISO tariff authority to contract for black start capability and direction from the ISO governing board regarding the use of a competitive solicitation process to evaluate potential black start resources to enhance the system restoration time in the greater San Francisco bay area after a widespread system outage. The ISO issued a request for proposals (RFP) and undertook (1) an analysis to determine whether each proposal for the provision of black start capability would satisfy the technical requirements and (2) a comparative analysis of their merits with regard to the selection factors established by the ISO and posted on the ISO website in order to determine which of the proposals the ISO would select to provide the black start capability.

The ISO received proposals from four different prospective black start providers for the provision of black start capability to enhance the system restoration time in the greater San Francisco bay area from ten different proposed black start resources. The proposals that the ISO reviewed were detailed and well-supported. However, the ISO's analysis determined that four of the proposals would not satisfy all of the technical requirements established by the ISO to ensure that the proposed black start resources would be capable of providing the black start capability identified by the ISO as needed to enhance the system restoration time in the greater San Francisco bay area.

While conducting the comparative analysis of the proposals for the remaining six proposed black start resources, the ISO assessed how the black start capability proposals compared with regard to certain technical and commercial criteria in order to determine which proposals to select. The details of the ISO's comparative analysis are set forth in Sections 3.14-3.22 of this report, and the overall analysis is set forth in Section 3.23. The result of this competitive solicitation process is that the ISO has selected an affiliate of NRG Energy, Inc. to provide black start capability from its proposed black start resource and has selected Calpine Corporation to provide black start capability from one of its proposed black start resources.

2. BACKGROUND

2.1 Need for Black Start Capability to Enhance the System Restoration Time in the Greater San Francisco Bay Area and the Black Start Stakeholder Process

Black start capability refers to the ability of a generating unit or facility to begin operating and delivering electric power without external assistance from the electric system. Black start resources are essential to restart other generation and to restore power to the grid in the event of a widespread system outage.¹ The ISO tariff requires black start resources to have a number of attributes, including the ability to: start without external aid from the grid, make a minimum number of starts, operate in stand-alone and parallel modes, have start-up load pickup capability, produce and absorb reactive power, and have necessary communication/control equipment.²

In the early years of its operation, the ISO relied on multiple resources to provide black start capability to the system. The ISO secured this capability through either reliability must run agreements or interim black start agreements.³ Under a reliability must run agreement, the ISO contracted for the ability to dispatch a generating unit to meet a reliability need, including the capability to provide black start. Under the interim black start agreements, the ISO contracted for black start from generating units either owned by or under contract to incumbent utilities. Over the years, the ISO has reduced its reliance on reliability must run agreements. In addition, the North American Electric Reliability Corporation (NERC) has adopted new reliability standards involving critical infrastructure and protection that have increased requirements for personnel training as well as cyber and physical security for assets critical to the reliability of the bulk electric system. These assets include generating units providing black start capability under a system restoration plan.

In 2011, the Federal Energy Regulatory Commission (FERC) approved NERC Reliability Standard EOP-005-2 that requires, among other things, that transmission operators have a system restoration plan approved by their reliability coordinator.⁴

¹ System Restoration Reliability Standards, FERC Order No. 749, FERC Stat. & Regs. ¶ 32,666, at P 2 (2011).

² ISO tariff, Appendix D.

³ The ISO tariff previously referred to these agreements as interim black start agreements, which the ISO tariff defined as follows:

An agreement entered into between the CAISO and a Participating Generator (other than a Reliability Must-Run Contract) for the provision by the Participating Generator of Black Start capability and Black Start Energy on an interim basis until the introduction by the CAISO of its Black Start auction (or until terminated earlier by either party in accordance with its terms).

The ISO has amended the ISO tariff, effective as of November 1, 2017, to revise this term and its definition to remove the word “interim” and to reflect that the ISO has not pursued, and does not intend to pursue, an auction process for black start.

⁴ System Restoration Reliability Standards 134 FERC ¶ 61215 (FERC Order 749) March 2011 at P 13. See also Requirement 1 of NERC Reliability Standard EOP-005-02 available at <http://www.nerc.com/files/EOP-005-2.pdf>

NERC Reliability Standard EOP-005-2 has the stated purpose to “[e]nsure plans, [f]acilities, and personnel are prepared to enable [s]ystem restoration from [b]lack [s]tart resources to assure reliability is maintained during restoration and priority is placed on restoring the Interconnection.” In addition, NERC Reliability Standard EOP-005-2 requires periodic testing of the resources, verification, and execution of the system restoration plan, and further states that each transmission operator should have testing requirements to verify that black start resources are capable of following the transmission operator’s restoration plan.⁵

In 2013, the ISO filed tariff revisions to specify how the ISO determines its black start needs pursuant to a system restoration plan that meets the requirements of NERC Reliability Standard EOP-005-2.⁶ Under these tariff provisions, the ISO has developed a system restoration plan in consultation with participating transmission owners, which are also required to develop system restoration plans under NERC Reliability Standard EOP-005-2.⁷ The ISO may, however, identify black start needs for the ISO system not identified in participating transmission owners’ system restoration plans.⁸ As required by NERC Reliability Standard EOP-005-2, the reliability coordinator for the ISO, Peak Reliability, has approved the ISO’s system restoration plan.

Separately, the ISO, in consultation with participating transmission owners and participating generators, amended existing black start agreements to incorporate testing requirements under NERC Reliability Standard EOP-005-2. FERC accepted these amended agreements. At this time, these agreements provide the black start capability the ISO relies upon in its system restoration plan under NERC Reliability Standard EOP-005-2. These agreements have a \$0 reservation fee and, as such, the ISO does not allocate black start capability costs from those agreements to market participants.

In 2016, as part of its efforts to review its system restoration plan, the ISO determined that system black start capability is necessary to ensure adequate service restoration time in the greater San Francisco bay area during a black start event and particularly that it is reasonably consistent with that of other major population centers in the state of California. To secure this capability, the ISO initiated the current process to select black start resources and contract with prospective black start providers.⁹

The ISO tariff provides authority for the ISO to enter into black start agreements that compensate resources for black start capability. The ISO expects that any new agreement it enters into to procure black start capability will require the ISO to compensate the resource owner to provide that capability. Based on feedback from stakeholders, the ISO amended the ISO tariff to define this cost as a reliability services

⁵ NERC Reliability Standard EOP-005-2, Requirement 9.

⁶ ISO filing dated January 3, 2013 in FERC Docket No. ER13-699. *See also* FERC delegated order dated February 23, 2013, accepting the ISO’s tariff revisions in FERC Docket No. ER13-699.

⁷ Only ISO participating transmission owners registered as transmission operators under the NERC functional model must develop system restoration plans under NERC Reliability Standard EOP-005-2.

⁸ *See* ISO tariff Section 5.1 (former Section 8.2.3.4).

⁹ The ISO issued a market notice on June 15, 2017 requesting that interested providers submit proposals to provide black start capability to support the greater San Francisco bay area by July 31, 2017:

<http://www.caiso.com/Documents/BlackStart-SystemRestorationPhase2Request-ProposalFinalDocumentsPosted.html>

cost. Under this new approach, the ISO will invoice the participating transmission owner where the black start resource is located, and the participating transmission owner will recover the cost from transmission customers under its reliability services tariff, as described in Section 2.2 of this report.

In addition, the ISO will use a cost of service model for compensating black start resources. Under this approach, the black start provider would submit its costs to FERC for acceptance under Section 205 of the Federal Power Act.¹⁰

The ISO's proposal to acquire this black start capability raised a number of questions relating to selection and procurement. The selection of black start resources depends on their specific location and electrical connection implications. The ISO's stakeholder process examined the process it would undertake to procure black start capability under its tariff authority to contract for black start capability and the appropriate method for allocating the costs of this black start capability. The stakeholder process for the black start procurement initiative included the following process steps:

Stakeholder Process Schedule for Black Start Procurement Process

<u>Milestone</u>	<u>Date</u>
Issue paper posted	January 17, 2017
Stakeholder call	January 24, 2017
Stakeholder comments due	January 30, 2017
Straw proposal posted	February 14, 2017
Stakeholder call	February 21, 2017
Stakeholder comments due	February 28, 2017
Draft final proposal posted	March 14, 2017
Stakeholder call	March 21, 2017
Stakeholder comments due	April 4, 2017
Board Meeting	May 1, 2017
Draft technical documents for RFP and draft agreement posted	May 8, 2017
Technical workshop	May 24, 2017
Final technical documents for RFP and sample agreement posted	June 15, 2017
Matrix of answers to additional stakeholder questions posted	July 19, 2017
Deadline for submittal of proposals	July 31, 2017
ISO selection of black start providers	Dec. 1, 2017

The ISO considered the comments submitted by stakeholders and agreed that securing black start resources should occur through an open and transparent competitive procurement process, while respecting the need for prudent handling of information regarding black start resources that qualifies as critical energy/electric infrastructure information (CEII) pursuant to FERC regulations.

In its draft final proposal posted on the ISO website on March 14, 2017, the ISO proposed the following process steps for the black start procurement process:

1. The ISO, in consultation with the applicable participating transmission owner, will develop a black start technical specification document that defines requirements and key selection criteria.

¹⁰ See 16 U.S.C. § 824d (c); see also 18 C.F.R. 35.1.

2. The ISO will conduct an onsite meeting with stakeholders to review the technical requirements and selection criteria and answer interested parties' questions.
3. The ISO will issue a request for proposals for incremental black start resources.
4. The ISO will apply the technical criteria and evaluate the proposals. The ISO will consult with the applicable participating transmission owner with respect to how each offer meets the technical requirements.
5. The ISO will apply its selection criteria and select the most technically and commercially viable offer based on the technical and cost data submitted. As part of this selection, the ISO will consider the nature of the costs and whether they are reasonable, as well as what assurances exist that the prospective black start resource will continue to operate over the term of the black start agreement.
6. The ISO will initiate a contracting process with the black start resource. The contract will be a three party agreement among the ISO, the participating transmission owner, and the black start resource.

The ISO governing board approved these process steps for the black start procurement process at its meeting on May 1, 2017.

Regarding considerations for contracting for black start capability, the ISO concluded that the length of any contractual commitment by the ISO and the black start service provider carry different risks and benefits to each party. A longer commitment term to the ISO will provide greater certainty of sufficient black start capability, but the ISO may also want reasonable exit provisions to address changes in circumstances. Similarly, a longer term contract provides greater certainty to the black start provider, but also could restrict future flexibility for the resource.

Given this context, the ISO considers a multi-year contract term with exit provisions to be appropriate. The ISO posted a draft black start agreement on the ISO website for stakeholder review on May 8, 2017. After receiving stakeholder comments on the draft agreement, the ISO posted a revised version of a sample black start agreement on the ISO website on June 15, 2017.

To implement the competitive procurement process, the ISO posted drafts of the technical requirements and selection factors for the RFP on the ISO website for stakeholder review on May 8, 2017. After receiving stakeholder comments on these technical requirements and selection factors, the ISO posted a final version of the technical requirements and selection factors for any proposed black start resource to enhance the system restoration time in the greater San Francisco bay area on the ISO website in a technical specification document entitled "Greater Bay Area Blackstart Technical Variables and Criteria" posted on June 15, 2017. The technical requirements set forth in this technical specification document for the RFP include:

- Must satisfy the NERC definition of "Blackstart Resource:" "A generating unit(s) and its associated set of equipment which has the ability to be started without support from the System or is designed to remain energized without connection to the remainder of the System, with the ability to energize a bus, meeting the Transmission Operator's restoration plan needs for Real and Reactive Power capability, frequency and voltage control, and that has been included in the Transmission Operator's restoration plan."

- Must be able to supply own start-up power.
- Must serve own plant load.
- Must have ability to meet fault impedance requirements of the restoration path. Generating unit protection relays should be flexible to assume temporary setting changes required to provide adequate protection during anticipated black start system configurations. This could be accommodated, but is not limited to, by utilizing microprocessor based protective relays with multiple group setting capability.
- Must follow the ISO planned outage procedures.
- Must have ability to meet minimum continuous running time for unit - 48 hours.
- Must have ability to energize a dead transmission bus within targeted timeframe: 3 hours.
- Must demonstrate the ability to comply with all applicable NERC critical infrastructure protection (CIP) and other reliability standards as a “Blackstart Resource” (including but not limited to NERC reliability standards PRC 19-2 and 25-1, EOP 005-2, CIP 008-3, CIP 009-3, and COM-001 and ISO resource testing procedures).

The selection factors set forth in the technical specification document for the RFP are:

- (a) Calculated time to energize the backbone 230 kV substation loop within the greater San Francisco bay area;
- (b) Technical ability to meet restoration requirements (reactive and real power, frequency and voltage regulation, protection coordination, ramping capability, permits, etc.);
- (c) Restoration flexibility (resource flexibility based on location to provide operations multiple options to restore the 230 kV system, proximity to other generators);
- (d) Locational diversity of resource (location with respect to other black start resources in the area);
- (e) Probability of resource completing five-year term of contract;
- (f) Cost of service and capital costs;
- (g) Black start service commencement date; and
- (h) Any other strengths and advantages the proposal may have to provide the specific black start capability, as well as any specific efficiencies or benefits demonstrated in the proposal.

The ISO governing board did not direct the ISO to make any substantive revisions to the tariff provisions specifying the ISO’s authority to conduct this procurement process in approving the ISO’s procurement process proposal. Consequently, the ISO issued its RFP for the provision of black start capability to enhance the system restoration time in the greater San Francisco bay area in a market notice issued on June 15, 2017, along with the posting of technical documents and a model black start agreement on the ISO website on that same day as described above. The documents posted by the ISO included application information requirements set forth in the “Facility Worksheet” section of the technical specification document and in a separate “Black Start Resource Commercial Worksheet/Questionnaire.” The ISO received proposals by the deadline of July 31, 2017, from four prospective black start providers proposing to provide black start capability from ten different proposed black start resources. The ISO has evaluated each of these proposals with regard to the technical requirements and selection factors posted on the ISO website on June 15, 2017 and has selected the black start providers

and proposed black start resources identified in this report to provide the black start capability to enhance the system restoration time in the greater San Francisco bay area.

In parallel, the ISO proceeded with a separate stakeholder process regarding the specifics of the revisions needed to the ISO tariff to address the implementation of the black start procurement process, including revisions to specify the appropriate allocation of the costs of the procurement of black start capability. Pursuant to this separate stakeholder process, the ISO filed proposed amendments to the ISO tariff with FERC on August 3, 2017. These tariff amendments addressed not only the substantive matter of cost allocation, but they also included a proposed reorganization and clarification of the tariff provisions specifying ISO's existing authority to conduct the procurement process. On October 30, 2017, FERC issued an order accepting all of the ISO's proposed tariff amendments as filed.

Based on the FERC order confirming the ISO's authority to conduct this procurement process and the ISO's evaluation and selection of the black start providers and proposed black start resources identified in this report, the ISO plans to proceed with the negotiation of black start agreements with the selected black start providers and to allocate the resulting costs pursuant to the provisions of the ISO tariff accepted by FERC. The ISO will use the sample agreement posted on the ISO website on June 15, 2017 as the basis for its negotiation of final agreements with the prospective black start providers selected to provide the black start capability to enhance the system restoration time in the greater San Francisco bay area.

2.2 The ISO Black Start Tariff Structure

Although the ISO had existing tariff authority to contract for black start prior to its commencement of its stakeholder initiative and competitive solicitation process for black start capability,¹¹ the ISO conducted a separate stakeholder process regarding proposed revisions to the ISO tariff to restructure and clarify tariff requirements applicable to black start. Among other changes, the ISO consolidated the existing tariff black start requirements into Section 5 of the ISO tariff, a section that was previously not used. In addition, the ISO incorporated settlement and cost allocation rules into a new Section 11.4 that was previously not used. These revisions were intended to enhance the ability of affected stakeholders to find and understand the ISO's black start tariff provisions.

During the ISO's development of tariff language, one stakeholder requested that the ISO include in its tariff language explaining the steps of the process it is undertaking to procure black start capability. As part of its approach to procure black start capability, the ISO has chosen to use a competitive solicitation process to ensure it obtains a technically and commercially feasible solution as well as to promote transparency.¹² The ISO governing board approved using a competitive solicitation process for selecting black start resources to meet black start capability needs in the greater San Francisco

¹¹ ISO tariff Section 5.2 (former Section 8.3.1).

¹² See Memorandum to CAISO Board of Governors from Keith Casey dated April 24, 2017, Decision on black start and system restoration proposal at 2-3 at the following link:
http://www.caiso.com/Documents/Decision_BlackStart_SystemRestorationProposal-Memo-May2017.pdf

bay area but did not direct that the ISO modify its existing tariff authority to contract for black start capability.

The ISO anticipates the process of entering into contracts for black start capability will occur very infrequently and does not believe that incorporating the elements of its solicitation process into the tariff is necessary. The ISO published technical specifications for the solicitation and issued a questionnaire for bidders and posted all of this information on the ISO website.¹³ The ISO also held a workshop on May 24, 2017 with prospective black start providers to discuss to discuss the technical, commercial, and contractual requirements for black start resources.¹⁴ Through these steps, the ISO worked to meet its objective of obtaining a technical and commercially feasible solution as well as maintaining full transparency of its contracting process.

On October 30, 2017, FERC issued an order accepting all of the ISO's proposed revisions to the black start provisions of the ISO tariff effective as of November 1, 2017. As a result, the effective ISO tariff provisions governing black start are now set forth primarily in Sections 5 and 11.4 and in Appendix D of the ISO tariff. The provisions of new Section 5 essentially consolidate and clarify the prior tariff provisions regarding the ISO's identification and procurement of necessary black start capability under which the ISO initiated and has conducted its competitive procurement process for black start capability to enhance the system restoration time in the greater San Francisco bay area. Consequently, the provisions of new Section 5 of the ISO tariff do not affect the current competitive solicitation process. The provisions of new Section 11.4 address the settlement of payments for black start capability and black start energy and also do not affect the current competitive procurement process, although they may be relevant to the negotiation of black start agreements with the selected black start providers.

Appendix D of the ISO tariff continues to set forth the fundamental requirements that must be met by a black start generating unit. The revisions to Appendix D effective as of November 1, 2017 primarily consolidate requirements that were previously set forth in the body of the ISO tariff with the existing provisions of Appendix D. The most significant new requirements added to Appendix D are the requirement for a black start generating unit to pass performance tests to demonstrate its black start capability and the requirement that a black start generating unit comply with applicable reliability criteria. These requirements are applicable to any generating unit of a participating generator providing service pursuant to the provisions of the ISO tariff, so they should have no effect on the expectations of the participants in the current competitive solicitation process. Consequently, none of the revisions to Appendix D materially affect the competitive solicitation process that this the subject of this report.

¹³ See the ISO's stakeholder initiative page relating to Black Start and System Restoration at the following link:

http://www.caiso.com/informed/Pages/StakeholderProcesses/Blackstart_SystemRestorationPhase2.aspx

¹⁴ See May 8, 2017 ISO market notice scheduling workshop at the following link:

<http://www.caiso.com/Documents/BlackStart-SystemRestorationPhase2TechnicalWorkshop052417.html>

ISO tariff Appendix D now reads as follows:

The following requirements must be met by Black Start Generating Units:

- (a) Black Start Generating Units must be capable of starting and paralleling with the CAISO Controlled Grid without aid from the CAISO Controlled Grid;
- (b) Black Start Generating Units must be capable of making a minimum number of starts per event (to be without aid from the CAISO Controlled Grid as determined by the CAISO);
- (c) Black Start Generating Units must be equipped with governors capable of operating in the stand alone (asynchronous) and parallel (synchronous) modes.
- (d) Black Start Generating Units must have Start-Up load pickup capabilities at a level to be determined by the CAISO, including total Start-Up load (MW) and largest Start-Up load (MW) for such power output levels as the CAISO may specify. Each Black Start Generating Unit must be able to start up with a dead primary and station service bus within ten (10) minutes of issuance of an Exceptional Dispatch by the CAISO requiring a Black Start. Each Black Start Generating Unit must be capable of sustaining its output for a minimum period of twelve (12) hours from the time when it first starts delivering Energy. Black Start Agreements may specify a different minimum period.
- (e) All Black Start Generating Units must be capable of producing reactive Power (boost) and absorbing reactive Power (buck) as required by the CAISO to control system voltages. Each Black Start Generating Unit must provide sufficient reactive capability to keep the energized transmission bus voltages within emergency Voltage Limits over the range of no load to full load. This requirement may be met by the operation of more than one Black Start Generating Unit in parallel providing that:
 - (i) the Black Start Generation supplier demonstrates that the proposed Generation resource shares reactive burden equitably;
 - (ii) all Participating Generators associated with the proposed Black Start source are located in the same general area.

Buck/boost capability requirement shall be dependent on the location of the proposed resource in relation to Black Start load.

- (f) All Black Start Generating Units must have the following communication/control requirements:
 - (i) dial-up telephone;
 - (ii) backup radio;
 - (iii) manning levels which accord with Good Utility Practice.

(iv) Each Black Start Generator must ensure that normal and emergency voice communications are available to permit effective Exceptional Dispatch of Black Start Generating Units.

(g) The Scheduling Coordinator for the Black Start Generating Unit shall not use the Black Start Generating Unit to serve any Load other than station service Load required by the Black Start Generating Unit until the CAISO has confirmed that the need for such Black Start service has passed.

(h) Black Start Generating Units must pass performance tests for demonstrating Black Start capability, which the CAISO may periodically undertake in accordance with the CAISO's Operating Procedures for Black Start testing.

(i) All Black Start Generating Units will comply with Applicable Reliability Criteria.

The technical requirements and selection factors set forth in the technical specification document posted by the ISO on the ISO website for this competitive solicitation are derived in large part from the foregoing requirements of Appendix D but are more detailed and specific to the identified need for black start capability to enhance the system restoration time in the greater San Francisco bay area than the more general requirements set forth in Appendix D. Consequently, the ISO has focused its analysis of the proposals of the prospective black start providers set forth in this report based on the posted technical requirements and selection factors.

3. SELECTION OF THE BLACK START RESOURCES

3.1 Description of Black Start Resources Selection Process

In the course of its stakeholder process regarding the procurement of black start capability, the ISO considered comments submitted by stakeholders during the policy development process described in Section 2.1 and agreed that securing black start capability should occur through an open and transparent competitive procurement process. At its May 1, 2017 meeting, the ISO governing board approved the procurement process steps described in Section 2.1. Pursuant to that ISO governing board direction, the ISO has implemented the selection process for black start resources to provide black start capability to enhance the system restoration time in the greater San Francisco bay area as follows:

1. The ISO, in consultation with the applicable participating transmission owner, in this case Pacific Gas and Electric Company (PG&E), developed a black start technical specification document that defines the technical requirements and selection factors for this procurement process. The ISO posted a draft of the technical specification document on the ISO website on May 8, 2017, including a reference to the substations defined in the ISO's local capacity requirements technical study as the backbone 230 kV transmission system in the greater San Francisco bay area,¹⁵ and posted a presentation for the May 24, 2017 stakeholder meeting regarding the draft, including a specific listing of substations constituting the backbone 230 kV system in the greater San Francisco bay area, on May 22, 2017.¹⁶ The ISO posted the final version of the technical specification document on the ISO website on June 15, 2017.¹⁷
2. The ISO conducted an onsite meeting for stakeholders on May 24, 2017 to review the technical requirements and selection factors and answer interested parties' questions. The ISO subsequently posted a matrix of answers to additional stakeholder questions on the ISO website on July 19, 2017.¹⁸
3. The ISO issued an RFP in a market notice issued on June 15, 2017 requesting that interested providers submit proposals to provide black start capability to enhance the system restoration time in the greater San Francisco bay area.¹⁹ The ISO posted documents implementing the RFP on the ISO website in draft form on May 8, 2017 and in final versions on June 15, 2017. The final RFP documents posted by the ISO on June 15, 2017 included application information requirements set forth in the "Facility Worksheet" section of the technical

¹⁵

http://www.caiso.com/Documents/BlackStart_SystemRestorationPhase2_DraftTechnicalSpecification.pdf

¹⁶

http://www.caiso.com/Documents/Presentation_BlackStart_SystemRestorationPhase2_TechnicalWorkshop.pdf

¹⁷

http://www.caiso.com/Documents/BlackStart_SystemRestorationPhase2FinalTechnicalSpecification.pdf

¹⁸ <http://www.caiso.com/Documents/BlackStartServiceQuestionsMatrix.pdf>

¹⁹ <http://www.caiso.com/Documents/BlackStart-SystemRestorationPhase2Request-ProposalFinalDocumentsPosted.html>

specification document (Attachment 1 to this report) and in a separate “Black Start Resource Commercial Worksheet/Questionnaire” (Attachment 2 to this report). The ISO also posted a model black start agreement.²⁰

4. As discussed in Sections 3.4-3.11 of this report, the ISO has applied the technical requirements and evaluated the proposals in response to its RFP. The ISO consulted with the applicable participating transmission owner, PG&E, with respect to how each proposal satisfies the technical requirements.

5. As discussed in Sections 3.14-3.23 of this report, the ISO has applied its selection factors and has selected the two most technically and commercially viable proposals based on the technical and cost data submitted.²¹ As part of this selection, the ISO has considered the nature of the costs and whether they are reasonable, as well as what assurances exist that the proposed black start resources will continue to operate over the term of their black start agreements.

6. The ISO will initiate a contracting process with the owners of the black start resources that the ISO has selected to provide the black start capability. The contract will be a three party agreement among the ISO, the participating transmission owner, and the owner of the black start resource.²²

The ISO received proposals from four prospective black start providers proposing to provide black start capability to enhance the system restoration time in the greater San Francisco bay area from ten different proposed black start resources. The ISO has evaluated each of these proposals and has selected the black start providers and proposed black start resources identified in this report to provide the black start capability.

In the course of this selection process, the ISO first evaluated all of the proposals regarding their ability to satisfy the technical requirements of the RFP with regard to provision of black start capability to enhance the system restoration time in the greater San Francisco bay area. As described in Section 2.1 of this report, these technical requirements include:

- Must satisfy the NERC definition of “Blackstart Resource:” “A generating unit(s) and its associated set of equipment which has the ability to be started without support from the System or is designed to remain energized without connection to the remainder of the System, with the ability to energize a bus, meeting the Transmission Operator’s restoration plan needs for Real and Reactive Power capability, frequency and voltage control, and that has been included in the Transmission Operator’s restoration plan.”
- Must be able to supply own start-up power.

²⁰ http://www.caiso.com/Documents/BlackStart_SystemRestorationPhase2SampleAgreement.pdf

²¹ The ISO specified that it would select two black start resources on page 4 of the presentation to the ISO governing board at its meeting on May 1, 2017 at which the ISO governing board approved the ISO’s competitive solicitation process for black start resources to serve the greater San Francisco bay area. The presentation is posted on the ISO website at:

http://www.caiso.com/Documents/Decision_BlackStart_SystemRestorationProposal-Presentation-May_2017.pdf

²² See the sample version of the black start agreement posted on the ISO website at:

http://www.caiso.com/Documents/BlackStart_SystemRestorationPhase2SampleAgreement.pdf

- Must serve own plant load.
- Must have ability to meet fault impedance requirements of the restoration path. Generating unit protection relays should be flexible to assume temporary setting changes required to provide adequate protection during anticipated black start system configurations. This could be accommodated by, but is not limited to, utilizing microprocessor based protective relays with multiple group setting capability.
- Must follow the ISO planned outage procedures.
- Must have ability to meet minimum continuous running time for unit - 48 hours.
- Must have ability to energize a dead transmission bus within targeted timeframe: 3 hours.
- Must demonstrate the ability to comply with all applicable NERC CIP and other reliability standards as a “Blackstart Resource” (including but not limited to NERC reliability standards PRC 19-2 and 25-1, EOP 005-2, CIP 008-3, CIP 009-3, and COM-001 and ISO resource testing procedures).

After determining which proposals satisfied these technical requirements with regard to provision of black start capability to enhance the system restoration time in the greater San Francisco bay area, the ISO then evaluated the remaining proposals based on a comparative analysis of the merits of each proposal with regard to the selection factors set forth in the technical specification document for the RFP. The selection factors specified in the technical specification document are:

- (a) Calculated time to energize the backbone 230 kV substation loop within the greater San Francisco bay area;
- (b) Technical ability to meet restoration requirements (reactive and real power, frequency and voltage regulation, protection coordination, ramping capability, permits, etc.);
- (c) Restoration flexibility (resource flexibility based on location to provide operations multiple options to restore the 230 kV system, proximity to other generating facilities);
- (d) Locational diversity of resource (location with respect to other black start resources in the area);
- (e) Probability of black start provider completing five-year term of contract;
- (f) Cost of service and capital costs;
- (g) Black start capability commencement date; and
- (h) Any other strengths and advantages the proposal may have to provide the specific black start capability, as well as any specific efficiencies or benefits demonstrated in the proposal.

In selecting the black start resources, the ISO has undertaken a comparative analysis of the prospective black start providers’ proposals with regard to the foregoing selection factors as part of its comprehensive, holistic review of all factors and elements of the prospective black start providers’ proposals.

This report summarizes information provided by each prospective black start provider that was considered by the ISO to be important in analyzing their proposals with respect to each of the technical requirements and selection factors. At the beginning of each subsection of this Section 3, commencing with Section 3.3, of this report, the ISO has provided a listing of the sections of (1) the facility worksheet in the technical specification document (set forth in Attachment 1 to this report for reference) or (2) the commercial

worksheet/questionnaire that the ISO posted on the ISO website on June 15, 2017 (set forth in Attachment 2 to this report for reference) that the ISO particularly considered in undertaking its analysis of the proposals' satisfaction of the technical requirement or its comparative analysis for that selection factor. In addition, in the ISO's summaries in this report describing the information provided by each prospective black start provider, the ISO has provided a reference to the particular sections of the prospective black start provider's proposal that served as the source for that summary. Because this report is a summary, it does not repeat all of the information provided by the prospective black start providers. However, the ISO reviewed and considered all of the information provided by the prospective black start providers, and the ISO's failure to reference any specific information provided by a prospective black start provider does not indicate lack of consideration of such information.

3.2 Description of Prospective Black Start Providers and Their Proposals

The ISO evaluated proposals submitted by four prospective black start providers, identified in their proposals as:

- Silicon Valley Power (SVP)
- Northern California Power Agency (NCPA)
- An affiliate of NRG Energy, Inc. (NRG)
- Calpine Corporation (Calpine)

Although the other three prospective black start providers each submitted a proposal to provide black start capability from a single proposed black start resource, Calpine submitted proposals for the provision of black start capability from seven different proposed black start resources. Although not all proposed black start resources were able to satisfy all the technical requirements, all four prospective black start providers submitted strong, competitive proposals. As a result, the ISO had to make detailed distinctions among the technically qualifying proposals to provide black start capability to enhance the system restoration time in the greater San Francisco bay area in the comparative analysis process in selecting the black start resources.

In preparing this report for distribution to the public, the ISO has determined that certain information relating to the proposed black start resources is CEII. Based on this determination, the ISO has drafted this report to refer only generally to the proposed black start resources identified in the proposals, including using a letter identifier (A-G) for each of the seven proposed black start resources included in Calpine's proposal. In addition, the ISO has concluded that many of the details of the proposals of the prospective black start providers are sensitive and should remain confidential. Based on this determination, the ISO has referenced the details of the proposals only generally in this report and has described (1) the ability of the proposals to satisfy the technical requirements and (2) the comparative analysis of their merits with regard to the selection factors for this competitive procurement process in qualitative terms.

SVP

SVP is the City of Santa Clara’s municipal electric utility, which operates as a metered subsystem within the ISO balancing authority area. SVP proposes to provide black start capability from an existing SVP generating facility. (Proposal summary and profile)

NCPA

NCPA is a joint powers agency and part of the public power providers in northern California. NCPA proposes to provide black start capability from a proposed black start resource at an existing NCPA generating facility, which was designed from the start to feature black start functions. (Proposal cover letter)

NRG

NRG proposes to provide black start capability from a proposed black start resource at an existing generating facility. (Proposal transmittal letter) NRG indicated that it proposes two alternative configurations for retrofitting its generating facility. (Proposal transmittal letter)

Calpine

Calpine proposes to provide black start capability from proposed black start resources located at any one of seven alternative generating facilities all located in the greater San Francisco bay area. (Proposal transmittal letter) Calpine indicated that it is offering two alternatives as the source of its proposed black start capability at each of the seven different generating facilities. (Proposal transmittal letter) This report references Calpine’s proposed black start resources by the letter designations A through G.

3.3 Technical Requirements for Qualification to Be Considered in Competitive Procurement Process

In order to determine that the black start resources identified in the proposals of prospective black start providers would be capable of providing the black start capability identified by the ISO as needed to enhance the system restoration time in the greater San Francisco bay area, the ISO specified in the technical specifications document posted on the ISO website the basic technical requirements for the RFP. As the first step in the evaluation of the proposals submitted in response to the RFP, the ISO evaluated all of the proposals regarding their ability to satisfy these technical requirements.

3.4 Technical Requirement: Satisfy the NERC Definition of “Blackstart Resource”

(Facility worksheet 6-25)

The first technical requirement for the RFP is that the proposed black start resource must satisfy the NERC definition of “Blackstart Resource.” The NERC definition of this term is: “A generating unit(s) and its associated set of equipment which has the ability to be started without support from the System or is designed to remain energized without

connection to the remainder of the System, with the ability to energize a bus, meeting the Transmission Operator’s restoration plan needs for Real and Reactive Power capability, frequency and voltage control, and that has been included in the Transmission Operator’s restoration plan.”

3.4.1 Determination for SVP

SVP provided information describing the ability of its proposed black start resource to be started without support from the electric system, its ability to supply real and reactive power, frequency control, and voltage control, and its capability to energize a bus on the electric system. (Proposal summary; facility worksheet 6-25; response to request for additional information 1, 4).

Based on the ISO’s analysis of the information in SVP’s proposal, the ISO has determined that the proposed black start resource described in SVP’s proposal would satisfy the NERC definition of “Blackstart Resource.” The ISO has determined that SVP’s proposed black start resource would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that SVP’s proposed black start resource would have the capability of energizing a bus on the electric system. Consequently, the ISO finds that SVP’s proposal satisfies this technical requirement of the RFP, although, as discussed in Section 3.10.1, it would lack the capability of energizing one of the busses on the 230 kV system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits.

3.4.2 Determination for NCPA

NCPA provided information describing the ability of its proposed black start resource to be started without support from the electric system, its ability to supply real and reactive power, frequency control, and voltage control, and its capability to energize a bus on the electric system. (Proposal cover letter; facility/plant information 6-25; response to request for additional information 2)

Based on the ISO’s analysis of the information in NCPA’s proposal, the ISO has determined that the proposed black start resource described in NCPA’s proposal would satisfy the NERC definition of “Blackstart Resource.” The ISO has determined that NCPA’s proposed black start resource would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that NCPA’s proposed black start resource would have the capability of energizing a bus on the electric system. Consequently, the ISO finds that NCPA’s proposal satisfies this technical requirement of the RFP, although, as discussed in Section 3.10.2, it would lack the capability of energizing one of the busses on the 230 kV system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits.

3.4.3 Determination for NRG

NRG provided information describing the ability of its proposed black start resource to be started without support from the electric system, its ability to supply real and reactive power, frequency control, and voltage control, and its capability to energize a bus on the electric system. (Proposal transmittal letter; variables and criteria 6-25; response to request for clarifications and additional information 1, 6)

Based on the ISO's analysis of the information in NRG's proposal, the ISO has determined that the proposed black start resource described in NRG's proposal would satisfy the NERC definition of "Blackstart Resource." The ISO has determined that NRG's proposed black start resource would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that NRG's proposed black start resource would have the capability of energizing one of the 230 kV busses on the electric system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that NRG's proposal satisfies this technical requirement of the RFP.

3.4.4 Determination for Calpine

Calpine provided information describing the ability of each of its seven proposed black start resources to be started without support from the electric system, their ability to supply real and reactive power, frequency control, and voltage control, and their capability to energize a bus on the electric system. (Proposal transmittal letter; facility worksheet 6-25; responses to request for clarifications and additional information 1-5, 7)

Proposed Black Start Resource A

Based on the ISO's analysis of the information in Calpine's proposal regarding proposed black start resource A, the ISO has determined that the proposed black start resource described in Calpine's proposal would satisfy the NERC definition of "Blackstart Resource." The ISO has determined that Calpine's proposed black start resource A would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that Calpine's proposed black start resource A would have the capability of energizing one of the 230 kV busses on the electric system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that Calpine's proposal for proposed black start resource A satisfies this technical requirement of the RFP, although, as discussed in Section 3.10.4, it would lack the capability of energizing one of the busses on the 230 kV system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits.

Proposed Black Start Resource B

Based on the ISO's analysis of the information in Calpine's proposal regarding proposed black start resource B, the ISO has determined that the proposed black start resource

described in Calpine’s proposal would satisfy the NERC definition of “Blackstart Resource.” The ISO has determined that Calpine’s proposed black start resource B would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that Calpine’s proposed black start resource B would have the capability of energizing one of the 230 kV busses on the electric system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that Calpine’s proposal for proposed black start resource B satisfies this technical requirement of the RFP.

Proposed Black Start Resource C

Based on the ISO’s analysis of the information in Calpine’s proposal regarding proposed black start resource C, the ISO has determined that the proposed black start resource described in Calpine’s proposal would satisfy the NERC definition of “Blackstart Resource.” The ISO has determined that Calpine’s proposed black start resource C would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that Calpine’s proposed black start resource C would have the capability of energizing one of the 230 kV busses on the electric system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that Calpine’s proposal for proposed black start resource C satisfies this technical requirement of the RFP.

Proposed Black Start Resource D

Based on the ISO’s analysis of the information in Calpine’s proposal regarding proposed black start resource D, the ISO has determined that the proposed black start resource described in Calpine’s proposal would satisfy the NERC definition of “Blackstart Resource.” The ISO has determined that Calpine’s proposed black start resource D would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that Calpine’s proposed black start resource D would have the capability of energizing one of the 230 kV busses on the electric system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that Calpine’s proposal for proposed black start resource D satisfies this technical requirement of the RFP.

Proposed Black Start Resource E

Based on the ISO’s analysis of the information in Calpine’s proposal regarding proposed black start resource E, the ISO has determined that the proposed black start resource described in Calpine’s proposal would satisfy the NERC definition of “Blackstart Resource.” The ISO has determined that Calpine’s proposed black start resource E would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that Calpine’s proposed black start resource E would have the capability of energizing one of the 230 kV busses on the

electric system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that Calpine’s proposal for proposed black start resource E satisfies this technical requirement of the RFP.

Proposed Black Start Resource F

Based on the ISO’s analysis of the information in Calpine’s proposal regarding proposed black start resource F, the ISO has determined that the proposed black start resource described in Calpine’s proposal would satisfy the NERC definition of “Blackstart Resource.” The ISO has determined that Calpine’s proposed black start resource F would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that Calpine’s proposed black start resource F would have the capability of energizing one of the 230 kV busses on the electric system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that Calpine’s proposal for proposed black start resource F satisfies this technical requirement of the RFP.

Proposed Black Start Resource G

Based on the ISO’s analysis of the information in Calpine’s proposal regarding proposed black start resource G, the ISO has determined that the proposed black start resource described in Calpine’s proposal would satisfy the NERC definition of “Blackstart Resource.” The ISO has determined that Calpine’s proposed black start resource G would be able to meet the requirements of starting without support from the electric system and supplying real and reactive power, frequency control, and voltage control. In addition, the studies conducted by the ISO determined that Calpine’s proposed black start resource G would have the capability of energizing a bus on the electric system. Consequently, the ISO finds that Calpine’s proposal for proposed black start resource G satisfies this technical requirement of the RFP, although, as discussed in Section 3.10.4, it would lack the capability of energizing one of the busses on the 230 kV system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits.

3.5 Technical Requirement: Supply Own Start-up Power

(Facility worksheet 6-18)

The second technical requirement for the RFP is that the proposed black start resource must be able to supply its own start-up power.

3.5.1 Determination for SVP

SVP provided information describing the ability of its proposed black start resource to supply its own start-up power. (Proposal summary; facility worksheet 6-18; response to request for additional information 1, 3) SVP provided information indicating that the proposed system to supply start-up power would be capable of providing approximately 12 starts. (Response to request for additional information 1)

Based on the ISO's analysis of the information in SVP's proposal, the ISO has determined that the proposed black start resource described in SVP's proposal would have the ability to supply its own start-up power. Consequently, the ISO finds that SVP's proposal satisfies this technical requirement of the RFP.

3.5.2 Determination for NCPA

NCPA provided information describing the ability of its proposed black start resource to supply its own start-up power. (Facility/plant information 6-18; response to request for additional information 2). NCPA provided information indicating that the system to supply start-up power would be capable of a theoretical maximum of 25 starts. (Response to request for additional information 2)

Based on the ISO's analysis of the information in NCPA's proposal, the ISO has determined that the proposed black start resource described in NCPA's proposal would have the ability to supply its own start-up power from its existing system. Consequently, the ISO finds that NCPA's proposal satisfies this technical requirement of the RFP.

3.5.3 Determination for NRG

NRG provided information describing the ability of its proposed black start resource to supply its own start-up power. (Variables and criteria 6-18; response to request for clarifications and additional information 1) NRG provided information on two initial start-up power alternatives. NRG indicated that one of the proposed start-up power systems would be capable of supporting a minimum of three attempted starts. NRG also indicated that preliminary engineering has been completed on an alternative system for start-up power and that it would use this alternative to support the plant start-up load if the ISO were to select this alternative.

Based on the ISO's analysis of the information in NRG's proposal, the ISO has determined that the proposed black start resource described in NRG's proposal would have the ability to supply its own start-up power. Consequently, the ISO finds that NRG's proposal satisfies this technical requirement of the RFP.

3.5.4 Determination for Calpine

Calpine provided information describing the ability of each of its seven proposed black start resources to supply their own start-up power. (Proposal transmittal letter; facility worksheet 6-18; responses to request for clarifications and additional information 1, 3, 7) Calpine provided information on two initial start-up power alternatives. Calpine indicated that its proposed systems to provide start-up power would be capable of supporting a minimum of three attempted starts.

Based on the ISO's analysis of the information in Calpine's proposals regarding each of its proposed black start resources, the ISO has determined that each of the proposed black start resources described in Calpine's proposals would have the ability to supply its own start-up power. Consequently, the ISO finds that Calpine's proposals for each of its proposed black start resources satisfy this technical requirement of the RFP.

3.6 Technical Requirement: Serve Own Plant Load

(Facility worksheet 6-20)

The third technical requirement for the RFP is that the proposed black start resource must serve its own plant load.

3.6.1 Determination for SVP

SVP provided information related to the ability of its proposed black start resource to serve its own plant load. (Proposal summary; facility worksheet 6-20; response to request for additional information 1, 3) SVP also provided a plant single line diagram for the proposed black start resource. (Facility worksheet 14) The ISO has determined that the proposed facility plant load is terminal fed and can be supplied from the proposed black start resource once the generating unit has started and reached full speed no load.

Based on the ISO's analysis of the information in SVP's proposal, the ISO has determined that the proposed black start resource described in SVP's proposal would have the initial ability to serve its own plant load. Consequently, the ISO finds that SVP's proposal satisfies this technical requirement of the RFP.

3.6.2 Determination for NCPA

NCPA provided information describing the ability of its proposed black start resource to serve its own plant load. (Facility/plant information 6-20; response to request for additional information 2). NCPA also provided a single line diagram for the proposed black start resource indicating that the plant load is terminal fed. (Facility/plant information 14) NCPA also provided a black start operating procedure that details the exact steps necessary to start the proposed black start resource (Facility/plant information 15) and noted that the "[u]nit supplies its own power once the generator breaker closes so there are no limitations on how long it can run." (Facility/plant information 12(c))

Based on the ISO's analysis of the information in NCPA's proposal, the ISO has determined that the proposed black start resource described in NCPA's proposal would have the initial ability to serve its own plant load. Consequently, the ISO finds that NCPA's proposal satisfies this technical requirement of the RFP.

3.6.3 Determination for NRG

NRG provided information describing the ability of its proposed black start resource to serve its own plant load. (Variables and criteria 6-20; response to request for clarifications and additional information 1) NRG also provided a plant single line diagram for the proposed black start resource. (Variables and criteria 14) The ISO has determined that the facility plant load can be supplied from the proposed black start resource once the generating unit has started and reached full speed no load. NRG also provided a black start operating guideline that details the exact steps necessary to start the proposed black start resource and serve the facility's plant load. (Variables and criteria 15)

Based on the ISO's analysis of the information in NRG's proposal, the ISO has determined that the proposed black start resource described in NRG's proposal would

have the initial ability to serve its own plant load. Consequently, the ISO finds that NRG's proposal satisfies this technical requirement of the RFP.

3.6.4 Determination for Calpine

Calpine provided information describing the ability of each of its seven proposed black start resources to serve their own plant load. (Proposal transmittal letter; facility worksheet 6-18; responses to request for clarifications and additional information 1, 3, 7) Calpine provided single line diagrams for all seven of its proposed black start resources. (Facility worksheet 14) The ISO has determined that the facility plant load can be supplied from each proposed black start resource once the generating unit has started and reached full speed no load. Calpine also provided a generalized description of the steps necessary at each proposed black start resource to start the proposed facility and serve the respective generating facility's plant load. (Facility worksheet 15)

Based on the ISO's analysis of the information in Calpine's proposals regarding each of its proposed black start resources, the ISO has determined that each of the proposed black start resources described in Calpine's proposals would have the ability to serve its own plant load. Consequently, the ISO finds that Calpine's proposals for each of its proposed black start resources satisfy this technical requirement of the RFP.

3.7 Technical Requirement: Meet Fault Impedance Requirements of the Restoration Path

(No facility worksheet or commercial worksheet/questionnaire section)

The fourth technical requirement for the RFP is that the proposed black start resource must have the ability to meet the fault impedance requirements of the restoration path. The technical specification document states that generating unit protection relays should be flexible to assume temporary setting changes required to provide adequate protection during anticipated black start system configurations. The technical specification document further states that this could be accommodated by, but is not limited to, utilizing microprocessor based protective relays with multiple group setting capability.

The ISO did not expressly include a request for information regarding this requirement in the facility worksheet or the commercial worksheet/questionnaire, and the proposals did not expressly address this requirement. However, the ISO did identify it as a technical requirement in the technical specification document, and no prospective black start provider requested an exception from this requirement in its proposal. In addition, the ISO has concluded that all of the proposed black start resources have or could install protective relays with the flexibility to meet the fault impedance requirements of the restoration path and that therefore all of the proposals satisfy this technical requirement of the RFP.

3.8 Technical Requirement: Follow the ISO Planned Outage Procedures

(No facility worksheet or commercial worksheet/questionnaire section)

The fifth technical requirement for the RFP is that the proposed black start resource must follow the ISO planned outage procedures. The ISO did not include a request for information regarding this requirement in the facility worksheet or the commercial

worksheet/questionnaire, and the proposals did not expressly address this requirement. The ISO has determined that the proposed black start resources of all the prospective black start providers are all already subject to the ISO's planned outage procedures pursuant to ISO tariff requirements regarding outage coordination for each of the generating facilities associated with the proposed black start resources. In addition, because this is a requirement specified in the technical specification document and because no prospective black start provider requested an exception from this requirement in its proposal, the ISO has concluded that all of the proposed black start resources would follow the ISO planned outage procedures and that therefore all of the proposals satisfy this technical requirement of the RFP.

3.9 Technical Requirement: Meet Minimum Continuous Running Time for Unit - 48 Hours

(Facility worksheet 5-20)

The sixth technical requirement for the RFP is that the proposed black start resource must have the ability to meet a minimum continuous running time for the generating unit of 48 hours.

3.9.1 Determination for SVP

The information provided by SVP regarding the continuous running time for its proposed black start resource indicated that its continuous running time following a start of the generating unit is to be determined. (Facility worksheet 8-9, 12-13, 15-16) SVP also noted that the generating facility does not have any emission restrictions under emergency conditions. (Facility worksheet 9)

Based on the ISO's analysis of the information in SVP's proposal, the ISO has determined that the proposed black start resource described in SVP's proposal does not have any technical limitations that would limit its continuous running time to less than 48 hours. Consequently, the ISO finds that SVP's proposal satisfies this technical requirement of the RFP.

3.9.2 Determination for NCPA

NCPA provided information regarding the continuous running time for its proposed black start resource. (Facility/plant information 8-9, 12-13, 15-16). NCPA indicated that its generating unit has no limitations on how long it can run once the generating unit breaker closes but that the air emissions permit for the generating facility currently limits the length of time the generating facility is able to run at full speed with no load. (Facility/plant information 8(c), 13) In addition, NCPA noted that the its air emissions permit allows both generating units to be run for up to 10 days on fuel oil at full output but that current air emissions permits limit operations to full load. (Facility/plant information 8(c), 9, 13) In addition, NCPA noted that, in the event the ISO were to select its proposal, it would conduct testing and submit an application to the air district to remove the limitations or grant an exception for special circumstances. (Facility/plant information 8(c))

Based on the ISO's analysis of the information in NCPA's proposal, the ISO has determined that the proposed black start resource described in NCPA's proposal would

have the ability to achieve a continuous running time of 48 hours. Consequently, the ISO finds that NCPA's proposal satisfies this technical requirement of the RFP.

3.9.3 Determination for NRG

NRG provided information regarding the continuous running time for its proposed black start resource. (Variables and criteria 8-9, 12-13, 15-16; response to request for clarifications and additional information 1) NRG indicated that there is no technical limit on the running time of its generating facility but that the maximum duration at full speed with no load is limited due to the existing air emissions permit for the generating facility (Variables and criteria 13) and that it expects to amend the existing air emissions permit to allow emergency operation as required to provide black start. (Variables and criteria 9, response to request for clarifications and additional information 1)

Based on the ISO's analysis of the information in NRG's proposal, the ISO has determined that the proposed black start resource described in NRG's proposal would have the ability to achieve a continuous running time of 48 hours. Consequently, the ISO finds that NRG's proposal satisfies this technical requirement of the RFP.

3.9.4 Determination for Calpine

Calpine provided information regarding the continuous running time for each of its seven proposed black start resources. (Proposal transmittal letter; facility worksheet 8-9, 12-13, 15-16; responses to request for clarifications and additional information 1, 2, 7) Calpine indicated that there is no technical limit on the running time of any of its generating facilities but that the maximum duration at full speed with no load is limited, depending on the generating facility, due to the existing air emissions permits for the generating facilities. (Facility worksheet 13) Calpine also indicated that none of the generating facilities for its proposed black start resources have emergency provisions in their air emissions permits. (Facility worksheet 9)

Based on the ISO's analysis of the information in Calpine's proposals regarding its seven proposed black start resources, the ISO has determined that each of the proposed black start resources described in Calpine's proposals would have the ability to achieve a continuous running time of 48 hours. Consequently, the ISO finds that Calpine's proposals for each of its seven proposed black start resources satisfy this technical requirement of the RFP.

3.10 Technical Requirement: Energize a Dead Transmission Bus within Targeted Timeframe - 3 Hours

(Facility worksheet 4, 6-25)

The seventh technical requirement for the RFP is that the proposed black start resource must have the ability to energize a dead transmission bus within a targeted timeframe of three hours.

In the context of the RFP, the ISO considers this technical requirement to be composed of two parts. The first component of the requirement is the proposed black start resource's ability to energize, within system operating voltage limits, one of the busses on the 230 kV system serving the greater San Francisco bay area identified in the technical specification document, particularly including the substations defined in the

ISO's local capacity requirements technical study referenced in the technical specification document, as key to the restoration of service to the area. The second component of the requirement is the proposed black start resource's ability to energize one of the target busses within three hours.

Regarding the first component of this requirement, the ISO considers it essential to the value of the black start capability it proposes to procure that the proposed black start resource actually be effective in restarting the system, which the ISO has identified as the energization, within system operating voltage limits, of one of the busses on the 230 kV system identified in the technical specification document. To ensure that the selected black start resources would be effective to meet the identified need, the ISO conducted technical studies to determine if each of the proposed black start resources could energize one of the identified busses on the 230 kV system serving the greater San Francisco bay area within system operating voltage limits and, if so, whether it could do so within the targeted three-hour timeframe. The ISO simulated a system blackout and restoration using each proposed black start resource being studied to energize the closest 230 kV system bus identified in the ISO's technical specification document. Proposed black start resources that were unable to energize one of the identified 230 kV system busses within system operating voltage limits were not considered for further dynamic simulation. Those that were successfully able to restore one of the identified 230 kV busses in the simulation within system operating voltage limits were further evaluated to determine if they could do so within the targeted three-hour timeframe. In addition, proposed black start resources that were capable of energizing one of the identified 230 kV busses within system operating voltage limits were evaluated on multiple paths and considered in the comparative analysis for the selection factors in this report based on each generating facility's reactive power capabilities and other selection factors.

3.10.1 Determination for SVP

SVP provided information describing the capability of its proposed black start resource to energize a bus on the electric system. (Proposal summary; facility worksheet 4, 6-25; response to request for additional information 1, 4) This information included generating unit capability curves, step up transformer impedance data, and test results from the generating facility's data and model validation compliance NERC testing. (Facility worksheet 12, 17-25; response to request for additional information 4)

Based on the ISO's analysis of the information in SVP's proposal, as discussed in Section 3.10, the ISO has determined that the proposed black start resource described in SVP's proposal does not satisfy this requirement in the manner necessary to meet the specific requirements of the RFP. Although the ISO has determined that SVP's proposed black start resource would be able to energize a dead bus at the generating facility's interconnected voltage level, the studies conducted by the ISO determined that SVP's proposed black start resource would lack the capability of energizing any of the busses on the 230 kV system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that SVP's proposal does not satisfy this technical requirement of the RFP. Having made this determination, the ISO did not consider SVP's proposal in the comparative analysis phase of the competitive solicitation process.

3.10.2 Determination for NCPA

NCPA provided information describing the capability of its proposed black start resource to energize a bus on the electric system. (Proposal cover letter; facility/plant information 4, 6-25) This information included generating unit capability curves, step up transformer impedance data, and test results from the generating facility's data and model validation compliance NERC testing. (Facility/plant information 12, 17-25)

Based on the ISO's analysis of the information in NCPA's proposal, as discussed in Section 3.10, the ISO has determined that the proposed black start resource described in NCPA's proposal does not satisfy this requirement in the manner necessary to meet the specific requirements of the RFP. Although the ISO has determined that NCPA's proposed black start resource would be able to energize a dead bus at the generating facility's interconnected voltage level, the studies conducted by the ISO determined that NCPA's proposed black start resource would lack the capability of energizing any of the busses on the 230 kV system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that NCPA's proposal does not satisfy this technical requirement of the RFP. Having made this determination, the ISO did not consider NCPA's proposal in the comparative analysis phase of the competitive solicitation process.

3.10.3 Determination for NRG

NRG provided information describing the capability of its proposed black start resource to energize a bus on the electric system. (Proposal transmittal letter; variables and criteria 4, 6-25; response to request for clarifications and additional information 1, 6) This information included generating unit capability curves, step up transformer impedance data, and test results from the generating facility's data and model validation compliance testing for purposes of Western Electricity Coordinating Council (WECC) compliance. (Variables and criteria 12, 17-25; response to request for clarifications and additional information 1, 6)

Based on the ISO's analysis of the information in NRG's proposal, the ISO has determined that the proposed black start resource described in NRG's proposal would be capable of energizing one of the busses on the 230 kV system in the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. In addition, as discussed in Section 3.14 of this report, the ISO has evaluated the steps and associated time required to energize one of the 230 kV busses identified in the technical specification document. Based on this analysis, the ISO has determined that NRG's proposed black start resource would be capable of energizing one of the identified busses on the 230 kV system within the required three-hour timeframe. Consequently, the ISO finds that NRG's proposal satisfies this technical requirement of the RFP.

3.10.4 Determination for Calpine

Calpine provided information describing the capability of each of its seven proposed black start resources to energize a bus on the electric system. (Proposal transmittal letter; facility worksheet 4, 6-25; responses to request for clarifications and additional information 1, 2, 7) This information included generating unit capability curves, step up

transformer impedance data, and test results from the generating facilities' data and model validation compliance NERC testing. (Facility worksheet 12, 17-25)

Proposed Black Start Resource A

Based on the ISO's analysis of the information in Calpine's proposal regarding proposed black start resource A, as discussed in Section 3.10, the ISO has determined that proposed black start resource A as described in Calpine's proposal does not satisfy this requirement in the manner necessary to meet the specific requirements of the RFP. Although the ISO has determined that Calpine's proposed black start resource A would be able to energize a dead bus at the generating facility's interconnected voltage level, the studies conducted by the ISO determined that Calpine's proposed black start resource A would lack the capability of energizing any of the busses on the 230 kV system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that Calpine's proposal does not satisfy this technical requirement of the RFP. Having made this determination, the ISO did not consider the proposal for Calpine's proposed black start resource A in the comparative analysis phase of the competitive solicitation process.

Proposed Black Start Resource B

Based on the ISO's analysis of the information in Calpine's proposal regarding proposed black start resource B, the ISO has determined that the proposed black start resource described in Calpine's proposal would be capable of energizing one of the busses on the 230 kV system in the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. In addition, as discussed in Section 3.14 of this report, the ISO has evaluated the steps and associated time required to energize one of the 230 kV busses identified in the technical specification document. Based on this analysis, the ISO has determined that Calpine's proposed black start resource B would be capable of energizing one of the identified busses on the 230 kV system within the required three-hour timeframe. Consequently, the ISO finds that Calpine's proposal satisfies this technical requirement of the RFP.

Proposed Black Start Resource C

Based on the ISO's analysis of the information in Calpine's proposal regarding proposed black start resource C, the ISO has determined that the proposed black start resource described in Calpine's proposal would be capable of energizing one of the busses on the 230 kV system in the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. In addition, as discussed in Section 3.14 of this report, the ISO has evaluated the steps and associated time required to energize one of the 230 kV busses identified in the technical specification document. Based on this analysis, the ISO has determined that Calpine's proposed black start resource C would be capable of energizing one of the identified busses on the 230 kV system within the required three-hour timeframe. Consequently, the ISO finds that Calpine's proposal satisfies this technical requirement of the RFP.

Proposed Black Start Resource D

Based on the ISO's analysis of the information in Calpine's proposal regarding proposed black start resource D, the ISO has determined that the proposed black start resource described in Calpine's proposal would be capable of energizing one of the busses on the 230 kV system in the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. In addition, as discussed in Section 3.14 of this report, the ISO has evaluated the steps and associated time required to energize one of the 230 kV busses identified in the technical specification document. Based on this analysis, the ISO has determined that Calpine's proposed black start resource D would be capable of energizing one of the identified busses on the 230 kV system within the required three-hour timeframe. Consequently, the ISO finds that Calpine's proposal satisfies this technical requirement of the RFP.

Proposed Black Start Resource E

Based on the ISO's analysis of the information in Calpine's proposal regarding proposed black start resource E, the ISO has determined that the proposed black start resource described in Calpine's proposal would be capable of energizing one of the busses on the 230 kV system in the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within the system operating voltage limits. In addition, as discussed in Section 3.14 of this report, the ISO has evaluated the steps and associated time required to energize one of the 230 kV busses identified in the technical specification document. Based on this analysis, the ISO has determined that Calpine's proposed black start resource E would be capable of energizing one of the identified busses on the 230 kV system within the required three-hour timeframe. Consequently, the ISO finds that Calpine's proposal satisfies this technical requirement of the RFP.

Proposed Black Start Resource F

Based on the ISO's analysis of the information in Calpine's proposal regarding proposed black start resource F, the ISO has determined that the proposed black start resource described in Calpine's proposal would be capable of energizing one of the busses on the 230 kV system in the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. In addition, as discussed in Section 3.14 of this report, the ISO has evaluated the steps and associated time required to energize one of the 230 kV busses identified in the technical specification document. Based on this analysis, the ISO has determined that Calpine's proposed black start resource F would be capable of energizing one of the identified busses on the 230 kV system within the required three-hour timeframe. Consequently, the ISO finds that Calpine's proposal satisfies this technical requirement of the RFP.

Proposed Black Start Resource G

Based on the ISO's analysis of the information in Calpine's proposal regarding proposed black start resource G, as discussed in Section 3.10, the ISO has determined that proposed black start resource G as described in Calpine's proposal does not satisfy this requirement in the manner necessary to meet the specific requirements of the RFP.

Although the ISO has determined that Calpine’s proposed black start resource G would be able to energize a dead bus at the generating facility’s interconnected voltage level, the studies conducted by the ISO determined that Calpine’s proposed black start resource G would lack the capability of energizing any of the busses on the 230 kV system serving the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. Consequently, the ISO finds that Calpine’s proposal does not satisfy this technical requirement of the RFP. Having made this determination, the ISO did not consider the proposal for Calpine’s proposed black start resource G in the comparative analysis phase of the competitive solicitation process.

3.11 Technical Requirement: Comply with All Applicable NERC CIP and Reliability Standards as a “Blackstart Resource” (Facility worksheet 26)

The eighth technical requirement for the RFP is that the prospective black start provider must demonstrate that the proposed black start resource will have the ability to comply with all applicable NERC CIP and other reliability standards as a “Blackstart Resource,” including but not limited to NERC reliability standards PRC 19-2 and 25-1, EOP 005-2, CIP 008-3, CIP 009-3, and COM-001 and ISO resource testing procedures.

3.11.1 Determination for SVP

SVP provided information describing the ability of its proposed black start resource to comply with all applicable NERC CIP and other reliability standards as a “Blackstart Resource.” (Facility worksheet 26) SVP indicated that it is already registered with NERC as a generating unit owner and operator and transmission owner and operator. (Facility worksheet 26) Under these registrations, SVP is already required to comply with all applicable NERC CIP and other reliability standards.

Based on the ISO’s analysis of the information in SVP’s proposal, the ISO has determined that SVP, pursuant to its registration with NERC as a generating unit owner and operator and transmission owner and operator, has had the obligation to comply with all applicable NERC CIP and other reliability standards and will have the necessary experience to comply with the specific NERC CIP requirements and other reliability standards for operating a “Blackstart Resource.” Consequently, the ISO finds that SVP’s proposal satisfies this technical requirement of the RFP.

3.11.2 Determination for NCPA

NCPA provided information describing the ability of its proposed black start resource to comply with all applicable NERC CIP and reliability standards as a “Blackstart Resource.” (Facility/plant information 26) NCPA provided records of its compliance with specific NERC reliability standards. (Facility/plant information 26) NCPA noted that NCPA is not currently part of a black start plan but that it would comply if selected. (Facility/plant information 26)

Based on the ISO’s analysis of the information in NCPA’s proposal, the ISO has determined that NCPA, pursuant to its registration with NERC as a generating unit owner and operator, has had the obligation to comply with all applicable NERC CIP and other reliability standards and will have the necessary experience to comply with the

specific NERC CIP requirements and other reliability standards for operating a “Blackstart Resource.” Consequently, the ISO finds that NCPA’s proposal satisfies this technical requirement of the RFP.

3.11.3 Determination for NRG

NRG provided information describing the ability of its proposed black start resource to comply with all applicable NERC CIP and other reliability standards as a “Blackstart Resource.” (Variables and criteria 26) NRG noted that NRG operates generating units with black start capability outside California and has NERC compliance professionals supporting the plant operations team. (Variables and criteria 26)

Based on the ISO’s analysis of the information in NRG’s proposal, the ISO has determined that NRG, pursuant to its registration with NERC as a generating unit owner and operator, has had the obligation to comply with all applicable NERC CIP and other reliability standards and that therefore NRG will have the necessary experience to comply with the specific NERC CIP requirements and other reliability standards for operating a “Blackstart Resource.” Consequently, the ISO finds that NRG’s proposal satisfies this technical requirement of the RFP.

3.11.4 Determination for Calpine

Calpine provided information describing the ability of each of its seven proposed black start resources to comply with all applicable NERC CIP and other reliability standards as a “Blackstart Resource.” (Facility worksheet 26) The ISO has determined that Calpine is already registered with NERC as a generating unit owner and operator. Under these registrations, Calpine is already required to comply with all applicable NERC CIP and other reliability standards.

Based on the ISO’s analysis of the information in Calpine’s proposals regarding each of its proposed black start resources, the ISO has determined that Calpine, pursuant to its registration with NERC as a generating unit owner and operator, has had the obligation to comply with all applicable NERC CIP and other reliability standards and will have the necessary experience to comply with the specific NERC CIP requirements and other reliability standards for operating a “Blackstart Resource.” Consequently, the ISO finds that Calpine’s proposals for each of its proposed black start resources satisfy this technical requirement of the RFP.

3.12 Determination of Capability to Satisfy Technical Requirements

Based on the foregoing analysis, the ISO has determined that the proposals for NRG’s proposed black start resource and Calpine’s proposed black start resources B, C, D, E, and F satisfy all of the technical requirements established by the ISO to ensure that the proposed black start resources would be capable of providing the black start capability identified by the ISO as needed to enhance the system restoration time in the greater San Francisco bay area.

Based on the foregoing analysis, the ISO has determined that the proposals for SVP’s proposed black start resource, NCPA’s proposed black start resource, and Calpine’s proposed black start resources A and G do not satisfy all of the technical requirements

established by the ISO to ensure that the proposed black start resources would be capable of providing the black start capability identified by the ISO as needed to enhance the system restoration time in the greater San Francisco bay area. As discussed in Section 3.10.1, the ISO has determined that SVP's proposal to provide black start capability from its proposed black start resource does not satisfy the requirement that its proposed black start resource have the capability of energizing one of the identified busses on the 230 kV system serving the greater San Francisco bay area within system operating voltage limits. As discussed in Section 3.10.2, the ISO has determined that NCPA's proposal to provide black start capability from its proposed black start resource does not satisfy the requirement that its proposed black start resource have the capability of energizing one of the identified busses on the 230 kV system serving the greater San Francisco bay area within system operating voltage limits. As discussed in Section 3.10.4, the ISO has determined that Calpine's proposals to provide black start capability from its proposed black start resources A and G do not satisfy the requirement that its proposed black start resource have the capability of energizing one of the identified busses on the 230 kV system serving the greater San Francisco bay area within system operating voltage limits. Consequently, the ISO did not evaluate the proposals for these proposed black start resources in its comparative analysis in selecting the proposed black start resources to provide the identified black start capability to enhance the system restoration time in the greater San Francisco bay area.

Pursuant to the foregoing determinations, the ISO has conducted its comparative analysis for the RFP of the proposals for the following proposed black start resources:

- NRG's proposed black start resource
- Calpine's proposed black start resource B
- Calpine's proposed black start resource C
- Calpine's proposed black start resource D
- Calpine's proposed black start resource E
- Calpine's proposed black start resource F

3.13 Selection Factors for Comparative Analysis for Competitive Procurement Process

After determining which proposals satisfied the technical requirements of the RFP, the ISO then evaluated the remaining six technically qualifying proposals based on a comparative analysis of the merits of each proposal with regard to the selection factors set forth in the technical specification document for the RFP. In selecting the black start providers and proposed black start resources to provide black start capability to enhance the system restoration time in the greater San Francisco bay area pursuant to this comparative analysis, the ISO has evaluated the proposals with regard to the specified selection factors as part of its comprehensive, holistic review of all factors and elements of the prospective black start providers' proposals.

3.14 Selection Factor: Calculated Time to Energize the Backbone 230 kV Substation Loop within the Greater San Francisco Bay Area

(Facility worksheet 6-20)

The first selection factor is the calculated time for the proposed black start resource to energize a 230 kV bus on the identified backbone 230 kV substation loop within the greater San Francisco bay area.

3.14.1 Information Provided by NRG

NRG provided information relating to the time by which its proposed black start resource could energize one of the busses on the 230 kV system in the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. (Proposal transmittal letter; variables and criteria 3-4, 6-25; response to request for clarifications and additional information 1, 6). NRG provided information regarding the location, interconnecting substation, start-up time, and time to close to a dead bus for its proposed black start resource and whether it is a manned facility. (Variables and criteria 3-4, 10, 12, 14-16) NRG provided its proposed black start resource's start-up time and indicated that the facility is a manned facility. (Variables and criteria 10, 12(e)) NRG also provided voltage and impedance data, power flow models, and dynamic modeling for stability studies for its proposed black start resource. (Variables and criteria 17-25)

3.14.2 Information Provided by Calpine

Calpine provided information relating to the time by which each of its five technically qualifying proposed black start resources could energize one of the busses on the 230 kV system in the greater San Francisco bay area identified in the technical specification document as key to the restoration of service to the area within system operating voltage limits. (Proposal transmittal letter; facility worksheet 3-4, 6-25; responses to request for clarifications and additional information 1, 2, 7) Calpine provided information regarding the location, interconnecting substation, start-up time, and time to close to a dead bus for its proposed black start resource B and whether it is a manned facility. (Proposal transmittal letter; facility worksheet 3-4, 10, 12, 14-16, 18; responses to request for clarifications and additional information 1, 2, 7)

Proposed Black Start Resource B

Calpine provided its proposed black start resource B's start-up time and indicated that the facility is a manned facility. (Facility worksheet 10, 15-16, 18(a); responses to request for clarifications and additional information 7) Calpine also provided voltage and impedance data, power flow models, and dynamic modeling for stability studies for its proposed black start resource B. (Facility worksheet 17-25)

Proposed Black Start Resource C

Calpine provided its proposed black start resource C's start-up time and indicated that the facility is a manned facility. (Facility worksheet 10, 15-16, 18(a); responses to request for clarifications and additional information 7) Calpine also provided voltage and

impedance data, power flow models, and dynamic modeling for stability studies for its proposed black start resource C. (Facility worksheet 17-25)

Proposed Black Start Resource D

Calpine provided its proposed black start resource D's start-up time and indicated that the facility is not a manned facility but that personnel can be on-site in a set amount of time. (Facility worksheet 10, 15-16, 18(a); responses to request for clarifications and additional information 7) Calpine also provided voltage and impedance data, power flow models, and dynamic modeling for stability studies for its proposed black start resource D. (Facility worksheet 17-25)

Proposed Black Start Resource E

Calpine provided its proposed black start resource E's start-up time and indicated that the facility is a manned facility. (Facility worksheet 10, 15-16, 18(a); responses to request for clarifications and additional information 7) Calpine also provided voltage and impedance data, power flow models, and dynamic modeling for stability studies for its proposed black start resource E. (Facility worksheet 17-25)

Proposed Black Start Resource F

Calpine provided its proposed black start resource F's start-up time and indicated that the facility is a manned facility. (Facility worksheet 10, 15-16, 18(a); responses to request for clarifications and additional information 7) Calpine also provided voltage and impedance data, power flow models, and dynamic modeling for stability studies for its proposed black start resource F. (Facility worksheet 17-25)

3.14.3 ISO Comparative Analysis

For purposes of the comparative analysis for this factor, the ISO has considered the representations by NRG and Calpine relating to the time by which each of their proposed black start resources could energize one of the identified busses on the 230 kV system in the greater San Francisco bay area within system operating voltage limits. All of the proposed black start resources in the analysis, with the exception of Calpine's proposed black start resource D, are manned facilities, so the ISO does not anticipate that any of the proposed black start resources would have an advantage in that regard. According to their proposals, NRG's proposed black start resource would require the least amount of time for startup, Calpine's proposed black start resource D would require somewhat longer for startup, and Calpine's proposed black start resources B, C, E, and F would require the greatest amount of time for startup.

The ISO also utilized the interconnecting substation information provided in the proposals to determine the number of breaker operations required to energize one of the 230 kV busses identified in the technical specification document as key to the restoration of service to the area. Each operation was assumed to take a set amount of time. In this way, the ISO was able to determine an anticipated restoration time. The ISO's analysis of the number of breaker operations necessary to reach one of the identified busses on the 230 kV system in the greater San Francisco bay area has determined that Calpine's proposed black start resource E would require the fewest breaker operations, Calpine's proposed black start resource B would require the next fewest breaker

operations, Calpine's proposed black start resources C and D and NRG's proposed black start resource would require the next fewest breaker operations, and Calpine's proposed black start resource F would require the most breaker operations.

Based on the foregoing considerations and information, in conjunction with all the other considerations included in the ISO's analysis for this factor, the ISO has determined that the proposal for NRG's proposed black start resource would have a slight advantage over the proposals for the other proposed black start resources with regard to the time to energize one of the identified busses on the 230 kV system serving the greater San Francisco bay area and that there is no material difference among the proposals for Calpine's proposed black start resources B, D, and E with regard to this factor and that they would have a slight advantage over the proposal for Calpine's proposed black start resource C, which would have a slight advantage over the proposal for Calpine's proposed black start resource F, with regard to this factor.

3.15 Selection Factor: Technical Ability to Meet Restoration Requirements

(Facility worksheet 3-4, 6-25)

The second selection factor is the technical ability of the proposed black start resource to meet system restoration requirements, which are described in the technical specification document as including reactive and real power, frequency, and voltage regulation capabilities, protection coordination, impedance data, ramping capability, permits, etc. The ISO considers this factor to include an evaluation of steady state voltage regulation capabilities within system operating voltage limits at the closest identified 230 kV substation as determined by ISO studies of the proposed black start resources' reactive power capabilities, as well as a verification of the each proposed black start resource's dynamic stability. In addition, the ISO reviewed operational studies supplied by the applicable participating transmission owner to identify any limitations during the restoration steps following the energization of the identified 230 kV target bus.

3.15.1 Information Provided by NRG

NRG provided detailed information relating to the technical ability of its proposed black start resource to meet system restoration requirements, including reactive and real power capability, frequency and voltage regulation capability, impedance data, ramping capability, and single line diagrams. (Proposal transmittal letter; variables and criteria 3-4, 6-25; response to request for clarifications and additional information 1, 6) NRG particularly provided voltage and impedance data, power flow models, and dynamic modeling for stability studies for its proposed black start resource, as well as a description of the control system and protective relaying modifications to support black start operation. (Variables and criteria 12, 17-25)

3.15.2 Information Provided by Calpine

Calpine provided detailed information relating to the technical ability of each of its five technically qualifying proposed black start resources to meet system restoration requirements, including reactive and real power capability, frequency and voltage regulation capability, impedance data, ramping capability, and single line diagrams. (Proposal transmittal letter; facility worksheet 3-4, 6-25; responses to request for

clarifications and additional information 1-3, 7) Calpine particularly provided voltage and impedance data, power flow models, and dynamic modeling for stability studies for each of its five technically qualifying proposed black start resources. (Facility worksheet 12, 17-25)

3.15.3 ISO Comparative Analysis

For purposes of the comparative analysis for this factor, the ISO has considered the representations by NRG and Calpine relating to the technical ability of their proposed black start resources to meet system restoration requirements, including reactive and real power capability, frequency and voltage regulation capability, ramping capability, single line diagrams, power flow models, and dynamic modeling for stability studies. The ISO's analysis has concluded that all of the proposed black start resources meet the voltage control, dynamic stability, and other technical capabilities to restore the electric system serving the greater San Francisco bay area successfully. However, system studies supplied by the applicable participating transmission owner and considered by the ISO in its analysis indicated that proposed black start resource B would rely on facilities subject to voltage limits that would decrease the proposed black start resource's effectiveness in system restoration. In addition, studies conducted by the ISO identified a number of limitations regarding the capability of proposed black start resource D to restore the system due to its limited reactive power capabilities. The ISO has determined that the limitations associated with Calpine's proposed black start resource B place this proposed black start resource at a slight disadvantage relative to the other proposed black start resources with regard to their technical ability to meet system restoration requirements and that the limited reactive power capability of Calpine's proposed black start resource D places this proposed black start resource at a disadvantage relative to all the other proposed black start resources.

Based on the foregoing considerations and information, in conjunction with all the other considerations included in the ISO's analysis for this factor, the ISO has determined that there is no material difference among the proposals for NRG's proposed black start resource and Calpine's proposed black start resources C, E, and F with regard to this factor and that the proposals for those proposed black start resources have a slight advantage over the proposal for Calpine's proposed black start resource B, which in turn has a slight advantage over the proposal for Calpine's proposed black start resource D, with regard to this factor.

3.16 Selection Factor: Restoration Flexibility

(Facility worksheet 3-4, 6-25)

The third selection factor is system restoration flexibility, described in the technical specification document as including resource flexibility based on location to provide operations multiple options to restore the 230 kV system and proximity to other generating facilities. In considering this factor as applied to the proposals for the proposed black start resources, the ISO has based its analysis for this factor on path diversity associated with restoring the 230 kV system, proximity to other generating facilities and stabilizing load, and any other benefits or limitations with regard to system restoration flexibility.

3.16.1 Information Provided by NRG

NRG provided location and plant operation information for its proposed black start resource. (Proposal transmittal letter; variables and criteria 4, 6-25; response to request for clarifications and additional information 1, 6)

3.16.2 Information Provided by Calpine

Calpine provided location and plant operation information for each of its five technically qualifying proposed black start resources. (Proposal transmittal letter; facility worksheet 3-4, 6-25; responses to request for clarifications and additional information 1-3, 7)

3.16.3 ISO Comparative Analysis

For purposes of the comparative analysis for this factor, the ISO has considered the information provided by NRG and Calpine regarding the flexibility of each proposed black start resource based on its location to provide operations multiple options to restore the 230 kV system. The ISO has also considered the proximity of each proposed black start resource to other generating facilities and stabilizing load, as well as any other benefits or limitations with regard to system restoration flexibility, along with bulk electric system information, to determine each proposed black start resource's potential contribution to system restoration flexibility.

The ISO's analysis has determined that NRG's proposed black start resource and Calpine's proposed black start resource E each interconnect with a substation with several transmission lines connecting into it, providing multiple potential options for restoration of the 230 kV system, while Calpine's proposed black start resources B, C, and F each interconnect with a substation with fewer transmission lines connecting into it, and Calpine's proposed black start resource D interconnects with a substation with the fewest transmission lines connecting into it.

With regard to proximity to other generating facilities, the ISO's analysis has determined that NRG's black start resource and Calpine's black start resource E are slightly better positioned than Calpine's black start resources B, C, D, and F with regard to their proximity to other generating facilities in the greater San Francisco bay area.

Related to the matter of proximity of stabilizing load required for system restoration, the ISO's analysis also considered the proximity of the proposed black start resources to stabilizing load centers. The ISO's analysis has determined that there is no material difference among the proposed black start resources with regard to their proximity to load centers.

The ISO's analysis also took into account any other benefits or limitations of each proposed black start resource with regard to system restoration flexibility. The ISO concluded that Calpine's proposed black start resource C would be located in a better position to start service restoration to the San Francisco peninsula and downtown San Francisco than any of the other proposed black start resources.

Based on the foregoing considerations and information, in conjunction with all the other considerations included in the ISO's analysis for this factor, the ISO has determined that there is no material difference among the proposals for NRG's proposed black start

resource and Calpine's proposed black start resources C and E and that they have a slight advantage over the proposals for Calpine's proposed black start resources B, D, and F, among which there is no material difference, with regard to this factor.

3.17 Selection Factor: Locational Diversity of Resource (See 3.22)

(Facility worksheet 3-4, 14-15)

The fourth selection factor is the locational diversity of the resource, which is described in the technical specification document as including its location with respect to other black start resources in the area. Because this selection factor effectively requires the ISO to compare different pairs of proposed black start resources to each other, which could otherwise involve an extensive analysis of all the possible combinations of pairs of proposed black start resources, the ISO has chosen to make this the last selection factor to be addressed in the comparative analysis, and to defer the analysis to Section 3.22, so that the analysis can focus on comparisons of pairings of the proposals for the proposed black start resources that the ISO has determined to have the greatest advantages with regard to other selection factors without having to address every possible combination.

3.18 Selection Factor: Probability of Resource Completing Five-Year Term of Contract

(Commercial worksheet/questionnaire 1-4)

The fifth selection factor is the probability of the proposed black start resource completing the five-year term of the black start agreement. The ISO considers this factor to relate primarily to the existence of a power purchase agreement and any other agreements providing a source of revenue for the proposed black start resource for that five-year period.

3.18.1 Information Provided by NRG

NRG provided information regarding the contracts currently in place for its proposed black start resource. (Commercial worksheet/questionnaire 1) NRG indicated that the power purchase agreement for its proposed black start resource extends only partially through the proposed term of the black start agreement. (Commercial worksheet/questionnaire 1) NRG also described its proposed capital improvements and schedule for converting its generating facility into a black start resource. (Commercial worksheet/questionnaire 2-4)

3.18.2 Information Provided by Calpine

Calpine provided information regarding the contracts currently in place for each of its five technically qualifying proposed black start resources. (Commercial worksheet/questionnaire 1) Calpine also described its proposed capital improvements and schedule for converting each of its five generating facilities into a black start resource. (Commercial worksheet/questionnaire 2-4)

Proposed Black Start Resource B

Calpine did not provide any information indicating that there is any power purchase agreement for proposed black start resource B. (Commercial worksheet/questionnaire 1)

Proposed Black Start Resource C

Calpine indicated that the power purchase agreement for proposed black start resource C extends through the five-year term of the black start agreement. (Commercial worksheet/questionnaire 1)

Proposed Black Start Resource D

Calpine indicated that the power purchase agreement for proposed black start resource D extends only partially through the five-year term of the black start agreement. (Commercial worksheet/questionnaire 1)

Proposed Black Start Resource E

Calpine did not provide any information indicating that there is any power purchase agreement for proposed black start resource E beyond this year. (Commercial worksheet/questionnaire 1)

Proposed Black Start Resource F

Calpine provided information indicating that there are commercial arrangements in place to support the operation of proposed black start resource F through the five-year term of the black start agreement. (Commercial worksheet/questionnaire 1)

3.18.3 ISO Comparative Analysis

The ISO considers this factor to relate primarily to the existence of a power purchase agreement and any other agreements providing a source of revenue for the proposed black start resource for the five-year term of the black start agreement. The ISO has determined that all of the proposed black start resources have costs and schedules that should permit any of the prospective black start providers to complete the five-year term of their black start agreements so long as they find it economical to do so. However, the ISO has determined that only Calpine's proposed black start resources C and F have power purchase agreements or other commercial arrangements in place that extend through the full five-year term of the black start agreement. NRG's proposed black start resource and Calpine's proposed black start resource D have power purchase agreements that extend for a portion of the five-year term of the black start agreement, and Calpine's proposed black start resources B and E do not have power purchase agreements beyond this year.

Based on the information provided by NRG and Calpine, the ISO has concluded that there is a slightly greater likelihood that Calpine would complete the five-year term of a black start agreement for its proposed black start resources C and F than would be the case for any of the other proposed black start resources and that NRG with regard to its proposed black start resource and Calpine with regard to its proposed black start resource D would be slightly more likely to complete the five-year term of a black start

agreement than Calpine with regard to its proposed black start resources B and E. Based on the foregoing considerations and information, in conjunction with all the other considerations included in the ISO's analysis for this factor, the ISO has determined that, for this particular factor, there is no material difference between the proposals for Calpine's proposed black start resources C and F, that they have a slight advantage over the proposals for NRG's proposed black start resource and Calpine's proposed black start resource D, between which there is no material difference, which have a slight advantage over the proposals for Calpine's proposed black start resources B and E, between which there is no material difference.

3.19 Selection Factor: Cost of Service and Capital Costs

(Commercial worksheet/questionnaire 3-10)

The sixth selection factor is the projected cost of service and capital costs for the proposal.

3.19.1 Information Provided by NRG

NRG provided information regarding its proposed capital costs, operations and maintenance costs, and projected total revenue requirement for its two proposed start-up power alternatives for the availability of black start capability from its proposed black start resource. (Commercial worksheet/questionnaire 3-10) The information provided by NRG showed a difference between the projected total revenue requirements for the alternative start-up power systems.

3.19.2 Information Provided by Calpine

Calpine provided information regarding its proposed capital costs, operations and maintenance costs, and projected total revenue requirement for its two proposed start-up power alternatives for the availability of black start capability from each of its five technically qualifying proposed black start resources. (Commercial worksheet/questionnaire 3-10) The information provided by Calpine for each of the five proposed black start resources showed a difference between the projected total revenue requirements for the alternative start-up power systems.

3.19.3 ISO Comparative Analysis

For purposes of the comparative analysis for this factor, the ISO has considered the representations by NRG and Calpine regarding the proposed capital costs, operations and maintenance costs, and projected total revenue requirements for their proposed black start resources. In conducting the analysis, the ISO focused its comparison on the projected total revenue requirements for the lower-cost alternative start-up systems for each proposed black start resource. The ISO considers the proposed revenue requirements for NRG's proposed black start resource and for Calpine's proposed black start resource D to be less than the proposed revenue requirements for the other proposed black start resources. The ISO also considers the proposed revenue requirement for Calpine's proposed black start resource F to be greater than the proposed revenue requirements for the other proposed black start resources.

Based on the foregoing information and considerations, in conjunction with all the other considerations included in the ISO's analysis for this factor, the ISO has determined that

there is no material difference between the proposals of NRG for its proposed black start resource and Calpine for its proposed black start resource D with regard to this factor and that these proposals have a slight advantage over the other proposals with regard to this factor. The ISO has also determined that the estimated revenue requirements for Calpine's proposed black start resources B, C, and E are similar enough that there is no material difference among those proposals with regard to this factor and that they all have a slight advantage over the proposal of Calpine for its proposed black start resource F.

3.20 Selection Factor: Black Start Service Commencement Date (Commercial worksheet/questionnaire 2-4)

The seventh selection factor is the proposed black start service commencement date.

3.20.1 Information Provided by NRG

NRG provided information regarding its proposed commencement dates for its two proposed start-up power alternatives for the availability of black start capability from its black start resource. (Commercial worksheet/questionnaire 2-4) Depending on the alternative start-up power system to be installed, NRG indicated that its proposed commercial operation date for black start capability from its proposed black start resource would be either May 1, 2019 or June 1, 2019. (Commercial worksheet/questionnaire 4)

3.20.2 Information Provided by Calpine

Calpine provided information regarding its proposed commencement dates for its two proposed start-up power alternatives for the availability of black start capability from each of its five technically qualifying proposed black start resources. (Commercial worksheet/questionnaire 2-4) Depending on the alternative start-up power system to be installed, Calpine indicated that its proposed commercial operation date for black start capability from each of its proposed black start resources would be either December 1, 2018 or March 1, 2019. (Commercial worksheet/questionnaire 4)

3.20.3 ISO Comparative Analysis

For purposes of the comparative analysis for this factor, the ISO has considered the representations by NRG and Calpine regarding their schedules for the commencement of availability of black start capability from their black start resources. The ISO has determined that the proposed schedules are reasonable and feasible. Based on the fact that the schedule for NRG's proposed black start resource would result in the availability of black start capability approximately five months later than the availability for Calpine's proposed black start resources for the start-up power alternative with the earliest commencement date and the foregoing considerations and information, in conjunction with all the other considerations included in the ISO's analysis for this factor, the ISO has determined that there is no material difference among Calpine's proposals for its proposed black start resources and that they have a slight advantage over NRG's proposal for its proposed black start resource with regard to this factor.

3.21 Selection Factor: Any Other Strengths and Advantages the Proposal May Have to Provide the Specific Black Start Capability, as well as Any Specific Efficiencies or Benefits Demonstrated in the Proposal

(Facility worksheet 5, 12, responses to request for clarifications and additional information)

The eighth selection factor is any other strengths and advantages the proposal may have to provide the specific black start capability, as well as any specific efficiencies or benefits demonstrated in the proposal. The ISO considered the following information regarding the proposed black start resources in its comparative analysis for this factor: the age of the generating facility, reliability data for the generating facility, and specific generating facility dynamics, including the generating facility's maximum generating capability.

3.21.1 Information Provided by NRG

NRG provided start reliability and availability data for its proposed black start resource, as well as the age and power capabilities of its generating facility. (Variables and criteria 5, 12; response to request for clarifications and additional information 2) NRG indicated that the generating facility is less than five years old and has an output capability of greater than 300 MW. (Variables and criteria 5, 12) NRG provided three-year average reliability data indicating that the generating facility for its proposed black start resource had a start reliability of greater than 99% and an availability factor of greater than 97% over that period. (Response to request for clarifications and additional information 2)

3.21.2 Information Provided by Calpine

Calpine provided start reliability and availability data for each of its five technically qualifying proposed black start resources, as well as the age and power capabilities of its generating facilities. (Facility worksheet 5, 12; responses to request for clarifications and additional information 4)

Proposed Black Start Resource B

Calpine indicated that the generating facility for its proposed black start resource B is greater than 10 years old and has an output capability of greater than 300 MW. (Facility worksheet 5, 12) Calpine provided reliability data indicating that the generating facility for its proposed black start resource B had a start reliability of less than 97% and an availability factor of less than 97% over that period. (Responses to request for clarifications and additional information 4)

Proposed Black Start Resource C

Calpine indicated that the generating facility for its proposed black start resource C is less than five years old and has an output capability of greater than 300 MW. (Facility worksheet 5, 12; supplemental information) Calpine provided reliability data indicating that the generating facility for its proposed black start resource C had a start reliability of

slightly less than 99% and an availability factor of somewhat less than 97% over that period. (Responses to request for clarifications and additional information 4)

Proposed Black Start Resource D

Calpine indicated that the generating facility for its proposed black start resource D is greater than 10 years old and has an output capability of less than 300 MW. (Facility worksheet 5, 12) Calpine provided reliability data indicating that the generating facility for its proposed black start resource D had a start reliability of greater than 99% and an availability factor of nearly 97% over that period. (Responses to request for clarifications and additional information 4)

Proposed Black Start Resource E

Calpine indicated that the generating facility for its proposed black start resource E is greater than 10 years old and has an output capability of greater than 300 MW. (Facility worksheet 5, 12) Calpine provided reliability data indicating that the generating facility for its proposed black start resource E had a start reliability of less than 99% and an availability factor of less than 97% over that period. (Responses to request for clarifications and additional information 4)

Proposed Black Start Resource F

Calpine indicated that the generating facility for its proposed black start resource F is greater than 10 years old and has an output capability of greater than 300 MW. (Facility worksheet 5, 12) Calpine provided reliability data indicating that the generating facility for its proposed black start resource F had a start reliability of less than 99% and an availability factor of less than 97% over that period. (Responses to request for clarifications and additional information 4)

3.21.3 ISO Comparative Analysis

For purposes of the comparative analysis for this factor, the ISO has reviewed the additional information included in the proposals of NRG and Calpine to determine if there are other advantages provided by the proposals that were not addressed in other parts of the selection process. The ISO considers the age, output capability, and past reliability of the generating facilities for the proposed black start resources to be potentially significant when evaluating the reliability, longevity, and system restoration capabilities of the generating facilities proposed to provide black start to enhance the system restoration time in the greater San Francisco bay area. However, the ISO has not included these considerations in the analysis of the other selection factors and has determined to evaluate them with regard to this factor.

Regarding the age of the generating facilities, the ISO has determined that the relatively newer age of the generating facilities for NRG's proposed black start resource and Calpine's proposed black start resource C provides those proposed black start resources a slight advantage over Calpine's proposed black start resources B, D, E, and F. The ISO does not consider the age range for the generating facilities for Calpine's proposed black start resources B, D, E, and F to result in any material difference with regard to this consideration.

Regarding the output capability of the generating facilities, the ISO has determined that all of the generating facilities with an output capability of greater than 300 MW have similar likelihood of restoring the system successfully and have a slight advantage over Calpine's generating facilities for its proposed black start resource D with regard to this consideration.

Regarding the past reliability of the generating facilities, the ISO has determined that those generating facilities with a start reliability greater than 99% and an availability factor of approximately 97% or greater have a slight advantage over generating facilities with lower percentages. Based on this analysis, the ISO has determined that NRG's proposed black start resource and Calpine's proposed black start resource D have a slight advantage over Calpine's proposed black start resources B, C, E, and F with regard to this consideration. The ISO has also determined that the better start reliability and availability factor percentages for Calpine's proposed black start resource C give it a slight advantage over Calpine's proposed black start resources B, E, and F, among which there is no material difference, with regard to this consideration.

Based on the foregoing considerations and information, in conjunction with all the other considerations included in the ISO's analysis for this factor, the ISO has determined that NRG's proposal for its proposed black start resource has a slight advantage over the proposal from Calpine for its proposed black start resource C with regard to this factor and that these proposals have a slight advantage over the proposals of Calpine for its proposed black start resources B, D, E, and F with regard to this factor, among which there is no material difference, with regard to this factor.

3.22 Selection Factor: Locational Diversity of Resource

(Facility worksheet 3-4, 14-15)

The fourth selection factor is the locational diversity of the resource, which is described in the technical specification document as including its location with respect to other black start resources in the area. As discussed in Section 3.1, the ISO has determined to select two black start resources to enhance the system restoration time in the greater San Francisco bay area. Because this selection factor effectively requires the ISO to compare different pairs of proposed black start resources to each other, which could otherwise involve an extensive analysis of all the possible combinations of pairs of proposed or existing black start resources, the ISO has chosen to make this the last selection factor to be addressed in the comparative analysis, and to defer the analysis to this Section 3.22, so that the analysis can focus on comparisons of pairings of the proposals for the proposed black start resources that the ISO has determined to have the greatest advantages with regard to other selection factors without having to address every possible combination.

3.22.1 Information Provided by NRG

NRG provided information regarding the location of its proposed black start resource. (Variables and criteria 3-4)

3.22.2 Information Provided by Calpine

Calpine provided information regarding the location of each of its five technically qualifying proposed black start resources. (Proposal transmittal letter; facility worksheet 3-4)

3.22.3 ISO Comparative Analysis

The ISO has determined that two black start resources are needed for system restoration and to provide system operators the option, if both resources are available, to start system restoration from two separate locations, potentially resulting in restoration of the full system in a much shorter time than with just one black start resource. In performing the comparative analysis for this factor, the ISO has considered the location of the proposed black start resources in relation to each other, and in relation to fuel supply facilities, particularly with regard to their ability impact system restoration. Four of the proposed black start resources, NRG's proposed black start resource and Calpine's proposed black start resources D, E, and F, are located within a short distance geographically, although they have separate interconnections to the electric system. Calpine's proposed black start resources B and C are separate both geographically and electrically from each other and from the other proposed black start resources.

As discussed in Section 3.23, the four proposed black start resources whose proposals the ISO's analysis has determined are most responsive to the other selection factors are NRG's proposed black start resource and Calpine's proposed black start resources C, D, and E. NRG's proposed black start resource and Calpine's proposed black start resources D and E are located within a short distance geographically, while Calpine's proposed black start resource C is a significant distance away. In addition, the ISO's analysis has determined that NRG's proposed black start resource and Calpine's proposed black start resources D and E are served by the same main line natural gas system, whereas Calpine's proposed black start resource C has the ability to be served from a separate main line gas system.

Based on the foregoing considerations and information, in conjunction with all the other considerations included in the ISO's analysis for this factor, the ISO has determined that the proposal for Calpine's proposed black start resource C has an advantage over the proposals for the other three proposed black start resources whose proposals the ISO's analysis has determined are most responsive to the other selection factors, NRG's proposed black start resource and Calpine's proposed black start resources D and E, and that there is no material difference among the proposals for NRG's proposed black start resource and Calpine's proposed black start resources D and E with regard to this factor. Calpine's proposed black start resource C would particularly provide more locational diversity from NRG's proposed black start resource and would serve as a better option for system restoration from a second potential source. The ISO has also determined that, although Calpine's other proposed black start resources, particularly its proposed black start resource B might also provide locational diversity in relation to the selection of another proposed black start resources, the disadvantages of their proposals with regard to the other selection factors, as discussed in Section 3.23, eliminate the need for the ISO to undertake a comparative analysis of their locational diversity for purposes of this factor.

3.23 ISO Overall Comparative Analysis for Selection of Black Start Resources to Enhance the System Restoration Time in the Greater San Francisco Bay Area

As discussed above, the ISO has conducted this competitive solicitation because, based on its consideration of the timelines associated with the ISO's and utilities' system restoration plans, black start resources are needed to enhance the system restoration time in the greater San Francisco bay area to ensure that the area's service restoration following a widespread system outage is reasonably consistent with service restoration for other major population centers in the state. The ISO has conducted this competitive solicitation pursuant to ISO tariff authority to contract for black start capability and direction from the ISO governing board regarding the competitive solicitation process to evaluate potential black start resources to enhance the system restoration time in the greater San Francisco bay area. The ISO issued an RFP and received proposals from SVP, NCPA, NRG, and Calpine for the provision of black start capability to enhance the system restoration time in the greater San Francisco bay area from ten different proposed black start resources. The proposals that the ISO reviewed were detailed and well-supported. The ISO first undertook an analysis to determine whether each proposal for the provision of black start capability would satisfy the technical requirements set forth in the technical specification document posted on the ISO website in order to determine which of the proposals the ISO would consider in the comparative analysis regarding the selection factors to provide the black start capability to enhance the system restoration time in the greater San Francisco bay area. In the ISO's analysis of the ability of the proposals for each of the proposed black start resources to satisfy the technical requirements of the RFP, the ISO determined that the proposals for the proposed black start resources of SVP and NCPA, as well as Calpine's proposed black start resources A and G, do not satisfy one of the technical requirements and therefore could not be considered in the comparative analysis with regard to the selection factors.

The ISO then conducted a comparative analysis of the merits of each of the six technically qualifying proposals with regard to the selection factors set forth in the technical specification document for the RFP. In selecting the black start providers and proposed black start resources to provide black start capability to enhance the system restoration time in the greater San Francisco bay area pursuant to this comparative analysis, the ISO has evaluated the technically qualifying proposals with regard to the specified selection factors as part of its comprehensive, holistic review of all factors and elements of the prospective black start providers' proposals. While conducting the comparative analysis, the ISO had to make detailed distinctions among the technically qualifying black start proposals submitted by NRG and Calpine in order to determine the selected proposals.

In conducting the comparative analysis, the ISO first considered the alternatives for start-up power included in each of the proposals. As discussed in Sections 3.19 and 3.20, the ISO has determined that one of NRG's proposed start-up power systems for its proposed black start resource would be less costly and could be available sooner than NRG's proposal for its alternative start-up power system. The ISO's analysis did not identify any offsetting advantages of the proposal for the installation of the alternative start-up power system. Consequently, the ISO has chosen to undertake the overall comparative analysis based on NRG's proposal for the installation of the less costly and more expeditiously constructed start-up power system. As also discussed in Sections 3.19 and 3.20, the ISO has determined that one of Calpine's proposals for the

installation of a start-up power system for each of its proposed black start resources would be less costly and could be available sooner than Calpine's proposals for the installation of its alternative start-up power system. The ISO's analysis did not identify any offsetting advantages of the proposal for the installation of the alternative start-up power system. Consequently, the ISO has chosen to undertake the overall comparative analysis based on Calpine's proposals for the installation of the less costly and more expeditiously constructed start-up power system for each of its proposed black start resources.

With regard to the proposals of NRG and Calpine for the use of the start-up power systems identified by the ISO as the preferred alternatives, the ISO's analysis determined that there are either no material differences or only slight differences among the six technically qualifying proposals of NRG and Calpine with regard to many of the selection factors. The ISO's initial determination regarding the overall results of the comparative analysis of all the selection factors is that NRG's proposal for its proposed black start resource has an advantage over the proposals for the other five proposed black start resources with regard to more selection factors than any other proposal. In fact, as discussed in Sections 3.14-3.22, NRG's proposal for its proposed black start resource has an advantage over the proposals for the other five proposed black start resources or there is no material difference between it and any other proposal with regard to every selection factor with the exception that the schedule for NRG's proposed black start resource would result in the availability of black start capability approximately five months later than the availability for the other five proposed black start resources, as discussed in Section 3.20, and NRG is slightly less likely to complete the five-year term of the black start agreement because the power purchase agreement for its proposed black start resource extends through only a portion of the five-year term of the black start agreement, as discussed in Section 3.18. The ISO has concluded that this potential five-month lag in the availability of NRG's proposed black start resource and the slightly shorter term of its power purchase agreement are outweighed by the other advantages that NRG's proposal has over the other five technically qualifying proposals.

Having concluded that NRG's proposal for its proposed black start resource is better than the other five technically qualifying proposals, the ISO further concluded that the proposals for Calpine's proposed black start resources B and F have disadvantages that outweigh any advantages they may have relative to the other three technically qualifying proposals with regard to the selection factors. Calpine's proposal for its proposed black start resource F has disadvantages relative to most of the other proposals with regard to time to energize the system (Section 3.14), cost (Section 3.19), and other potential benefits (Section 3.21) that are not outweighed by its advantages over some of the other proposals with regard to technical ability to restore the system (Section 3.15) and likelihood of completing the five-year term of the black start agreement (Section 3.18). Calpine's proposal for its proposed black start resource B has disadvantages relative to several other proposals with regard to technical ability to restore the system (Section 3.15), flexibility to restore the system (Section 3.16), likelihood of completing the five-year term of the black start agreement (Section 3.18), and other potential benefits (Section 3.21) that are not outweighed by its advantage over some of the other proposals with regard to time to energize the system (Section 3.14).

Having reached the foregoing conclusions, the ISO focused on the overall comparison of the proposals for Calpine's proposed black start resources C, D, and E. With regard to the selection factor of the estimated time for each proposed black start resource to

restore the 230 kV system, as discussed in Section 3.14, Calpine's proposed black start resource D has a quicker estimated start-up time and relatively few breaker operations to reach one of the identified 230 kV substations that would initiate the energization of the 230 kV system than Calpine's proposed black start resources C and E, and Calpine's proposed black start resource E has a shorter estimated time to restore the system than Calpine's proposed black start resource C.

However, with regard to the six selection factors discussed in Sections 3.15, 3.16, 3.18, 3.19, 3.20, and 3.21, the proposal for Calpine's proposed black start resource C has an advantage over the proposal for Calpine's proposed black start resource E with regard to the likelihood of completing the five-year term of the black start agreement (Section 3.18) and other potential benefits of the proposals (Section 3.21), and there is no material difference between the two proposals with regard to any other of those selection factors. In addition, the advantage that the proposal for Calpine's proposed black start resource D has over the proposal for Calpine's proposed black start resource C with regard to cost (Section 3.19) is outweighed by the advantages of the proposal for Calpine's proposed black start resource C with regard to technical ability to restore the system (Section 3.15), flexibility to restore the system (Section 3.16), likelihood of completing the five-year term of the black start agreement (Section 3.18), and other potential benefits of the proposals (Section 3.21). Consequently, the proposal for Calpine's proposed black start resource C has an advantage over the proposals for Calpine's proposed black start resources D and E with regard to a comparative analysis of these six selection factors in this competitive solicitation process.

With the proposal for Calpine's proposed black start resource C holding an advantage with regard to more selection factors than the proposals for Calpine's proposed black start resources D and E, the ISO focused its final consideration on the selection factor of locational diversity in relation to the other proposed black start resources. Particularly given the ISO's identification of NRG's proposal for its proposed black start resource as having the greatest advantages of all the proposals, the ISO evaluated this selection factor as determining the most favorable location of the second proposed black start resource to complement the selection of NRG's proposed black start resource. As discussed in Section 3.22, the ISO has determined that two black start resources are needed for system restoration and to provide system operators the option, if both resources are available, to start system restoration from two separate locations, potentially resulting in restoration of the full system in a much shorter time than with just one black start resource. As also discussed in Section 3.22, the ISO has determined that the proposal for Calpine's proposed black start resource C provides additional benefits inherent to its location in comparison to the proposals for Calpine's proposed black start resources D and E. Calpine's proposed black start resource C would provide more locational diversity from NRG's proposed black start resource and would serve as a better option for system restoration from a second potential source.

For the foregoing reasons, the ISO has determined that NRG, with regard to its proposed black start resource, and Calpine, with regard to its proposed black start resource C, have provided the two best proposals to provide black start capability to enhance the system restoration time in the greater San Francisco bay area. NRG's proposal has an advantage over the other technically qualifying proposals with regard to more selection factors than any other proposal. And with regard to the five technically qualifying proposals from Calpine, its proposal for proposed black start resource C has an advantage over the other Calpine proposals with regard to an overall comparative

analysis of the selection factors. Based on the ISO's review of the proposals and a comparative analysis with regard to all of the selection factors, the ISO has determined that NRG's proposal is better than the technically qualifying proposals of Calpine with regard to this competitive solicitation process and the particular need for black start capability to enhance the system restoration time in the greater San Francisco bay area and that Calpine's proposal for its proposed black start resource C is better than Calpine's proposals for its other proposed black start resources. The result of this competitive solicitation process is that the ISO has selected NRG, with regard to its proposed black start resource, and Calpine, with regard to its proposed black start resource C, to enter into black start agreements with the ISO to provide black start capability to enhance the system restoration time in the greater San Francisco bay area.

Attachment 1

Greater Bay Area Blackstart Technical Variables and Criteria

GREATER BAY AREA BLACKSTART TECHNICAL VARIABLES and CRITERIA

Geographic Area of Consideration

- Upon the loss of AC to the Greater Bay Area (GBA), the potential blackstart resource must support the restoration of the backbone 230kV transmission system supporting the Greater Bay Area. The Greater Bay Area (or Bay Area) is at the center of PG&E's service territory. This area includes Alameda, Contra Costa, Santa Clara, San Mateo and San Francisco counties as shown in the adjacent illustration. The area is divided into three sub areas: East Bay, South Bay and San Francisco Peninsula.
 - The East Bay sub area includes cities in Alameda and Contra Costa counties. Some major cities are Concord, Berkeley, Oakland, Hayward, Fremont and Pittsburg.
 - The South Bay sub area covers approximately 1500 square miles and includes San Jose, Mountain View, Morgan Hill and Gilroy. Los Esteros, Metcalf, Monta Vista and Newark are the key substations that deliver power to this sub-area.
 - Last, the San Francisco Peninsula sub area encompasses San Francisco and San Mateo counties, which include the cities of San Francisco, San Bruno, San Mateo, Redwood City and Palo Alto.



- The backbone 230kV transmission system in the Greater Bay Area consists of the substations defined in the ISO's Local Capacity Requirements (LCR) Technical Study. The list of included

facilities can be found on page 45 of the report

(<http://www.caiso.com/Documents/Draft2018LocalCapacityTechnicalReport.pdf>)

- Generating resources that are not located within the defined geographic area may submit a proposal provided that they show that they can meet the technical requirements of energizing the Greater Bay Area 230kV system as defined in the ISO LCR report.

Selection Factors and Evaluation Criteria

The ISO encourages applicants to include as much detail and documentation as possible in their black start applications to demonstrate they meet the required technical specification and support their identified costs.

The ISO will not apply specified weights, scoring, and mathematical formulas for selecting black start generating units. The ISO's process will allow all applicants to demonstrate any specific benefits, efficiencies, or advantages their resource provides. Specific proposals may result in additional benefits or costs that the ISO will consider, but the ISO will not know the extent of those until it receives specific proposals. Pre-established weights cannot effectively predict these benefits or costs. The ISO's planned approach will permit a comprehensive, holistic review of all factors and elements of an applicant's proposal.

Factors and Criteria:

- Calculated time to energize backbone 230kV substation loop within the Greater Bay
- Technical ability to meet restoration requirements (Reactive and real power, frequency and voltage regulation, protection coordination, ramping capability, permits, etc.)
- Restoration flexibility (resource flexibility based on location to provide operations multiple options to restore the 230kV system, proximity to other generators.)
- Locational diversity of resource (location with respect to other black start resources in the area)
- Probability of resource completing 5 year term of contract
- Cost of service and capital costs
- Black Start Service commencement date
- Other

Black Start Unit Requirements

- Must satisfy the NERC definition of Blackstart Resource²³

²³ Glossary of Terms Used in NERC Reliability Standards:

http://www.nerc.com/files/glossary_of_terms.pdf

Blackstart Resource: A generating unit(s) and its associated set of equipment which has the ability to be started without support from the System or is designed to remain energized without connection to the

- Must be able to supply own startup power.
- Must serve own plant load.
- Must have ability to meet fault impedance requirements of the restoration path. Generator protection relays should be flexible to assume temporary setting changes required to provide adequate protection during anticipated blackstart system configurations. This could be accommodated, but is not limited to, by utilizing microprocessor based protective relays with multiple group setting capability.
- Must follow the CAISO planned outage procedures.

ADDITIONAL OPERATIONAL REQUIREMENTS:

- Must have ability to meet minimum continuous running time for unit - 48 hours
- Must have ability to energize a dead transmission bus within targeted timeframe: 3 hours

Facility Worksheet

Facility/Plant Information

- 1) Name
- 2) Owner
- 3) Location / Address
- 4) Interconnection point (POI) to the ISO Grid
 - a) Terminal Voltage Level
 - b) Voltage Level of Interconnecting substation
 - c) Interconnecting Substation
- 5) Age
- 6) Type (e.g. hydro, combined-cycle, combustion turbine, etc.)
- 7) Fuel Type
- 8) Inoperable Regions
 - a) Operational Deadbands
 - b) Configuration limitations (i.e. unit configurations 1x0, 2x1, etc.)
 - c) Other operational limitations
- 9) What, if any, are the current emission restrictions under emergency conditions?
- 10) Is this a manned facility (24x7)(Y/N)

remainder of the System, with the ability to energize a bus, meeting the Transmission Operator's restoration plan needs for Real and Reactive Power capability, frequency and voltage control, and that has been included in the Transmission Operator's restoration plan.

- a) If not, what are the facility's remote capabilities?
- 11) Minimum start-up power
- 12) Indicate for each unit
 - a) Identification
 - b) Pmins (stabilizing loads)
 - c) Pmax
 - i) Does Pmax vary on length of time without AC power? If so, what are they?
 - d) Reactive capabilities (a MVAR capability curve and a table including up to 8 MW points (if possible) with associated minimum and maximum MVAR points. Include the maximum sustained leading and lagging capability and any anticipated operational restrictions to the MVAR capability curve).
 - e) Start-up time
 - f) Fuel Type
 - g) MW/min ramp capability
- 13) How long can facility operate at full speed/ no load?
- 14) Please provide a one-line diagram for the facility including all associated auxiliary loads and transmission and distribution level equipment.
- 15) If known, list the steps that the plant would follow immediately following a full black out to start the Black Start Unit, close to a dead bus, and any anticipated GO/TO coordination for load pickup. The description should reference the submitted one-line diagram.
- 16) Indicate the anticipated time to close to a dead bus, and the time to ramp to minimum load.

Black Start Unit(s) Information

- 17) Number of blackstart units at the facility/plant
- 18) Identification
 - a) Of the identified blackstart unit(s), do any parameters for facility/plant information change in blackstart mode?
 - b) Droop Capability
 - i) Does the unit need to be off-loaded in order to change droop setting (to zero, from zero)?
 - c) Droop setting change via SCADA or manual operation?
- 19) Terminal voltage range (i.e. +/- 5% nominal?)
- 20) Generator impedance data (pu) (include base quantities)
 - a) X''_d
 - b) X'_d
 - c) X_d
 - d) X_2
 - e) X_0
- 21) GSU transformer impedance(pu) (include base quantities):

- a) X_1
- b) X_0
- 22) GSU tap settings
- 23) Tie-line impedance
- 24) Provide steady study models for power flow studies in GE PSLF format
- 25) Provide dynamic model for stability studies in GE PSLF format

Compliance

- 26) Demonstrate the ability to comply with all applicable NERC CIP and Reliability Standards as a Blackstart Resource (including but not limited to PRC 19-2, 25-1, EOP 005-2, CIP 008-3, CIP 009-3, COM-001 and CAISO Resource Testing Procedures.)

Attachment 2

Black Start Resource Commercial Worksheet/Questionnaire

Black Start Resource
Commercial Worksheet/ Questionnaire

Existing Facility information:

1. Provide details on existing contracts including interconnection agreements and any contracts to provide energy, capacity, etc. include the term of the agreement and summary of the services or products being provided.

Description of Contract	Term or expiration date

2. If upgrades are required, briefly describe the modifications necessary to convert the facility to be black start capable.

Capital Costs:

3. Are capital improvements to your existing facility required? If so, please provide the associated capital costs, in 2017 dollars. Please provide assumptions for the capital expenditure estimates (e.g. design assumptions, manpower requirements, work schedule, planned outages needed, etc.)

Description of Expenditure	Cost in \$2017
Total Capital Costs	

Assumptions:

4. Provide a schedule for Black Start service implementation and testing. Anticipated date of initial performance testing?

5. What is your proposed Debt to Equity ratio on capital expenditures?

Proposed Debit/Equity Ratio =

6. Please provide the percentage total Return on Equity (ROE) that you intend to seek from FERC.

Proposed Return on Equity (ROE) =

7. Please indicate whether you are proposing a cap on capital expenditures.

a. Please provide, in year of occurrence dollars and present year dollars, proposed cap on capital expenditures, if applicable.

b. Please indicate if all costs prior to the commencement date are included. If not, please explain.

8. Please indicate whether you are proposing a cap on ROE and / or debt cost.
 - a. Please describe any conditions under which the ROE and / or debt cap would not apply.

O&M Costs:

9. Please provide, in year-of-occurrence dollars, estimated operation and maintenance (O&M) expenses and estimated Administrative and General (A&G) expenses, by year and by FERC account, for all such expenses. Please include training, testing and compliance costs.

Description (FERC code)	Operating Costs (O&M, A&G, training, compliance, testing, etc.)				
	2019	2020	2021	2022	2023

10. Please provide, in year-of-occurrence and present year dollars, the estimated annual revenue requirement each year from commercial operation through the end of the term of the contract.
11. Please indicate who will be performing the maintenance, testing and verification services for the Black Start resource.

