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1.0 INTRODUCTION

On December 1, 2021, GEM A-CAES LLC (GEM, or the Applicant) filed this Application for Certification (AFC) with the California Energy Commission (CEC) seeking to construct and operate the Gem Energy Storage Center (21-AFC-02). On August 5, 2022, the Applicant changed the name of the project to the Willow Rock Energy Storage Center (Willow Rock, or WRESC). On June 21, 2023, the Applicant's *Status Report No. 10* stated that efforts to optimize the proposed WRESC were ongoing, including consideration of alternative surface facility configurations, cavern engineering options given the site geotechnical results, and alternate sites that may better support the cavern design. Alternative sites included adjacent and offsite properties in the area with potentially more favorable geologic conditions.

On July 12, 2023, CEC staff filed a motion requesting that the CEC Siting Committee for Willow Rock (Committee) grant an order suspending the AFC proceeding for Willow Rock and requested that the Applicant be directed to submit a supplemental AFC that contains all necessary information for the updated project.

On August 9, 2023, the Committee issued an order indicating that the Applicant may file a single supplemental AFC that updates the project description and all required elements of the application reflecting all project modifications to satisfy the information requirements for an application, as detailed in Appendix B to Article 6 of Title 20 in the California Code of Regulations.

This document is the Supplemental AFC filed in response to the direction set forth in the Committee's August 9, 2023, order (CEC Transaction Numbers (TN#) 251599, 251592).

As described further in this Supplemental AFC, the WRESC will be a nominal 520-megawatt (MW) gross (500 MW net) and 4,160 megawatt-hour (MWh) gross (4,000 MWh net) facility using Hydrostor, Inc.'s (Hydrostor's) proprietary, advanced compressed air energy storage (A-CAES) technology. Energy stored at the WRESC will be delivered to Southern California Edison's (SCE's) Whirlwind Substation located southwest of the WRESC at the intersection of 170th Street W and Rosamond Boulevard, via a new approximately 19-mile 230-kilovolt (kV) generation-tie (gen-tie) line. The WRESC will be capable of operating on a 24-hour basis, 365 days a year with an approximately 50-year lifespan.

WRESC will deploy proprietary A-CAES technology consisting of all-electric air compressors and associated power turbine trains, an underground compressed air storage cavern, and miscellaneous aboveground support facilities. Willow Rock will provide unique operation and reliability characteristics that neither conventional nor renewable power plant technologies or batteries can provide on their own. The main elements of Willow Rock, including an optional architectural berm, are further summarized in Section 1.3, below. A detailed project description is included in Chapter 2 of this Supplemental AFC.

Figure 1-1 shows the existing conditions of the WRESC site, and **Figure 1-2** and **Figure 1-3** provide architectural renderings of the same area after construction of Willow Rock with and without the architectural berm on the west and north sides of the WRESC site.

Figure 1-1: Existing Site Conditions

Figure 1-2: Rendering of Willow Rock Energy Storage Center With Architectural Berm

Figure 1-3: Rendering of Willow Rock Energy Storage Center Without Architectural Berm

1.1 Project Objectives

The Willow Rock basic project objectives are the following:

1. Provide 500 MW of quick-starting, flexible, controllable generation with the ability to ramp up and down through a wide range of electrical output to facilitate the integration of renewable energy into the electrical grid in satisfaction of California's Renewable Portfolio Standard and climate objectives, by displacing older and less efficient generation.
2. Interconnect the project to the CAISO-controlled SCE Whirlwind Substation, a major substation in or near the Tehachapi Renewable Wind Resource Area, to facilitate the integration of onshore and offshore renewable energy development.
3. Implement a proven sustainable energy storage technology that provides improved technological diversity, non-combustible energy storage, minimal residual hazardous waste at asset retirement, a long-term commercial lifespan of 30 years or greater, and non-degrading energy storage.
4. Use A-CAES technology to provide dispatchable long-duration storage and energy delivery for a minimum of 8 hours; fossil fuel and greenhouse gas emissions-free operation; flexible capacity with minimal response time; provide long-duration storage to avoid curtailment through energy storage and to facilitate the further integration of renewable resources; peaking energy for local contingencies; voltage support and primary frequency response, including synchronous power output to support grid resiliency without the need for fossil fuel; superior transient response attributes, including synchronous power output; and superior round-trip thermodynamic efficiency.
5. Locate the facility on a site with adequate geologic characteristics for the underground facilities for compressed air storage, including suitable overburden characteristics (limited thickness, constructable soil type); deep subsurface geological formation (2,000 to 2,500 feet below ground surface) of sufficient quality and definition at the required depth for construction of the excavated storage cavern; ultra-low hydraulic conductivity and permeability in deep subsurface geological formation to retain water and air under pressure within the excavated storage cavern; and competent geological structural integrity to sustain an excavated storage cavern at depth intact indefinitely, allowing for repeated compressed air injection and discharge cycles over the life of the project without eroding or collapsing.
6. Site the project on land with acceptable constructability and with adequate access and size for construction of aboveground facilities—at least approximately 80 acres.
7. Site the project near adequate water supply for construction.
8. Locate the project on a site that is available to provide adequate site control, through long-term lease or purchase.
9. Minimize additional supporting infrastructure needs and reduce potential environmental impacts by locating the facility near existing and planned infrastructure, including access to an existing substation with available transmission capacity.
10. Create jobs in Kern County and the state of California through both construction and operation of the facility.
11. Be a good corporate citizen and respected member of the community through the lifecycle of the project.

1.2 Project Location

Willow Rock will be located in unincorporated Kern County (County), approximately 4 miles north of Rosamond, California (**Figure 1-4** and **Figure 1-5**). The WRESC site is within the southeast quarter of Section 33 of Township 10 North, Range 12 West.

The WRESC site is located on the western portion of an approximately 112-acre parcel with Assessor's Parcel Number (APN) 431-022-13 that is bisected by Sierra Highway and the Union Pacific Railway. The eastern portion of APN 431-022-13 is not included in the project boundary. The WRESC site is bounded on the north and west by undeveloped property, on the east by Sierra Highway, and on the south by Dawn Road approximately 1,800 feet east of the State Route 14 corridor. Additional parcels adjacent to the WRESC site within the project boundary may be used for temporary parking, construction laydown, or construction of an architectural berm.

The WRESC site is currently proposed on undeveloped land in an area zoned Limited Agriculture (A-1) District. The area surrounding the project boundary is largely undeveloped with very sparse residential development; the nearest residence is approximately 0.8 miles northwest of the northwest corner of the WRESC site. The parcels within the project boundary including the WRESC site are not under a Williamson Act Contract.

Appendix 1A contains a copy of the Assessor's Parcel Map for the parcels within the project boundary. A list and map of the owners of properties within 1,000 feet of the project boundary and 500 feet of the proposed gen-tie line is provided in Appendix 1B. **Figure 1-6** shows the project boundary and gen-tie line.

Figure 1-4: Project Location Map of Willow Rock Energy Storage Center With Architectural Berm

Figure 1-5: Project Location Map of Willow Rock Energy Storage Center Without Architectural Berm

Figure 1-6: Project Site and Facilities Map

1.3 Project Elements

WRESC includes the following key features:

- A-CAES Energy Storage Process, Cooling Systems and Electric Transmission
 - All-electric-motor-driven air compressors configured in four trains, totaling nominally 500 MW net
 - Air-powered turbine generators with air discharge stacks
 - Heat extraction and recovery main process heat exchangers
 - Thermal storage system using water
 - Electric, air-cooled heat exchangers
 - Hydrostatically compensating surface reservoir with liner and interlocking shape floating cover
 - Evaporation pond for process water
 - Aboveground piping pipe racks and filter houses
 - Underground compressed air storage cavern
 - Interconnecting shafts for movement of compressed air and water to and from the cavern
 - Optional permanent aboveground architectural berm for onsite re-use of excavated cavern rock¹
 - Approximately 19-mile long 230 kV single-circuit, double-conductor bundle generation-tie (gen-tie) line interconnecting to the SCE Whirlwind Substation with a preferred gen-tie route and alternate route options
 - Approximately ~~125~~ 186 transmission poles
- Operation and Maintenance Facilities, Ancillary Support Systems and Other Features
 - Site stormwater drainage system and stormwater percolation/evaporation pond
 - Water supply from adjacent existing Antelope Valley East Kern Water Agency's supply pipeline
 - Fire detection and fire monitoring system
 - Firewater tank and fire suppression system
 - Diesel-fired emergency fire pump
 - Diesel-fired emergency backup power supply engines to maintain critical loads in the event of a loss of power
 - Combined Office, Control Room, and Maintenance Building
 - Employee and visitor parking area with electric vehicle charging ports and landscaping
 - Primary and secondary entrances with security access gates and site perimeter fencing
 - Permanent plant access roads within the WRESC
 - Extension/upgrades to Dawn Road between the State Route (SR) 14 interchange and Sierra Highway
 - Unpaved access road for portions of the gen-tie line corridor that do not have established access
- Temporary Construction Facilities
 - Temporary laydown and parking areas including cavern construction laydown area, construction phase earthwork areas, cavern rock temporary re-use areas, cavern rock temporary backup re-use areas, and parking areas located on adjacent and nearby parcels
 - Temporary rock crushing facility and portable concrete batch plant to support cavern construction and excavated rock management
 - Temporary entrances for construction
 - Temporary conductor pull and tensioning sites
 - Temporary disturbance for each transmission pole placement

Chapter 2, Project Description, of this Supplemental AFC provides details regarding project elements.

¹ Approximately 1.3 million cubic yards of crushed rock (accounting for swell and void space) would be extracted during construction of the cavern. The WRESC will include options for managing the extracted rock that may be implemented alone or in any combination, including (a) permanent onsite storage in the form of an architectural berm around portions of the WRESC; (b) off-taker transport for commercial use; and (c) off-taker transport for permanent offsite storage. The size of the potential architectural berm will depend on the quantity of rock. The height is expected to not exceed approximately 10 feet. If all the rock were re-used onsite, the total facility size would increase by up to an additional approximately 74.6 acres for a total of approximately 163.~~2~~5 acres.

1.4 Project Benefits

The WRESC will provide the following key environmental and economic benefits:

- **Strategic location:** The WRESC is located strategically to facilitate the further integration of variable renewable resources located in the Tehachapi Renewable Resource Area, which will help avoid curtailment of variable renewable energy resources through energy storage and to meet California and regional electric grid reliability needs.
- Hydrostor A-CAES technology that provides:
 - Fossil fuel emissions-free spinning reserve.
 - Flexible capacity with minimal start time.
 - Peaking energy for local contingencies.
 - Voltage support and primary frequency response without burning fossil fuel.
 - Superior transient response attributes.
 - Superior round-trip thermodynamic efficiency.
- **Minimized land use impacts:** Willow Rock is sited on compatibly zoned parcels in a sparsely populated area. There are no schools, parks, recreational areas, or other sensitive land uses immediately adjacent to the WRESC Site. The project is consistent with the applicable local land uses and land use plans.
- **Key project for integrating renewables:** Willow Rock will provide rapid-response delivery of energy and synchronous condenser voltage support services that are essential to providing reliability support and stability to the grid and integrating intermittent renewable energy sources into the electrical grid.
- **Substantial construction jobs:** Willow Rock will provide approximately 275 to 750 construction jobs (average to peak) with an expected construction payroll of approximately \$400–450 million over the 60-month construction and commissioning period.
- **Permanent local jobs:** Willow Rock will provide approximately 40 full time jobs for operation of the facility.
- **Substantial property tax revenue to Kern County and local schools:** With its sizeable capital cost (estimated at approximately \$1.5 billion), Willow Rock will generate significant income in the form of annual property tax payments, and therefore will provide a robust boost to Kern County's economy and local schools.
- **Local economic benefits:** In addition to the direct employment benefit, Willow Rock will require and use the services of local or regional firms for major maintenance and overhauls, plant supplies, and other support services throughout the life of the Willow Rock facility. The project will not significantly impact local housing, educational, or emergency response resources.
- **Supportive community participant:** The Applicant is committed to working collaboratively with the local community and the County to be a beneficial contributor to community programs and supportive community participant.

1.5 Project Operation

Willow Rock will be designed to operate 24 hours per day, 7 days per week and be available to operate at full load at least 95 percent of the time. The facility will typically cycle between Charging Mode (compression/energy storage) lasting approximately 14 hours and Discharging Mode (decompression/power production) lasting 8 hours at nameplate capacity.

During Charging Mode, electric power will be drawn from the grid (typically off-peak) to run the all-electric air compressors. Compressed air will be injected into a water-filled subterranean cavern displacing the cavern water upward into the hydrostatically compensating reservoir. Heat generated during the compression process will be recovered to heat water in a closed loop thermal storage system, with hot water stored in aboveground spherical tanks (spheres). Upon completion of the charging cycle, the system will be available to generate electricity.

During the Discharge Mode, water from the hydrostatically compensating reservoir will be allowed to flow down into the subterranean cavern, displacing the stored compressed air which will be expanded in power turbines to generate electricity for up to 8 or more hours. Hot water recovered and stored in the aboveground spheres during the charging cycle will be used to reheat the expanding air at intermediate turbine stages to facilitate higher

efficiency power generation. During the compression process, water vapor entrained in the compressed air will be condensed and recycled. Dry air exiting the power turbines will be discharged to the atmosphere through five stacks, one serving each power generation train. No fossil fuels will be required to operate the Willow Rock facility.

1.6 Project Ownership

Project Applicant, Owner, and Operator:

GEM A-CAES LLC is the Applicant, owner, and operator of the Willow Rock project, including all aboveground and underground power plant facilities, the onsite substation, and the interconnecting gen-tie line. GEM is a wholly owned subsidiary of Hydrostor Inc.

Hydrostor is a private company based in Toronto, Canada, and is the world's leading developer of utility-scale energy storage facilities deploying its proprietary A-CAES product.

Project Site Owner:

Willow Rock will be located on an approximately 88.6-acre portion of an approximately 112-acre parcel that is currently owned by Zevsar Concepts, LLC, a Nevada limited liability company. GEM has obtained site control of the entire 112-acre parcel by virtue of an optional purchase and sale agreement with the landowner.

Project Construction and Laydown Area Owners:

GEM has entered into, or is in the process of completing, pending purchase and sale agreements with each of the parcel owners that provides the project with full access and site control.

There are no current plans to merge project parcels. Further, merger is not required under the Kern County Code (§ 18.06.030).

A complete listing of properties associated with the project development included in Tables 2-1 and 2-2. Additional information regarding the WRESC and construction laydown area parcels is provided in Appendix 1D.

1.7 Project Schedule

Construction of Willow Rock is expected to begin no later than ~~March~~ December 2025. Pre-operational testing of the power plant is expected to begin during 2029, and full-scale operation is expected to begin in 2030. Additional details of the major milestones are provided in Table 2-8 in Chapter 2, Project Description.

1.8 Persons Who Prepared the Application for Certification

Appendix 1C contains a listing of the persons involved in preparation of the AFC, including their roles and responsibilities.

APPENDIX 1A

Assessor's Parcel Map

APPENDIX 1B

Property Owner's Addresses and Map

(This Appendix Is Filed Under a Request for Confidential Designation)

APPENDIX 1C

Persons Who Prepared the AFC

APPENDIX 1D

**Site-Related Property Owners
and Relationship to Project
Owner**

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