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December 20, 2016

Mr. John Mathias
California Energy Commission
1516 Ninth Street MS-20
Sacramento, CA 95814

Dear Mr. Mathias:

Subject: Los Angeles Department of Water and Power Assembly Bill 2514: Energy Storage Report

Pursuant to the requirements of Assembly Bill (AB) 2514 (Skinner, Chapter 469, Statutes of 2010), the Los Angeles Department of Water and Power (LADWP) hereby submits this report to the California Energy Commission (CEC) regarding its energy storage (ES) system procurement targets and policies adopted by the LADWP Board of Water and Power Commissioners (Board).

Consistent with the LADWP's recommendation, on September 2, 2014, the Board of Water and Power Commissioners adopted a resolution authorizing the implementation of the LADWP ES targets for procurement in 2016 and 2021 consisting of 24 megawatts (MW) and 154 MW, respectfully. The resolution also included the recommendation to re-evaluate the procurement targets every three years based on power system needs, regulatory requirements, cost-effectiveness, and feasibility.

The enclosed document titled *2016 Assembly Bill 2514 Report* discusses LADWP's 2016 energy storage targets, achievements, and current projects underway to meet the 2021 targets.

Mr. John Mathias
Page 2
December 20, 2016

Please contact Ms. Pjoy T. Chua with any questions regarding LADWP's energy storage efforts. Ms. Chua may be reached at (213) 367-1750 or via e-mail at Pjoy.Chua@ladwp.com.

Sincerely,



Louis C. Ting
Chief Compliance Officer and
Director of Power Planning and Development Division

MH:cwr
Enclosure
c/enc: Ms. Pjoy T. Chua

LOS ANGELES DEPARTMENT OF WATER AND POWER

ASSEMBLY BILL 2514 REPORT

REPORTING AB 2514 ENERGY STORAGE EFFORTS BY THE LOS ANGELES DEPARTMENT OF WATER AND POWER TO THE CALIFORNIA ENERGY COMMISSION (CEC).

DECEMBER 2016

ENERGY STORAGE TARGETS & ACHIVEMENTS

AB 2514 TARGETS

LADWP has developed an analytical framework from which technologically viable and cost-effective Energy Storage (ES) procurement targets were determined in response to AB 2514. In September 2014, the LADWP Board of Commissioners approved LADWP ES targets for procurement in 2016 and 2021 summarized in the table below.

Table 1: AB 2514 LADWP Targets

CONNECTION LEVEL	EXISTING TARGETS			PROPOSED TARGETS					
	PRE 2010			2016 TARGETS			2021 TARGETS		
	LOCATION	ES TYPE	CAPACITY	LOCATION	ES TYPE	CAPACITY	LOCATION	ES TYPE	CAPACITY
GENERATION	Castaic	Pumped Hydro Storage	1,275 MW	Castaic	Pumped Hydro Storage	21 MW	Valley Generating Station	Thermal ES	60 MW
	SUB-TOTAL		1,275 MW	SUB-TOTAL		21 MW	SUB-TOTAL		60 MW
TRANSMISSION	None			None			Beacon Solar Project	Battery ES	30 MW
	None			None			Springbok Solar Projects	Battery ES	20 MW
	None			None			Sub-Total		50 MW
DISTRIBUTION	None			None			Distribution Circuit	Battery ES	4 MW
	None			None			SUB-TOTAL		4 MW
CUSTOMER	UCLA	Thermal ES	4.375 MW	LAX	Thermal ES	3 MW	Distributed Energy Storage Systems	Thermal ES	40 MW
	USC	Thermal ES	4.668 MW						
	TAIX	Thermal ES	0.004 MW	LA Downtown (Pilot)	Battery ES	0.05 MW			
	LADWP Boyle Heights Facility	Thermal ES	0.006 MW	Garage of the Future (Pilot)	Battery ES	0.025 MW	John Ferraro Building (JFB) Energy Storage System	Battery ES	0.3 MW
	McDonald's	Thermal ES	0.03 MW						
	SUB-TOTAL		9.08 MW	SUB-TOTAL		3.08 MW	SUB-TOTAL		40.3 MW
TOTAL		1,284.08 MW	TOTAL		24.08 MW	TOTAL		154.3 MW	

2016 TARGETS AND ACHIVEMENTS

LADWP's board approved targets for 2016 consists of 21 MW of pumped hydro at the Castaic Pumped Hydro Power Plant and 3 MW of Thermal Energy Storage (TES) at the Los Angeles International Airport (LAX). The 21 MW pump storage target was achieved by making modifications to the existing pumped hydro units; increasing their capacity.

The LAX TES is a project conceived by the airport authority in collaboration with the LADWP. Under the current LADWP Energy Efficiency (EE) program, LADWP incentivizes installed TES capacity. The targeted TES capacity by LAX was 3 MW. Post commissioning, due to TES's operational configuration and its dependence on ambient temperature, LADWP analysis indicate that the installed TES capacity is 1.25 MW— Table 1. Therefore, LADWP claims 1.25 MW of installed TES capacity towards its 3MW TES target.

LOS ANGELES DEPARTMENT OF WATER AND POWER

Additionally, multiple customers have installed behind the meter energy storage systems within LADWP's service territory. LADWP has worked closely with the energy storage installers to assure compliance to current interconnection requirements. LADWP's behind the meter installations include over 220kW of battery energy storage, providing customers with peak shaving, self-consumption of solar PV, and backup capabilities. One of these projects is located at the newly build LADWP La Kretz Innovation Campus; a facility demonstration Los Angeles's commitment to renewable power and sustainability. The campus uses 150kW of utility built solar to charge its 60kWh battery promoting innovation and the self-consumption of renewable energy.

Table 2: 2016 Targets and Achievements

PROJECT NAME	COST	TARGET CAPACITY	STATUS	ACHIEVEMENT
Castaic Pumped Hydro Storage Power Plant Unit 1 Upgrade	\$41,000,000	21 MW	Complete	21 MW
LAX Thermal ES Incentive	\$2,022,000	3 MW	Complete	1.25 MW
LA Downtown (Pilot)	-	50 kW	Complete	60 kW
Garage of the Future (Pilot)	-	25 kW	Complete	9 kW
Behind the Meter (Batteries)	-	-	Complete	158.4kW
Behind the Meter (TES)	-	-	Complete	97 kW
Total	\$43,022,000	24.08 MW		22.57 MW

STATUS OF ENERGY STORAGE TARGETS

GENERATION

The 2014 Energy Storage Development Plan submitted to the CEC states that LADWP will conduct a study to determine the feasibility of Thermal Energy Storage (TES) at its generating facility. The targeted capacity was set to 60MW—table 1. In 2016 LADWP initiated the study which includes an expanded scope to analyze both Valley Generating Station and Apex Generating Station located in Los Angeles and Las Vegas Nevada respectfully. The study is currently underway and is expected to be completed Q1 2017. However, preliminary analysis indicates TES configuration at Apex Generating Station will not be cost effective. Further due to high night time ambient temperatures and the current evaporative configuration of the generating station a TES will reduce the overall capacity and efficiency of the plant. The Valley Generation Station is still being studied.

TRANSMISSION

LADWP's 2021 Transmission level energy storage targets consist of 50MW. To determine the correct use case of the storage system(s), in 2015 LADWP conducted the Maximum Generation Renewable Energy Penetration Study (MGREPS). The study was geared to identify the grid impacts of Variable Energy Resources (VERs) in multiple Renewable Portfolio Standards (RPS) scenarios—up to RPS 50. The study analyzed both hourly and

sub-hourly scenarios. MGREPS quantified matrices such as overgeneration amounts, regulation, ramping needs, and N-1 stability.

Based on the MGREPS results, LADWP is moving forward with a 20MW Battery Energy Storage Project (BESS) which is planned to perform frequency response, regulation, and voltage support. The system will interconnect at LADWP's largest renewable energy corridor planned to supply LADWP with over 650MW of solar photovoltaic (PV) and 135MW of renewable wind generation. The system is to be commissioned in late 2017. If this pilot project is successful, LADWP plans to accelerate development of a 30MW Phase 2 BESS expansion for a total of 50MW or more before the 2021 target. The project is subject to LADWP's Board approval.

DISTRIBUTION

LADWP's 2021 Distribution level targets include 4MW of energy storage both on the the 34.5kV and 4.8kV systems. To better understand the distribution system needs, LADWP conducted the Maximum Distribution Renewable Energy Penetration Study (MDREPS). LADWP studied the PV hosting capacity of distribution circuits and feeders and determined the impacts of high PV penetration. Modeling exercises simulated and tracked thermal overloads, voltage swells, and reverse power flow. The study findings indicate that there is reverse power flow—from load to distributing station—even during very low PV penetration. The possible impacts of reverse power flow include relay misoperation and regulator malfunction. The simulation results indicate that at higher levels of penetration, voltage swells occur on the feeder causing power quality issues. The recommendations of the study include energy storage for high penetration feeders with voltage issues.

However, at this point in time LADWP's distribution level PV penetration is not high enough to warrant cost effective deployment of Energy Storage. That being said, LADWP is planning distribution level energy storage pilot projects to determine actual costs, technology viability, logistics, commination requirements, dispatchability requirements, and safety, design and maintenance standards.

CUSTOMER ENERGY STORAGE

LADWP is initiating a Distributed Energy Resources Integration Study (DERIS) in which LADWP will study the locational value of Distributed Energy Resources (DERs) including energy storage. At the same time LADWP is working to understand the safety, value propositions, cost structures, interconnection, and communication requirements of behind the meter customer ES systems.

LADWP's behind the meter ES efforts include multi-technology battery energy storage systems such as the JFB Energy Storage R&D project and solar plus storage projects.