RIVERSIDE PUBLIC UTILITIES

Board Memorandum

BOARD OF PUBLIC UTILITIES **DATE**: SEPTEMBER 11, 2017

ITEM NO: 8

SUBJECT: **SECOND ENERGY STORAGE PROCUREMENT TARGET ADOPTION UNDER ASSEMBLY BILL 2514 FOR THE CITY OF RIVERSIDE TO ACHIEVE SIX (6) MEGAWATTS OF ENERGY STORAGE BY THE END OF YEAR 2020**

ISSUE:

Recommend that the City Council approve the second Energy Storage Procurement Target adoption under Assembly Bill 2514 for the City of Riverside to achieve six (6) megawatts of energy storage by the end of Year 2020.

RECOMMENDATIONS:

That the Board of Public Utilities recommend that the City Council:

1. Approve the second Energy Storage Procurement Target adoption under Assembly Bill 2514 for the City to achieve six (6) megawatts of energy storage by the end of Year 2020; and

2. Authorize the City Manager, or his designee, to submit the adopted second Energy Storage Procurement Target to the California Energy Commission by October 1, 2017.

LEGISLATIVE HISTORY:

Assembly Bill (AB) 2514, enacted in 2010, amended by Assembly Bill (AB) 2227 in 2012, and codified into Public Utilities Code §§ 2835-2839, mandates each California electric utility to evaluate the viability and cost-effectiveness of incorporating energy storage systems into the electricity grid, and to adopt Energy Storage Procurement Targets (ESPT), as appropriate. Under current law, the governing board of a Publicly Owned Utility is required to:

1. Open a proceeding on or before March 1, 2012 to initiate a process for determining the appropriate ESPT, if any, to be achieved by the Publicly Owned Utility by December 31, 2016, and a second target to be achieved by December 31, 2020;

2. Adopt an ESPT, if determined to be appropriate, by no later than October 1, 2014 and report the California Energy Commission (CEC) any such ESPT adoption;

3. Submit the first ESPT Compliance Report to the CEC to demonstrate compliance with the first ESPT adopted in 2014 for procurement through the end of Year 2016 by January 1, 2017;

4. Reevaluate ESPT determination not less than every three years or by October 1, 2017, and report to the CEC any modifications to the ESPT as a result of the reevaluation; and

5. Submit the second ESPT Compliance Report to the CEC to demonstrate compliance with the second ESPT, as revised and adopted in 2017, for procurement through the end of Year 2020 by January 1, 2021.

BACKGROUND:

In compliance with the legislative mandates with respect to energy storage target adoption, and following guidance from the CEC, the Board of Public Utilities and the City Council have taken the following actions:

1. The Board of Public Utilities initiated the proceeding for determining the appropriate ESPT on February 17, 2012;

2. The Board of Public Utilities and the City Council approved and adopted an ESPT of zero (0) megawatts (MW) on September 5, 2014 and September 23, 2014, respectively, as none of the viable applications of energy storage technologies/solutions that may benefit Riverside Public Utilities (RPU) were cost-effective at the time; and

3. On December 12, 2016, RPU submitted the first ESPT Compliance Report to the CEC, indicating RPU's proactive efforts in investigating viable energy storage options in the market and conducting energy storage pilot projects within the City.

As the law requires a reevaluation of the ESPT determination every three years, the City of Riverside must revisit the first adopted ESPT of zero (0) MW, consider any modification thereof, and approve and adopt a second ESPT, if appropriate, by no later than October 1, 2017.

DISCUSSION:

An energy storage system is defined as a commercially available technology that is capable of absorbing energy, storing it for a period of time, and discharging it at a later time. With California's progressive goal and continued efforts in reducing greenhouse gas emissions, and with the significant increase in the amount of renewable generation on the electricity grid in recent years, energy storage is becoming a desirable instrument that could potentially provide a variety of benefits to the grid and the local utilities, including but not limited to:

1. Integration of intermittent renewable resources.
2. Substituting fossil fuel-powered peaking plants.
3. Deferring distribution and transmission system upgrades.
4. Improving overall reliability on the electric system.

Nonetheless, the all-in-cost of most energy storage technologies remains high despite the recent downward movement on pricing on some storage options. As such, affordability continues to be a significant barrier to the proliferation of energy storage.

Since the adoption of the first ESPT in 2014, staff has continued to analyze energy storage options that would best fit RPU's operational needs while being cost-effective. Cost-effectiveness depends on many factors, including the characteristics of the technology, location, applications, market environment and grid conditions. All things considered, staff has taken a number of steps towards evaluating, experimenting and preparing for energy storage implementation. Staff's efforts are detailed below.

Energy Storage Working Group

Staff has actively participated in the Southern California Public Power Authority's (SCPPA's) Energy Storage Working Group (ESWG) to evaluate the various storage technologies and share relevant findings and experiences with other municipal utilities.

- In late 2016, the ESWG acquired an in-depth energy storage study report prepared by DNV-GL, a

well-respected consultant in the storage space. The report presented results from a few well-analyzed case studies using DNV-GL's proprietary ES-Select model, and demonstrated proper methodologies applied to evaluate cost-effectiveness. Staff was also able to gain industry insights on the technical parameters of the storage technologies, as well as the associated cost data and their suitability for various applications.

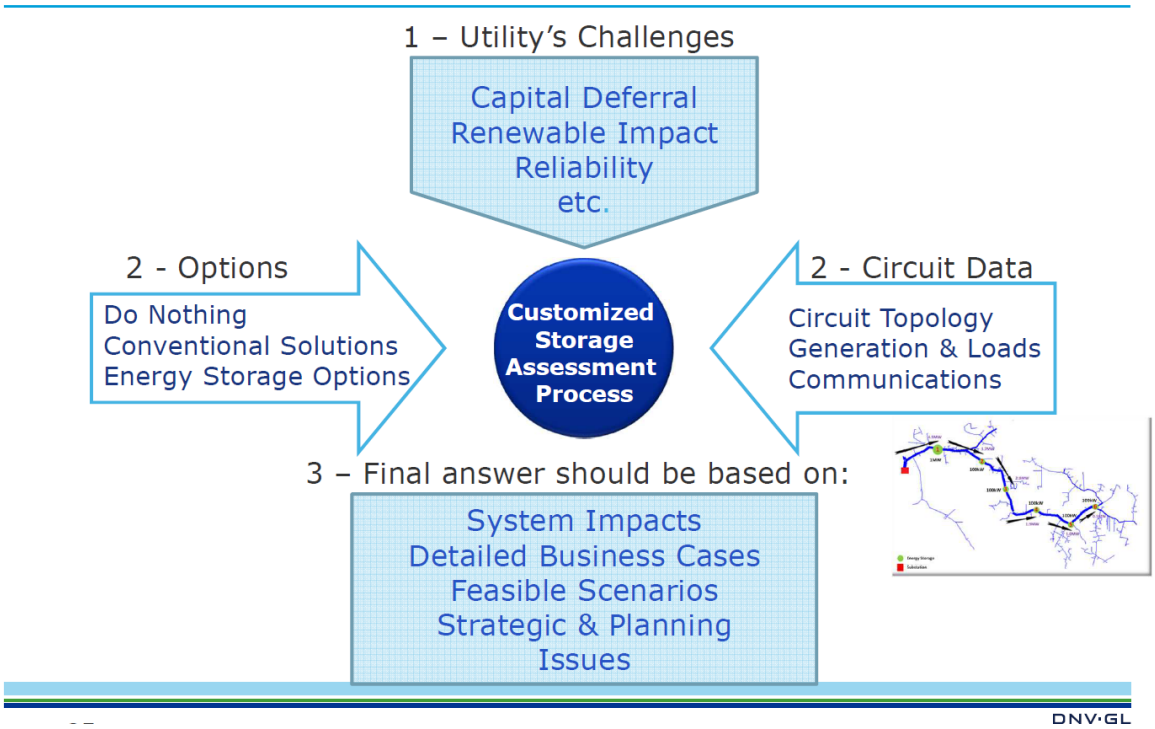

Figure 1 - Sample Slide from DNV-GL Report on Energy Storage Analysis Process

- In early 2017, the ESWG released an energy storage Request for Information, and received responses from over a dozen technology providers, each with multiple offers. The indicative pricing received from the proposals reflected a gradual decline in energy storage costs relative to those from three years ago, especially for lithium ion batteries.

- Also through the ESWG, RPU procured an analytical evaluation tool developed by Navigant Consulting to assist staff in modeling the financial feasibility of storage applications.

Improving Reliability on the Local Grid

With solar penetration reaching 30 MW in the City and anticipating more distributed generation to be placed in the service over the next few years, there is an increasing need to protect RPU's distribution system against voltage fluctuations and other potential power quality issues caused by the intermittent solar production. Energy storage is an ideal tool to facilitate such solar integration and mitigate negative effects on the distribution system. Associated benefits include:

1. Avoiding investment in distribution upgrades, such as voltage regulators, and re-conductoring overloaded equipment as a result of reverse power flow from solar generation.
2. Mitigating voltage fluctuations and reducing distribution system losses.
3. Improving power quality and local system reliability.

Energy storage presents an alternative to distribution equipment upgrades. Storage devices are able to store excess energy during peak solar hours to prevent overloading on certain circuits and then discharge the stored generation in the evening hours as the sun sets while demand is rising. At the same time, storage technology can be programmed to smooth out the sudden spikes and troughs during solar production caused by cloud covers to ensure a consistent and predicable output throughout the day.

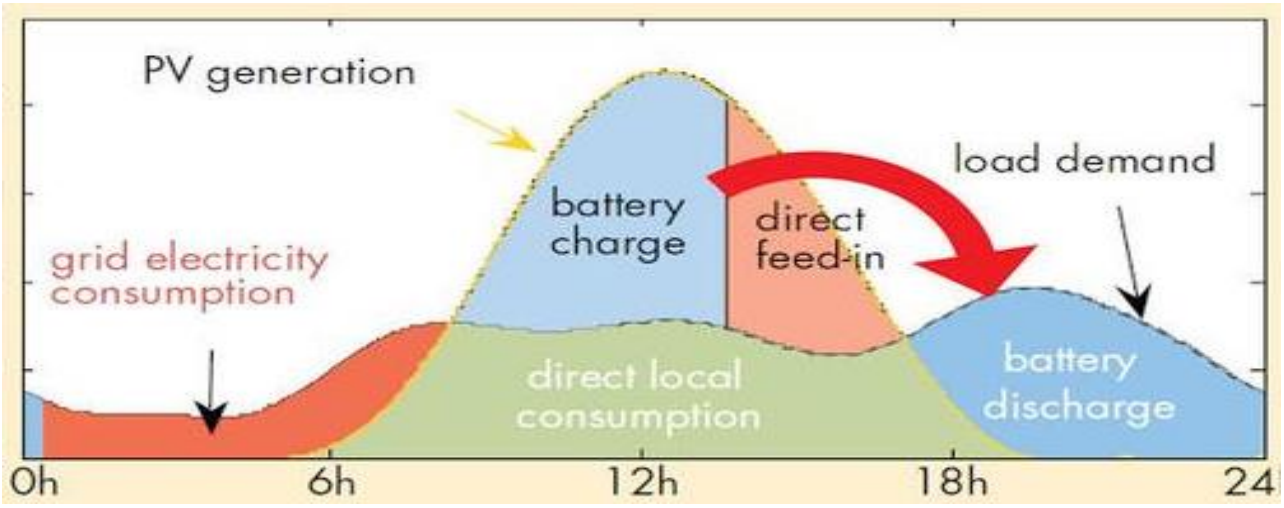

Figure 2 – Solar Energy Shifting with Battery Storage

Staff has begun examining the prospect of installing a three (3) to four (4) MW battery storage system by the Tequesquite Landfill Solar Project. Such installation will be able to mitigate any potential negative impact on the distribution system caused by solar penetration as described above. Maintaining and improving reliability of the grid by modernizing and upgrading RPU's electrical system infrastructure is one of the key goals under the Utility 2.0 framework, and energy storage can play an important role in helping the Utility to achieve this goal. Staff will collaborate cross-functionally to continue the cost and benefit analysis on the aforementioned storage concept, and will report and make recommendations to the Board on implementation of the project if it's deemed feasible.

Utility-Scaled Storage Option

On July 28, 2015, the City Council, with staff's recommendation, approved a 20 year power purchase agreement for the City to procure renewable energy from the Antelope DSR Solar Photovoltaic Project. This fifty (50) MW facility is a joint project with the City of Vernon, through SCPPA, in which RPU receives fifty percent (50%) of the solar generated electricity. The contract has a built-in energy storage option for buyers to exercise, during the first fifteen years of operation, to install up to twelve (12) MW of energy storage at the project site, or up to six (6) MW for RPU. The counterparty to the contract, sPower, has allocated enough acreage at the site to accommodate the footprint of any potential storage installations and will fund up to $182,000 for any permitting and interconnection modifications that might be required.

In addition to benefiting from sPower's pre-development work and the availability of the Investment Tax Credit, pairing energy storage with solar on a utility-scale also has an advantage of economy of scale, which further reduces cost of storage installation and therefore reducing the total cost to RPU. In fact, in the past month, RPU has seen proposals for new "solar plus storage" project at a fixed price below $60/MWh, which is just slightly higher than the last power purchase agreement RPU entered into for a solar-only project, indicating a considerable decrease in total installed cost on such combined utility-scale application. Staff will continue to work with SCPPA and other municipalities to investigate utility-scaled storage options as they represent the most economical approach to implement energy storage.

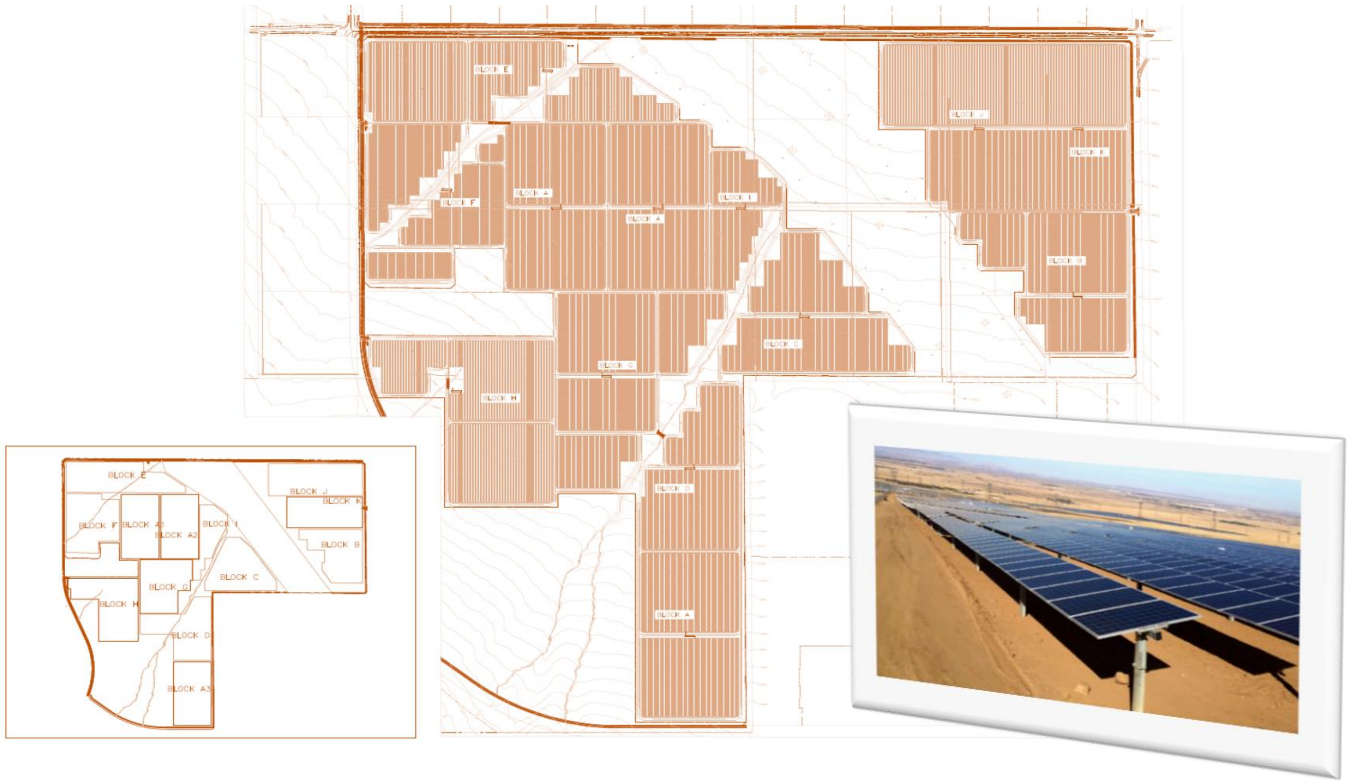

Figure 3 - Antelope DSR 1 Site Layout & Photo

Ice Bear Pilot Program

In 2015, the City entered into an agreement with Ice Energy, Inc. to establish a five (5) MW pilot program using thermal energy storage or Ice Bear. The Ice Bear technology makes ice at night (off peak) and releases the stored thermal energy during peak hours for use in the cooling cycle of air conditioning (A/C) units. The Ice Bear Pilot Program was designed for five consecutive years starting in 2015. Each calendar year, one megawatt (MW) of peak load reduction is to be achieved.

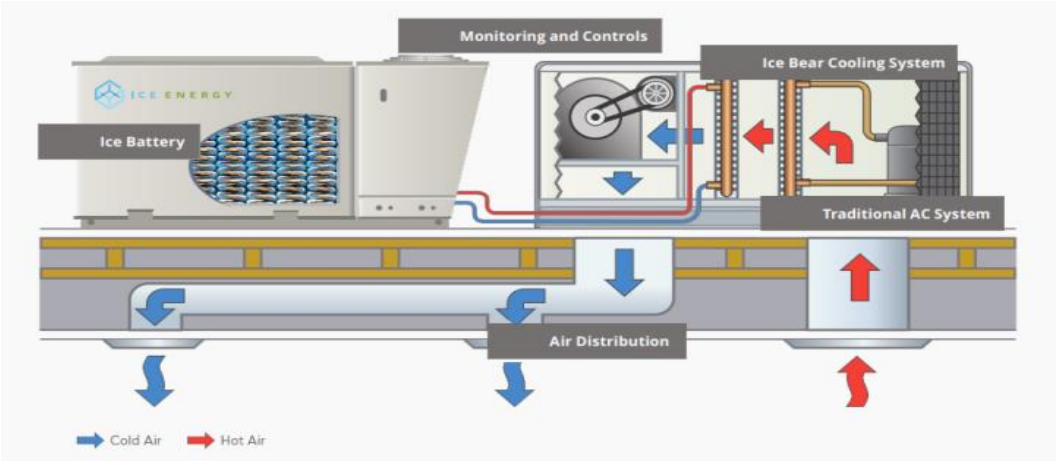

Figure 4 - Ice Bear Equipment Schematic

The City benefits from this program through: a) reduction of electricity peak demand; b) the consequential reduction in power procurement costs in the form of reduced electric capacity and energy purchases during peak hours; and c) relief to RPU's distribution peak system loading. In addition, RPU customers participating in the pilot program also benefit from improved energy efficiency as a result of free high efficiency A/C replacement, as well as from reduced energy consumption during peak demand hours, both

of which translate into lower utility bills. As of end of July, 2017, approximately 1.5 MW of peak load reduction has been achieved. With overwhelming customer reception, staff expects the Ice Bear Pilot Program to continue through the end of 2019 and help the City to reach five (5) MW in thermal energy storage.

California Independent System Operator Ancillary Services Pilot Project

Since late 2016, staff has been working with RPU's Production Cost Modeling Software vendor, Ascend Analytics, to study the cost-effectiveness of owning and operating battery storage in the California Independent System Operator (CAISO) market. The study considers two hypothetical battery storage systems: one designed for the traditional load-shifting application and another designed to provide Ancillary Services, particularly frequency regulation, in the CAISO market. While the study is ongoing, preliminary results for the latter battery storage application look promising. In light of the results, and as an extension of the battery storage study, staff is considering launching a small pilot battery storage project at the RPU Riverside Energy Resource Center facility by the end of 2020, which would consist of a one (1) to two (2) MW battery storage system design for frequency regulation. The goal of this pilot battery storage project will be twofold: first, it will give RPU valuable experience in owning and operating a battery storage system in the CAISO; second, it will produce real operational and CAISO financial settlement data that staff can analyze to determine the true cost-effectiveness of such a system. Having this information will be very beneficial for RPU as battery storage continues to gain traction and become more prevalent in the energy market. To this end, staff will continue to study the cost-effectiveness of battery storage and further explore the notion of a battery storage pilot project.

Figure 5 – Energy Storage Responding to Frequency Fluctuations

Recommendation for Second ESPT

Since the first ESPT adoption in 2014, new energy storage technologies have become commercially available, existing storage technologies have slowly matured while costs are decreasing, grid conditions have changed with increasing renewable penetration, and the perspective of most power industry stakeholders have shifted in favor of energy storage. While staff's endeavors discussed in this report towards evaluating and experimenting energy storage are still ongoing and that some of the potential projects are still being fully vetted for need and cost-effectiveness, staff recommends increasing City of Riverside's Energy Storage Procurement Target from zero (0) to six (6) MW, or about one percent (1%) of RPU's peak load, to be achieved by the end of Year 2020. RPU staff has high confidence that the 6 MW storage target can be met on schedule with the success in the ongoing Ice Bear Pilot Program and the launching of the CAISO Ancillary Services Pilot Project. Adopting a 6 MW ESPT will allow RPU to remain as a leader among the Publicly Owned Utilities in promoting and advancing California's energy storage agenda while at the same time ensuring RPU continue to provide clean and reliable energy to its customers.

While demonstrating cost-effectiveness of energy storage is challenging at the current price except for a few strong use cases with momentous benefits, staff expects more cost-effective opportunities to surface in the coming years with the price of energy storage continues to decline, and new value streams for storage continue to be uncovered. It's important to note that staff is writing on the prudency of setting a storage target in this report, rather than attesting to the cost-effectiveness of any specific project. RPU will bring all storage projects to the Board for consideration, including those discussed in this report, once they are adequately analyzed for feasibility. RPU will also revisit the ESPT in three years and recommend to the Board any revisions to the ESPT as appropriate.

FISCAL IMPACT:

There is no fiscal impact associated with this report.

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Attachments:

1. Riverside Public Utilities Compliance Filing on AB 2514 Energy Storage Procurement Target
2. DNV-GL Energy Storage Report (with Appendices)
3. Presentation