REDDING ELECTRIC UTILITY

2014 Adopted Energy Storage Targets & Policies:

On September 16, 2014 Redding's City Council approved REU's Energy Storage Compliance Plan (ESCP). The ESCP established a July 1, 2016 storage target of 3.2 mw and a target of 3.6 mW for July 1 2017. In the fall of 2014 the 2016 storage target was set for between 3.2 and 3.6 mW.

As of December 20, 2016 Redding's total energy storage installed capacity is 3.46 mW.

- *Redding contracted with Ice-Energy for an expansion of REU's Thermal Energy Storage (TES) Program in June of 2012. That expansion has provided for the procurement of additional energy storage which added approximately 2.1 mW to Redding's exiting storage capacity of 1.4 mW for a total of 3.5 mw installed TES capacity.*

Overview of REU's Energy Storage Portfolio:

REU has been actively investing in energy storage systems for nearly 12 years and has been installing TES systems since 2005. Redding has been well suited for technologies such as TES since it directly shifts electrical demand from high demand, high cost summer afternoon peak period to lower demand and lower cost off- peak periods. The TES systems consist of two types- chiller based large storage systems based on CALMAC glycol technology and direct expansion refrigerant based Ice-Energy systems ('Ice-Bears'). There are 3 CALMAC systems installed at larger commercial business locations and the other installations (approximately 90 sites) have the Ice-Energy equipment, Ice-Bears, at small commercial establishments. The CALMAC systems are wholly owned by the business that they are located at while Redding retains ownership of the Ice-Bears.

Key Factors Impacting Energy Storage Procurement:

As stated above, Redding's TES Program that has been in place for some time was born out of a comprehensive review of peak shaving technologies starting in 2004. Because our service territory has for many decades had an air-conditioning driven summer peak electric demand and since at least the early 1990s has been experiencing a declining load factor, Redding extensively reviewed the then state of art offerings available for energy storage. These technologies included batteries, pumped-hydro, flywheels, compressed air, etc. The least cost most proven of all these was TES. With exception of some specific applications, TES is still by far the least cost most flexible option, certainly for migrating peak demand. It also appears to be able to complement particular generation profiles associated with the increasing common renewable generation sources – wind and solar.

Redding is in its fifth year and final year of the current TES contract. With a noticeably lower load forecast for both energy and demand going forward compared to the 2012 forecast (which was a significant input to the 2012 decision to expand our TES program) it appears at this time Redding will likely significantly reduce expenditures on resources such as TES. As described below, Redding will be reviewing the results to date of the program and consider the pros and cons of the program going forward.

The TES program has proven to be a very viable one that has provided a good direct partnership with our commercial customers. It has allowed Redding to work directly with our customers on their priorities (reliable space conditioning with more stable costs).

In consideration of the good interactions with our customers and however a noticeably reduced load forecast, Redding will be preparing over the next few months an evaluation of the best use of expenditures for meeting energy efficiency and demand side management goals. This effort will include results of the NCPA/SCPPA joint contract with DNV GL which is providing a comprehensive evaluation of energy storage technologies.