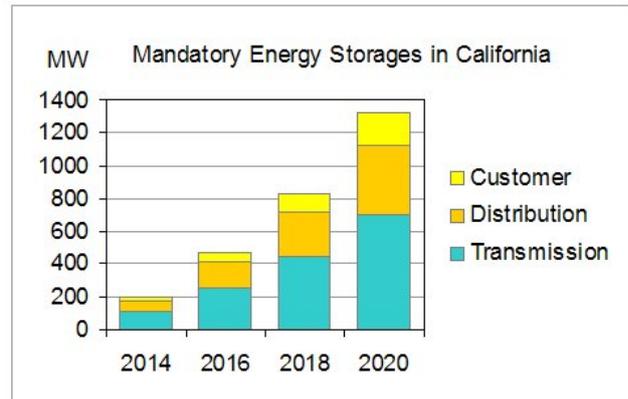


## Mandatory Energy Storages in California

The California Power Utility Commission (CPUC) has set energy storage goals for the Californian power utilities<sup>1</sup>. 1,325 megawatts (MW) of energy storage must be procured by Pacific Gas and Electric Company, Southern California Edison Company and San Diego Gas & Electric Company by 2020.

The storage capacity must be distributed between transmission systems, distribution systems and end-customers.

It has caused some confusion that the capacity has been specified in MW and not in MWh<sup>2</sup>. A target in MW is supposed to imply better flexibility because the necessary duration depends on the specific purpose of each storage facility.



CPUC has been preparing the initiative since 2010. CPUC presents several documents here: <http://www.cpuc.ca.gov/PUC/energy/electric/storage.htm>.

Among the documents are reports from EPRI and KEMA.

According to the EPRI report the following potential storage benefits must be considered:

- Deferral of transmission and distribution (T&D) reinforcements
- Saved system capacity
- Arbitrage from energy time-shift
- Spinning reserve
- Regulation services

The different potential benefits cannot just be added together. The calculated "Technical Potential" will be somewhat lower than the sum of potential benefits. A further reduction leads to the "Monetizable Potential" which is the profitable potential benefit for owners of energy storages. The monetizable potential benefit will be different for the first unit and the nth unit.

Some more indirect benefits are called "Societal Benefits of Storage". No existing tool can quantify the societal benefits, but the necessary development efforts are being made.

The calculations are divided into three cases: bulk energy storage, ancillary service only and distribution energy storage. A broad range of sensitivity analyses have been made for bulk energy storage and for distribution energy storage.

The following battery capacities have been analysed for the three cases:

<sup>1</sup> CPUC: DECISION ADOPTING ENERGY STORAGE PROCUREMENT FRAMEWORK AND DESIGN PROGRAM, 10/17/13

<sup>2</sup> <http://spectrum.ieee.org/energywise/energy/policy/are-we-talking-about-energy-or-power-in-california>

- Bulk energy storage: 50 MW/2 hours (Capital cost in 2020: \$ 528/kWh)
- Ancillary service only: 20 MW/15 minutes (Capital cost in 2020: \$ 3112/kWh)
- Distribution energy storage: 1 MW/4 hours (Capital cost in 2020: \$ 500/kWh)

For different technologies and scenarios benefit-to-cost ratios between 0.9 and 1.47 were found. Among the results 28 are higher than 1 and only 3 are less than 1.

The results confirm that each storage facility must be able to serve several functions in order to cover the costs. As a consequence of this the implementation could be rather challenging.