

**Comments of MegaWatt Storage Farms, Inc
Subject: CAISO's 2010 Transmission Plan
Study Plan Revision Dated April 22, 2009**

Submitted by	Company	Date
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MegaWatt Storage Farms, Inc. (MegaWatt) appreciates this opportunity to comment on the California ISO's (CAISO's) 2010 Transmission Plan Study Plan dated April 22, 2009.

4 GW of Grid-Scale Storage Should Be Evaluated in the Study

The CAISO and its market participants are well informed on the challenges of

- integration of 33% renewables by 2020,
- GHG limits,
- once thru cooling retirements and refurbishments for approximately 12 GW of fossil generation,
- air emissions limits on fossil generation, and
- building new transmission and fossil generation in time to meet the needs.

To partially address these challenges, MegaWatt has advocated and found broad support for a target of 4 GW of fast, clean, and deep distributed storage by 2020.

The CEC April 2, 2009 Workshop on Energy Storage Technologies and Policies Needed to Support California's Renewables Portfolio Standard (RPS) Goals of 2020 http://www.energy.ca.gov/2009_energy/policy/documents/ provides documentation of some of the discussions for such a target.

MegaWatt's presentation at http://www.energy.ca.gov/2009_energy/policy/documents/2009-04-02_workshop/presentations/1_7%20MegaWatt%20Storage%20Farms%20-%20Ed%20Cazalet.pdf sets forth the basis for the 4 GW target.

Recorded comments at the workshop, and comments submitted after the workshop http://www.energy.ca.gov/2009_energy/policy/documents/2009-04-02_workshop/comments/ support this target.

Transmission Planning

California transmission and generation planning is challenging. The challenges include integration of 33% renewables, retirement of once through cooling plants, scarcity of urban air emission allowances, replacement of aging generation, energy efficiency and demand response, likely federal GHG legislation, and the prospect of more distributed energy resources, including PV and storage.

Distributed storage, at a scale that makes a difference in meeting RPS goals, has so far not been addressed in California transmission, distribution and generation planning (TD&G).

Distributed storage is a new capability for the grid. Fully exploiting the capabilities of distributed storage requires that the Transmission Plan make it a primary resource. By way of example, before natural gas storage was commonplace, pipeline utilization was in the mid 30% range - about what the electric grid's transmission capacity utilization is today. Now that natural gas storage is widespread, pipeline utilization is 95% and higher. Just as with natural gas, widespread deployment of storage on the CA electric grid could significantly increase the capacity utilization of transmission lines as well as support variable renewables integration. These benefits can only be achieved if the Plan seeks these types of results up front, as a key goal. And that means storage must be treated as a primary resource throughout the planning cycle.

Policies Require Storage be Considered Ahead of Fossil

The CA Loading Order places demand response (including storage) ahead of many of the other non-transmission alternatives to solving transmission problems. The Transmission Plan assumes energy efficiency and demand response as part of the base case. Storage is embedded in demand response, so storage projects should be given equal priority to demand response in the Transmission Plan. Demand response is included in the plan. And to a transmission operator, unlike most demand response, storage is available 24/7 and it provides more controllable, faster and two-way dispatchability.

Furthermore, from a purely practical standpoint, given the permitting and construction difficulties with new transmission and generation, storage is a more realistic alternative than generation or transmission in the integration of renewables required to meet the RPS.

One could argue that storage could be applied when needed to solve local problems once the overall grid scenarios are run using existing and proposed generation, transmission and loads. We respectfully disagree - this would result in many benefits of storage being largely unrealized. It would result in higher costs, greater emissions, and reduced adaptability to changes in factors such as demand (e.g. as a result of changing economic cycles). We suggest that in evaluating congestion mitigation solutions as well as proposed transmission projects that storage be evaluated as an alternative.

It is hard to see how compliance with Order 890's requirements for a full, open transmission planning process can be complied with if a resource with the capabilities of storage is not a key element of the plan. Moreover, we note that the planning process must, under Order 890, support deployment of the storage by independent entities.

Governor Schwarzenegger issued Executive Order S-02-09¹ on 03/27/2009 creating a Federal Economic Stimulus Task Force, and asked all state agencies to ensure that California "receives the optimal benefit from the ARRA (American Recovery and Reinvestment Act.)

Given that storage is a major element in the ARRA, it would be unfortunate and inconsistent with the Governor's goals if storage is not a key central element in the CAISO Transmission Plan for 2010. The ARRA is specifically targeting projects that can be deployed quickly. Storage deployed as part of the 2010 Transmission Plan can meet the ARRA deployment deadlines - the 2011 plan will be too late - the money will be otherwise committed and the 2011 deployment dates very difficult or impossible to meet.

California's Opportunity to Lead

CA has the opportunity to embark on deploying 4 GW of storage on its grid, supported by federal funds.

CA has the opportunity to lead the country in using storage as a major element of its Smart Grid.

CA can lead the country in using storage to integrate intermittent renewables.

But this will not happen if the 2010 CAISO Transmission Plan neglects storage.

Proposed Storage Scenario

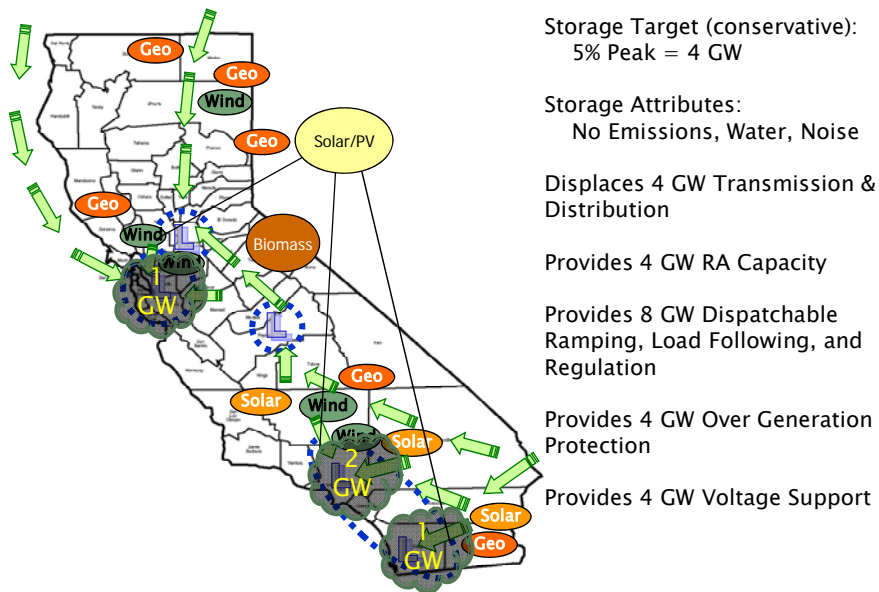
To focus attention on storage as an element of California TD&G planning, MegaWatt requests that the 2010 CAISO Transmission Plan study the following plan for storage:

- Four GW of storage installed by the end of 2020, at the rate of 250 MW per year for 2012 and 2013 (500 MW) and 500 MW per year for the years 2014 to 2020 (7 years * 500 = 3500 MW.)
- Storage is typically available in 1 MW increments. Typical installations will be under 20 MW. Larger installations can also be considered, if desired.

¹ <http://gov.ca.gov/executive-order/11849>

- The storage will be new equipment with a 15 year or longer expected life (after which the battery cell portion of the project could be refurbished) and located on the distribution grid, generally in the coastal communities. Approximately 2 GW will be located in the Los Angeles area, 1 GW in the San Diego Area and 1 GW in the San Francisco Bay Area. The map below illustrates the locations of the storage.
- The locations and timing of installations could be adjusted based on need. For example in the CAISO's analysis of congestion mitigation, storage could be located to mitigate such congestion. And the analysis should consider the flexibility of storage investment. For example, if demand grows more quickly in a given area than forecast, or if planned TD&G projects do not materialize, the 4 GW fleet of storage could be deployed first in the areas with the then greatest need, and if necessary redeployed.

California 2020 Storage Vision



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Modeling

CA ISO's transmission planning process builds a baseline case around those transmission and generation resources that are midway through this multi-year permitting process. For transmission and generation, deployment is a multi-year process. In contrast, storage can be deployed very quickly - in many cases in less than one year. Accordingly, it makes no sense to try to build a baseline case that only

includes storage that is midway through the permitting process. That would miss many opportunities to use storage to provide major transmission benefits.

As a result of these considerations, we suggest CAISO identify where the storage is beneficial and then build the plan around that model. Annual limits on storage deployment can keep the assumptions practical - we provide suggested deployment rates in comments below. Conceptually, this assumption that the storage deployment will happen is the same as assuming that there will be repowering to resolve once-through cooling issues, or the assumptions on the successes of energy efficiency and demand response programs. Just as with once-through cooling, an analysis can be done as a variation on the base case to identify contingencies in the event the storage construction does not happen or is delayed.

Models for storage need to take into account the unique capabilities of storage, especially with respect to storage's dispatchability and its ability to provide multiple services. Each MW of storage should be modeled with a dispatchable range of -1MW to +1MW. The energy storage capability should be modeled to provide at least 4 hours of discharge capability (4 MWh per MW of storage capacity) - longer durations are also available. (Shorter duration storage of about 15 minutes duration is generally only used for regulation services so is less of a factor in transmission planning.) The round trip efficiency, AC-to-AC, including power conversion losses, should be modeled at 75% (i.e. it would take $4 / 0.75 = 5.3$ hours to charge a 1 MW system capable of providing 1 MW for 4 hours discharge.) The storage should be modeled with a deployment timeline that recognizes that no air permits or water requirements are needed.

The storage should be modeled as providing RA and LCR capacity, all ancillary services (regulation, spinning and non-spinning reserves), capable of providing real and reactive power, and as being fully dispatchable in less than a second over its dispatchable range of -1 MW to +1 MW (i.e. a 2 MW range from 1 MW of storage.)

Analysis

Ideally, the analysis of this plan should consider this storage plan as a transmission reliability project.

With respect to reliability, the storage scenario should consider the likelihood that essentially no new fossil generation may be permitted in the LA, SD and SF air basins due to permitting issues and opposition. The scenario should consider that repowering of once through cooling units may be limited given California's' GHG and air emission limits. Moreover, the scenario should consider that little significant new transmission may be permitted or actually in service by 2020 in these three areas due to opposition in obtaining right-of-ways and permits. And the scenario should consider that urban PV, including roof-top PV and plug-in vehicles, may achieve significant penetration by 2020. Hence, by 2020, in these three geographic areas, storage may be the only practical

generation-like alternative to meet reliability needs, to achieve California's GHG requirements, and to enable the 33% renewables target from significant wind and distributed solar PV.

Benefits Assessment

As part of the Economic Planning Study, the storage analysis should explicitly consider the benefits of storage. These benefits include the impact of storage in reducing LMP and ancillary services prices (including mitigation of local market power). The benefits also include any increases in transmission stability ratings on existing transmission, given that storage offers sub-second dispatch capability in the major load centers, with a range of 8 GW (i.e. -4 GW to +4 GW). Because storage can be equipped with four quadrant power electronics (i.e. fully adjustable phase angle), the reliability benefits and cost savings that arise by reducing the need for local voltage support equipment should be added.

Storage sits alongside demand response in the CA Loading Order, so any model of benefits should take this deployment prioritization into account. Specifically, storage should be applied before fossil fuels in addressing reliability needs. Placing storage ahead of fossil fuels means storage should be considered ahead of making investments to repower with once through cooling plants. In addition to the reliability benefits, the value (both qualitative and financial) of the environmental benefits should be estimated. Published studies² show that battery storage can reduce carbon and NOX emissions of providing regulation, load following and ramping to meet system needs, including the needs of integrating variable generation such as wind and solar.

The cost savings from storage should include savings in the construction cost and financing costs by eliminating or deferring construction of new transmission and generation. The cost analysis should consider the financing savings of storage since storage can be built in small amounts as needed, rather than ahead of need as larger transmission and generation projects require.

Storage can provide regulation, load following and ramping. Unlike fossil plants used for these missions, storage does not have a minimum operating setting that generates energy. This impacts the LMP analysis because using fossil plants for these services adds extra energy to the grid when there is already overproduction and (often) negative LMP prices. By using storage rather than fossil plants, fuel costs are eliminated, excess energy production (including nighttime overproduction) are avoided, the need for transmission to move this excess energy is avoided, and wholesale grid pricing (both LMP and congestion pricing) is moderated. A final benefit is that there is reduced need to spill wind to bring the system into balance, a factor that also impacts transmission

² For example, [Air Emissions Due To Wind And Solar Power Warren Katzenstein, and Jay Apt Environ. Sci. Technol., 2009, 43 \(2\), 253-258 • DOI: 10.1021/es801437t • Publication Date \(Web\): 19 December 2008,](https://doi.org/10.1021/es801437t)
<http://pubs.acs.org/doi/pdf/10.1021/es801437t>

requirements. Reducing wind spillage is an important priority, as underscored by the Loading Order's ranking of renewables.

As was stated in the March 24, 2009 public meeting and 2010 ISO Transmission Study Plan document, while there is an explicit calculation of the economic value of solving grid problems, an assessment of the costs to deploy storage is not necessary in order to carry out the transmission planning process. Such cost information would become relevant later when specific projects are proposed, and at that time the costs would be compared to the benefits. However, we note that the cost of storage, as measured per MW of dispatchable range, is less than the latest CPUC approved costs for deploying fossil plants in urban areas. Depending on the length and capacity of a transmission line, storage can also be less expensive in combination with other benefits of storage than wires. In other words, compared to both generation and transmission, storage can be wise and economical choice.

Conclusion

Clean distributed storage as an alternative to TD&G investment is necessary and has substantial support, including government incentives to help pay for its use. If the CAISO is unable to include major storage options in its 2010 planning, major delays may result when parties propose specific storage projects as a clean and reliable alternative to transmission, distribution and fossil generation projects. The Loading Order places storage ahead of many of the other alternatives to solving transmission problems. From a practical standpoint, given the permitting and construction difficulties on new transmission and generation, storage may be the most practical alternative for supporting the CA RPS standards. It would accordingly be highly shortsighted to not include storage as a primary element of the 2010 CAISO Transmission Plan.

We look forward to further discussion in your 2010 transmission planning process of this storage scenario among participants and CAISO management and staff.