BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Pursuant to Assembly Bill 2514 to Consider the Adoption of Procurement Targets for Viable and Cost-Effective Energy Storage Systems.	Rulemaking R.10-12-007 (Filed December 16, 2010)

COMMENTS OF MEGAWATT STORAGE FARMS, INC. ON THE JUNE 28, 2011 WORKSHOP AND RELATED QUESTIONS

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Thank you for the opportunity to provide comments on the June 28, 2011 workshop and related questions listed in Administrative Law Judge Yip-Kikugawa's Ruling of July 21, 2011

Background

Megawatt Storage Farms is a four-year-old company focused on developing large grid scale scale storage facilities. Our focus is on facilities of tens to hundreds of megawatts per site, which is a size chosen so that these facilities can make a material difference in operation of the grid. We consider these facility sizes to be grid-scale, and contrast them with the single-digit MW sizes commonly deployed today, which are generally considered to be demonstrations of technology, and are too small to show any meaningful grid impact.

GWs of Storage Are Needed

We believe the California has a need for approximately 4 GW of storage facilities by 2020 if California is to achieve the 33% RPS. Megawatt independently developed this estimate many years ago. Due to our frustration with the many barriers to implementing grid-scale storage, we advocated that a storage portfolio standard be implemented. The editorial in Exhibit A and the slides in Exhibit B are examples of this advocacy. We have been told by Jerry Brown's office that this helped inspire AB 2514.

At the Workshop, Don Tretheway of CAISO showed a slide (number 2) illustrating a need for 2 GW of fast ramping to support integration of renewables.

KEMA's storage report issued June 2010 [1]validates this need for many GW's of storage.

More recently, on August 18, 2011, Steve Berberich, CAISO President and CEO, reported to the CAISO Board of Governors that 4700 MW of additional flexible generation would be needed on the CAISO grid to support the 33% RPS. He states that CAISO will be unable to maintain reliable electric service if this flexibility is not available.[2]

These and other analyses validate that California has an urgent need for GW of storage by 2020. Failure to provide this flexibility will result in an unreliable grid, if the system is operated at a 33% RPS. Alternatively, failure to provide this flexibility will result in substantial curtailment of renewables, in order to maintain reliable grid, and will therefore result in failure to meet the 33% RPS.

33% RPS is at risk without GWs of storage

The 33% RPS portfolio standard may be may be waived by the Commission if it finds that the retail sellers of electricity have had unanticipated curtailment of eligible renewable energy resources by a balancing authority[3] (e.g. CAISO.) The above-referenced statements by CAISO's Steve Berberich, the CEC / KEMA study, and statements by others (including utility executives to MegaWatt Storage Farms), indicate that curtailment is inevitable if storage of many GWs is not deployed by 2020.

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[1] California Energy Commission / KEMA, Research Evaluation of Wind Generation, Solar Generation, and Storage Impact on the California Grid, CEC-500-2010-010

[2] CEO's Report to the CAISO Board of Governors, Steve Berberich, August 18, 2011, "http://www.caiso.com/Documents/General session August 25, 2011|Board 3) CEO report" accessed August 23, 2011

[3] Public Utilities Code Section 399.15 (b) (5) (C), as amended by Senate Bill X1-2, Sec. 20.

Moreover, curtailment may be required even if this storage is deployed by 2020, because the California grid will reportedly start experiencing ramping problems as soon as 2013. In multiple presentations prior to his retirement, Jim Detmers, then VP Operations of CAISO, characterized these 2013 ramping issues as another potential energy crisis of similar impact to the 2000/2001 crisis.

CAISO has recently modified its Operating Procedures to explicitly permit curtailment of renewable resources.[4]

Curtailment of wind is also now being practiced by Bonneville Power Administration (BPA) in their territory. The financial impact of this step has led to legal proceedings by wind farm owners and the Oregon PUC.[5]

Curtailment in California of renewables threatens the economic viability of California's renewable facilities, both those that are installed and those that are in the planning stage.

Renewables facilities are typically financially leveraged projects which carry significant amounts of debt, which needs to be serviced with regular payments to debt holders. Existing California renewables facilities were built under the assumption that renewable energy was a must take resource and whatever they could make could be sold. When curtailment occurs, this cuts deeply into the return to equity holders of these projects, creating financial distress for the projects and potentially bankrupting them.

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[4] CAISO Operating Procedure 2390, Overgeneration, Version 11.2, Effective Date 7/11/11. http://www.caiso.com/2b67/2b67de7953b36.pdf accessed August 29, 2011. See page 12. Version 11.2 added renewable resources to step 1 of 3.1.2.1 and added renewable resources to step 2 of 3.1.2.4.

[5] " Oregon regulator slams BPA wind curtailments ", John McKenna, Windpower Monthly, July 20 2011, http://www.windpowermonthly.com/news/1081064/Oregon-regulator-slams-BPA-wind-curtailments/ accessed August 29, 2011

With respect to future projects, once curtailment becomes standard practice on existing projects, the project funding sources considering investing in a future project will want estimates of the amount of curtailment expected over the lifetime of that project. The project sponsors will need to provide compelling supportive evidence for these estimates in order to attract project funding (both equity and debt.). This is exceptionally difficult to do given the high uncertainty on how renewables integration will be performed over the entire 20 to 25 year lifetime of these projects. Project funding sources will be especially gun-shy if they have been burned by curtailment of existing California renewables facilities.

As a result, financing new renewables projects will become difficult or impossible (at reasonable costs) if curtailment becomes the norm. If existing projects are in financial distress or bankrupt and future projects cannot be built, this will make it impossible for California to have sufficient renewables operating to meet the 33% RPS. Accordingly, it is essential for achievement of the 33% RPS standard that the CPUC and CAISO do all they can to ensure that renewables are not curtailed.

Opportunity and Vision

Deployment of storage on the CA grid, in successive steps leading to 4 GW by 2020, is the most cost-effective way to support renewables integration and achievement of the 33% RPS. This storage needs to be clean (i.e. not consume natural gas or other fossil fuels, so this excludes conventional CAES) and deep (multi-hour - although some of the 4 GW could be shorter duration, such as 15 minute storage.) The storage should be electricity-in and electricity-out to achieve maximum grid benefits and flexibility from the investment. It should be located primarily in the load centers, with roughly 1 GW in the San Francisco Bay Area, 2 GW in the Los Angeles basin and surrounding areas, and 1 GW in the San Diego load center.

The grid is changing in a profound way and California has the opportunity to provide world leadership in these changes (as it has in many other environmental areas), thereby creating jobs and economic growth.

Specifically, the current grid is operated as a just-in-time delivery system characterized by predictable generation, unmanaged transmission and distribution flows (wires) and unmanaged loads that fluctuate with significant random changes. The new, green smart grid, (including renewables, storage and demand management) will have significant fluctuating generation (from intermittent renewables), manageable and schedulable transmission and distribution flows (via storage and DC–DC links), and significant amounts of managed and schedulable loads (via storage, demand response and real-time pricing).

In other words, with the new grid, the characteristics of generation, transmission, distribution and loads will all change. Storage will be a central element in making a smooth transition from the old just-in-time model to the emerging new grid model.

AB 2514 provides an opportunity for California to direct resources to help implement this new grid. California's success can be used as a showcase by California industries to sell similar renewables-friendly grid solutions around the world. California has a tremendous opportunity to build a massive new industry around future grid operating models using AB 2514 and other policies to help enable the success.

Barriers

We now discuss the existing barriers to more widespread use of energy storage. We note that our purpose in advocating a storage portfolio standard (AB 2514) was to bypass the unmanageable complexity of trying to change these barriers one-by-one. We recognized that a portfolio standard was essential in providing the driving force for renewables deployment and widespread use of demand response, and that a similar portfolio standard would be needed for storage. Accordingly, while the following list of barriers is long, we believe that with appropriate decisions by the CPUC in this proceeding, AB 2514 can cut through these barriers and achieve widespread storage deployment.

To ease readability, we have categorized the barriers into a few overall groups, but recognize that each specific barrier may relate to multiple groups.

Barrier Group A - A Bias Towards Study, Not Action

1. Lack of architectural leadership or vision

As described above, the grid is changing in profound ways, including rapidly growing deployment of renewables. Storage provides an outstanding resource for effectively managing these changes.

However there is no focal point for architectural leadership or vision of this future grid that has emerged within grid regulatory and operating bodies. As a result, most of the decisions pertaining to storage have focused on how storage can be added to the existing grid, rather than how storage can serve as a primary asset in helping to build the future grid.

2. Too many studies rehashing the same material

Perhaps partly because of this lack of architectural leadership, there is a tendency when regulatory bodies start looking at storage to hire research firms to investigate available storage technologies and possible applications. This has led to a literal mountain of storage reports being generated at the federal and state level, most of which cover the same ground over and over again. Within California there are multiple bodies involved in storage including the CPUC, the CEC, CAISO, the legislature, non-CAISO utilities, the three large IOUs and others.

The studies typically take a year or more to complete and although they largely repeat material previously reported, the delay needed to wait for the latest study simply sets back the deployment of storage. It would be far more effective if the multiple regulatory bodies cooperated to do a single, more thorough report, once, and in the cases where multiple reports already been completed, used the pre-existing reports as a basis for setting policy rather than going back to square one and commissioning a new report to cover the same material as preceding reports.

We note that most of these reports are done by research organizations whose primary product is research reports. The common thread in the conclusions of virtually all these reports is the need for more reports and future study of additional aspects of storage.

We recognize that there is always the possibility for more study, but what is really needed is a focus on how to widespread beneficial storage deployment might be obtained with available resources. For a research firm, their bias will be to reserve their jobs security by finding more things that need studying, not by finding ways to deploy using existing capabilities.

3. Repeated False Statements That Storage Isn't Yet Cost Effective or Proven, Resulting in Misguided Policy Decisions

We believe strongly that the barriers to storage are primarily regulatory and market barriers, not barriers of technology. We point to the successful operation of over 200 NAS battery facilities in

Japan, plus decades of experience with lead acid grid scale facilities worldwide, as evidence that there are viable grid scale storage technologies readily available today.

Despite this overwhelming evidence that such technology works today, we repeatedly see reports claiming that storage is not yet proven.

We also see reports claim that storage is not cost effective. The question of cost effectiveness actually consists of two elements: the cost of the actual storage and the revenue that can be achieved from that storage. On a cost per dispatchable megawatt basis, storage is less expensive than new peaker plants installed in California.[6] The fundamental problem is one of monetizing storage, not one of storage cost. By repeatedly claiming that storage is not cost effective, industry researchers misguide policymakers into freeing up more money for R&D and not directing money towards deployment of storage. While this is self-serving for the researchers, it is not a benefit to the RPS initiative.[7]

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[6] Recent peaker plants installed in the LA basin cost $1.4 million per nameplate MW (all-in costs). A typical peaker has a 50% minimum operating point, so for dispatchable MWs - what is needed for renewables integration functions like ramping - the effective cost if $2.8 million per dispatchable MW.

In contrast storage costs between $1.5 and $4 million per nameplate MW (depending on the technology and duration), and every nameplate MW can typically provide 2 MW of dispatchability (i.,e. can swing from 1 MW charge to 1 MW discharge = a swing of 2 MW). Thus the cost of storage is $0.75 to $2 milllion per dispatchable MW.

So storage is less costly than peakers for renewables integration.

[7] MegaWatt Storage Farms provided well over 100 corrections to the PIERS report done by the CEC in support of AB 2514 (to the best of our knowledge, the public release of the final report is still forthcoming.) The final draft we reviewed was filled with inaccuracies, had internally inconsistent data (in some cases apparently copied without checking from previous reports), and frankly overall was a sloppy piece of work. We and others objected to its release until it was significantly revised. Not only are there too many studies, there is a woeful lack of really good studies providing fresh new insights of how to move ahead.

4. Unreasonable Expectation That Cost of Storage Will Dramatically Drop

Often coupled with the repeated incorrect claims that storage is not cost effective, is the enticement offered to policymakers that some new storage technology is about to breakthrough and provide dramatic cost reduction.

In actual fact, it takes approximately 50 years for a revolutionary new storage technology that is currently at the lab beaker stage to reach the maturity level needed to allow its deployment in tens or hundreds of megawatts in a 15 year project. Similarly, an incremental but significant improvement in storage materials for an existing technology can take 20 to 30 years to reach the maturity level needed to allow its deployment in tens or hundreds of megawatts in a 15 year project. We believe there is ample prior evidence of these extended development times when one looks at improvements such as flow batteries, new lithium ion materials, new lead acid battery materials and the like.

As a result, any significant technology improvement developed tomorrow will make no difference with respect to grid scale deployments for many decades. While we applaud the investment of research dollars into both substantial improvements and revolutionary improvements in storage, we believe that it is essential that policymakers view these as the long term investments that they actually are, and not as a potential short-term solution that has any relevance to meeting California's 33% RPS.

With respect to cost decreases, there are over 100 years of experience with improvements in batteries which shows that the decrease in cost averages single digit % per year (3% to 5% is sometimes quoted.) To the extent raw materials prices rise (as may happen due to global economic recovery and increasing demand from China and other countries), the prices of raw materials may rise much faster than cost improvements, resulting in overall price increases, not overall price decreases.

For this reason, we believe policymakers should treat the cost of storage either as a constant or as a slightly decreasing (single digit %) cost per year, and build effective policy and implementation plans around that model. We believe that holding out the hope for revolutionary

cost decrease in the near-term (i.e. by 2020) does an extreme disservice to policymakers and ratepayers because it delays implementation of the storage solutions available from today's technologies, when the reality is nothing much better will be available if we wait.

5. Too many demos

There is a long history in the United States of doing storage demos, typically with state or federal incentives, and then spending 2 to 3 years studying the demo before making decisions with respect to large-scale deployment.[8] Frequently what results from these studies is another demo. What is really needed is to deploy larger grid scale systems tends to hundreds of megawatts so that real grid benefits can be seen and quantified rather than continuing to play with small demos of a few megawatts.

It is important to keep clear the two different roles the demos can provide. For a new technology, a demo of a few megawatts is entirely appropriate in order to prove out the reliability of the system. On the other hand for a proven technology, such as NAS, lead acid and lithium ion, deployment of a much larger facility is entirely appropriate, and doing small demos of these technologies followed by years of study simply delays widespread storage use. Unfortunately, many of the government incentive programs, due to limited funding resources, have focused on small demos. In an effort to capture this funding (which is all that is available due to the other barriers to large scale deployments discussed herein), storage manufacturers make the Hobson's Choice and argue that their technologies really are immature and require further study.

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[8] AEP, arguably one of the most aggressive US utility in trying new storage technologies, went through three rounds of demos with NAS batteries - resulting in about 7 MW total being deployed over 7 years. (Most other utilities in the US deployed zero NAS, which is why AEP is arguably one of the most aggressive.) The final reports on the last round of demos at AEP is forthcoming. In the same time, Japan went from under 100 NAS installations to over 200 and now has more than 300 MW operating. Do electrons really behave so differently in Japan that the results from Japan's sites can't just be applied to the US grid, without the need for multiple demo cycles in the US?

We strongly encourage the CPUC to take advantage of the results of the extensive number of existing storage facilities worldwide and to avoid unnecessary demos when the results are already available from other jurisdictions. For example, there are over 200 NAS battery facilities operating in Japan. Multiple large lead acid facilities have been deployed worldwide over the last number of decades. There is extensive reliability data under a wide range of usage profiles and environmental conditions for lithium ion storage from the work of the automotive companies. It would be a highly effective use of commission resources to have CPUC staffers visit with experts at these different locations to take advantage of these prior results, rather than sponsoring further demos on the California grid to repeat essentially the same studies. Silicon Valley's success is based in part on its ability to stand on the shoulders of pre-existing technology to reach new capabilities. The CPUC should follow this model with respect to storage.

6. Excessive focus on large installations like pumped hydro and CAES.

Substantial incentive money and feasibility investments have been directed towards pumped hydro and conventional CAES. Pumped hydro and CAES facilities are in the wrong places, require costly transmission lines to service them, and these transmission lines plus the hydro or CAES facilities take too long to build to meet the 2020 needs of California.

Existing CAES uses natural gas to convert compressed air to electricity and has an overall heat rate worse than a combined cycle unit, if the energy used to compress the air is taken into account using the average energy source mix of the grid. The sole existing facility in the USA reportedly is run infrequently due to its high operating cost.

There are few pumped hydro sites available and the cost of pumped hydro plus the transmission lines is more expensive than locating battery storage in a load center.

Barrier Group B - A Lack of Pro-Storage Planning, Policy and Markets

7. Storage is not in the Loading Order

Storage is not explicitly identified in the CA Loading Order, which disenfranchises storage from consideration under various procurements.

8. Storage does not need to be considered as an alternative

Until storage is given equal hearing to other energy assets, it is unlikely the widespread deployment of storage is going to occur. Quite simply, it is easier to simply consider deploying more of the usual assets than it is to undertake the more difficult planning process associated with giving storage a fair hearing. The CPUC is an excellent position to set policy mandating that storage get an equal hearing. We consider such a requirement to be in the best interests of California ratepayers and in keeping with the CPUC mandate.

We advocated in the CPUC's SmartGrid proceedings that the CPUC reject any energy asset purchase unless storage was considered as an alternative. This would relate to generation, transmission and distribution resources. We specifically had 10 recommendations relating to this filing. A copy of the filing is attached as exhibit C.

We encourage the CPUC to set this requirement that storage be given an equal hearing as part of its rulemaking under AB 2514.

9. Utilities do not know how to evaluate storage and are afraid they won't recover costs

At the invitation of a California utility, MegaWatt Storage Farms proposed a large grid scale storage facility using proven technology to be deployed on the California grid. Upon submission of well over 1500 pages of supporting material by MegaWatt, the utility reject the proposal in large part because it did not know how to evaluate storage. They were also fearful that the CPUC would not allow them to recover the cost of the storage. The utility was required to use an

outside reviewer for the storage proposed. This reviewer had no apparent motivation to try to adapt existing procurement models to account for the unique and valuable benefits of storage can provide, despite the guidance provided by MegaWatt in the submitted materials.

Under AB 2514, utilities will need to conduct storage procurements. Clear guidance is needed by the CPUC so the utilities have fair and just storage evaluation criteria, which the CPUC endorses. Obviously the CPUC must be willing to support the procurement with appropriate cost recovery.

10. Urgent reliability needs require CPUC decision on storage now

As outlined earlier, California needs gigawatts of clean deep storage in order to support its 33% RPS. The most pressing need for this storage is for quick dispatchability, including ramping services.

Unless the CPUC establishes a strong 4 GW storage standard, the CAISO and CPUC and utilities will likely proceed down alternate paths. The trajectory they are currently on is to commit to CTs and transmission over the next two years to meet the 2020 33% RPS, because the claimed planning lead time is about eight years to deploy the necessary GWs of resources.

Procurement of replacements for 2 GW of once-through cooling retirements should explicitly consider storage as an alternative. The 4 GW of storage we advocate can be deployed to provide the 2 GW of once through cooling replacement plus provide other benefits.

The CPUC has to decide now whether or not to proceed with GWs of storage to support the 2020 33% RPS. If the CPUC waits, the decision will be made by default and reliability needs will force commitment to CTs rather than storage.

Keith Casey, CAISO VP Market and Infrastructure Development stated the tradeoff facing CAISO clearly at the August 25-26, 2011 Board of Governors meeting - "the consequences of having insufficient resources to reliably operate the grid are much more significant than the

consequences of over-procurement." [9] At the Board meeting, CEO Steve Berberich, Keith Casey and Mark Rothleder (CAISO's Director, Department Analysis and Development) provided documentation to the Board showing the need for multiple GW of dispatchable resources, as can be provided by storage or CTs. [2,10]

The barrier for storage deployment for this item is the CPUC fails to act in a timely manner to commit to GWs of storage, and as a result CAISO and the CPUC procurement process is forced to deploy CTs instead.

11. No market for ramping services

As mentioned, CA needs GWs of ramping to support the 33% RPS. At the moment there is no market for ramping in California so the pricing of this service is unclear, even though it is indispensable to meeting the 33% RPS. Even if there were a market, if it was a capacity market like regulation, it will be impossible to deploy significant amounts of storage in such a market because that market has no long-term certain revenue stream. Accordingly, what is needed is a long-term (10-15 year) certain revenue stream that storage can be deployed under. A utility procurement as anticipated by AB 2514 could be perfect for this. It is impossible to see how these amounts of storage could be deployed by 2020 if CAISO needs to develop new markets and software to create markets for ramping services. The last round of market reform and

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[9] Briefing on Renewable Integration, to the CAISO Board of Governors, Keith Casey, August 18, 2011. http://www.caiso.com/Documents/Board%208)%20Briefing%20on%20renewable%20integration/110825BriefingonRenewableIntegration-Memo.pdf, accessed August 29, 2011

[10] Briefing on Renewables Integration - Presentation, to the CAISO Board of Governors, Mark Rothleder, August 25-26, 2011 http://www.caiso.com/Documents/Board%208)%20Briefing%20on%20renewable%20integration/110825_Briefing-RenewablesIntegration-Presentation.pdf, accessed August 29, 2011

software development (MRTU) took approximately 5 years and $300 million for CAISO to implement.

CAISO's current plan is to use the 5 minute energy markets to provide ramping services. However, CAISO recognizes that the bid stack depth is too thin for the gigawatts of ramping needed. Furthermore, the ramp rate of the entire fossil fleet will be inadequate to meet the ramp rate required on certain days to integrate renewables, perhaps as soon as 2013. The situation will be much worse by 2020. Without deployment of gigawatts of storage, widespread curtailment of renewables is highly likely with all the negative repercussions outlined earlier.

With respect to the use of storage for ramping, it is important that there be a fair mileage payment, since the storage is likely to be dispatched more frequently than fossil plants to provide a first level defense in meeting the ramp requirements. Related to this, we note that there is now strong evidence that using large steam facilities for integrating renewables for services such as ramping and frequency regulation causes the plant piping to become brittle and leak due to the repeated thermal cycling and thermal shock. This effect can shorten plant remaining lifetimes by an order of magnitude (e.g. from 20 years to 2 years was reported in one case.) As the damaging impact of using large facilities to integrate renewals becomes more widely understood by the industry, we expect these plant owners to refuse to provide these services. This makes deployment of storage all the more essential.

12. No long term market for frequency regulation.

Frequency regulation in California is typically provided by generators operating under energy contracts. These energy contracts are typically structured as tolling contracts and are entered into through bilateral negotiations or competitive procurements, which are primarily focused on obtaining energy. Under the tolling contracts, the purchasing party provides free natural gas to the generator and pays for its conversion to energy. The purchasing party has the right to use the generator for any functions that it wishes. Frequency regulation is one of the functions that these plants are typically used for, but represent a minor used compared to the main use of generating

energy. As a result of these tolling contracts, much of the frequency regulation in California is purchased as part of an energy competitive procurement. Since there is no separate procurement for frequency regulation, the frequency regulation service has no long-term pricing associated with it. That makes it impractical for utilities to attach a clear value to storage's ability to provide long term frequency regulation services, even if there were storage procurements (which there aren't.) Tolling procurements are the sole existing opportunity for storage to receive long-term contracts for providing frequency regulation. However, storage is unable to generate energy and accordingly cannot participate in these tolling procurements.

What is needed is to unbundle the different services bought in these competitive procurements so that the purchase of energy is a procurement conducted separately from the purchase of frequency regulation. This would open a distinct long-term market (10-20 years) for frequency regulation that storage could participate in.

The availability of the long-term frequency regulation market is essential for storage since long-term certain revenue streams serve as the basis for securing financing for appointment of the storage.

A further complicating factor in California is that the frequency regulation prices are seriously depressed compared to the rest of the country and historical CA prices. A contributory factor to these low prices may be that frequency regulation procured under tolling contracts is self-provided in the CAISO markets. Although it flows through the market mechanism in order to facilitate scheduling, the bid prices are often for nominal values (such as zero) due the self-scheduled nature of the frequency regulation. (Low natural gas prices are also contributory factors, but that doesn't explain the differences in pricing between CA and other regions.)

We recommend that market reforms be explored to allow pricing to track true value. These reforms might include a prohibition against self-scheduling frequency regulation at unrealistically low bids. We note that properly implemented, AB 2514 may circumvent the need for these reforms, although we are concerned that the unrealistic short term market prices for

frequency regulation may lead to distortion in the perception of long term value of the service, both with respect to CPUC policymaking and with respect to AB2514 procurements.

A further issue related to deployment of storage for frequency regulation is that software at CAISO for limited energy storage (LES) devices is not yet operational. (See CAISO Tretheway presentation at the Workshop, slide 6). A related software issue is that even if long duration storage were deployed for frequency regulation (to avoid the LES issue of the precious sentence), CAISO could not handle negative MW dispatches (i.e. charging of storage) for frequency regulation. Hence CAISO's frequency regulation software works only with generators and not for long duration storage.

As with ramping services, storage is likely to be preferentially dispatched for frequency regulation vis-à-vis conventional generation, so there needs to be a fair mileage payment that reflects the higher wear and tear that storage will see.

13. Five minute energy markets are not suitable support for for storage

CAISO is largely looking to the 5 minute energy market to provide it with the GW of ramping needed for the RPS. These markets traditionally have been much too thin to provide GWs of ramping. Moreover, even if copious storage was deployed, the profit from energy arbitrage (timeshifting) does not come anywhere close to covering the cost of the storage. Also, the more storage that is deployed for energy arbitrage, the more it will tend to collapse the price differential, thereby undercutting the financial basis on which the storage was initially been deployed.

Any arbitrage profit is based on short-term spot market prices rather than a long-term certain revenue stream and accordingly would be near impossible to finance with project financing.

For all these reasons, deployment of GW's of storage backed by the 5 minute energy market is impossible.

14. Storage not viewed as primary grid asset by CAISO planning process

Under the FERC ruling of January 2010, which allowed storage to be placed in the transmission ratebase, the storage project must be selected by the CAISO planning process before it can enter the ratebase.

Unfortunately, the CAISO Transmission Planning Process appears heavily biased towards traditional wires assets. The planning process appears to apply traditional wire assets to solve all grid problems and then look to see if there's any place storage can be tucked in as an afterthought. The result to date has been that there are no such places and every storage proposal has been rejected. While one might expect CAISO to take a leadership role in planning the future architecture of the grid, with storage is a primary resource that is on at least equal footing to generation, transmission and load, sadly this is not been the case. Storage is simply treated as an afterthought.

15. CAISO Relies on Outside Source for Transmission Planning and They Do Not Plan For Storage

CAISO explicitly bases its transmission planning on the results of the CTPG. CTPG membership includes utilities within CA, including the three large IOUs, some smaller utilities, plus WAPA. CTPG does not include storage in its planning process. CTPG operates independent of CAISO and without direct oversight of CAISO, yet its results form a substantial foundation for the CAISO transmission planning effort. Because of this process, storage is excluded from consideration by CTPG and by the time the process ends up at CAISO, it is too late to have storage considered as a primary resource on a fair footing with other alternatives. Quite simply, the game is impossible for storage to win. (We are not saying this has been intentional, just the way it developed.)

A further concern is that the CTPG discovered in the course of developing the 2010 Transmission Plan that their results were extremely sensitive to the assumptions made about the load and generation located in load centers. This surprised them. Since the assumptions used for 2020 had zero storage, given the high probability that AB 2514 will result in at least some storage in the load centers, by CTPG's own analysis of their model's sensitivity, their results are very likely wrong as to what transmission California needs.

MegaWatt has raised this issue with both CTPG and CAISO, but since neither has developed planning processes that account for storage, neither is able to take any corrective action. CTPG says they will consider storage in future plans, but the extent of this effort remains to be seen, and in any event, CAISO should be leading the vision of how to use storage as a primary grid asset.

16. Right of first refusal of incumbent when storage is transmission asset

A further complicating factor, which FERC has made some efforts to address (although it appears to now be entangled in a contentious rehearing proceeding), is the right of first refusal. This says that the incumbent utility can take over any transmission project proposed by an independent after it passes all screening processes. (There is apparently no legislative basis for this - it is simply a peculiarity of process that the utilities claim has force of law.)

While we believe that the right of first refusal would not apply to storage projects, this position is contested by others and the uncertainty associated with it is high enough to make it difficult to attract the support necessary to propose storage as transmission asset as an independent entity.

We note that the California Transmission Planning Group has representation of the same utilities that might assert a right of first refusal. Given that CAISO relies heavily on the CTPG for transmission planning, we view this as carrying at a minimum the appearance of potential collusion against independent transmission operators. Frankly, we are surprised the legal departments of the utilities have allowed it.

17. No clear mechanism for independent to deploy storage on the distribution grid

While the distribution wires business is viewed as a natural monopoly, there is no equivalent logic for why storage on the distribution grid should be treated as a monopoly. However there is no clear roadmap for how an independent could propose and deploy storage on the distribution grid. The lack of a roadmap discourages any independence from trying.

18. Storage is not a natural monopoly; storage should not be owned and operated by existing monopolies

As there are few economies of scale for storage, storage is not a natural monopoly and the CPUC should rule that storage is a competitive service that cannot be provided by existing monopolies.

The best way to encourage rapid innovation in storage and appropriate adoptions is a portfolio standard that requires the open competitive procurement of storage by utilities.

There is a perception among many investors that utilities will deploy all the storage and this chokes off funding for an innovative, vibrant, competitive storage ecosystem

19. Behind the meter storage costly; impractical to deploy GWs

An alternative way to deploy storage on the distribution grid is to locate it behind the customer meter. However this has its own significant difficulties associated with it, including the high sales cost of convincing end customers of the value of storage, the high cost of civil engineering to make room for storage around each site's pre-existing buildings and roads, and the high number of sales calls required and truck rolls needed in order to deploy a meaningful amount (e.g. 100 MW) of grid scale storage. Quite frankly it's impossible to see how California could deploy GW of storage in a timely manner to meet the needs of the 33% RPS if it's based on sites

with tens of kilowatts behind each customer meter. We note a very important difference between storage and solar panels in that storage takes a significant ground-level footprint due to its weight, whereas solar is typically roof mounted and thus is not displacing existing assets or valuable ground-level space.

20. Storage Deployed for Generation Can't be Used for Transmission, and Vice Versa

Under current rules, storage that is deployed as a generation asset cannot be used for transmission benefits, and vice versa. The basis of this prohibition is concern that transmission operators are privy to information that would give them an unfair advantage in participating in the markets. The highest and best use of storage is achieved when it can provide a wide range of services including both services related to operating as a generator and services related to operating as a transmission asset. We encourage the CPUC (and FERC) to find an effective way to unlock this full potential of storage. Without this capability, it becomes more difficult to monetize the storage.

Possible solutions are operating the storage as a transmission asset according to a fixed profile, which is the approach used when the TransBay Cable face similar regulatory barriers. Another option is to allow an independent third-party to bid the storage transmission asset into markets associated with generation functions such as frequency regulation.

Barrier Group C - Financing and Deployment

21. Project funding is challenging for storage

While not impossible to obtain, project funding for storage is certainly a lot more difficult to obtain than project funding for a more familiar asset such as a wind farm or solar site.

A key major barrier to unlocking project funding for storage is the availability of long-term, certain revenue streams that extend over the life of the project (e.g. 10 to 20 years.) AB 2514's establishment of procurement processes for storage go a long way to providing certain long-term revenue for storage facilities. (See also AES workshop presentation, slide 11)

22. Warranty terms, performance guarantees and 'deep pocket' guarantors

Deployment of large amounts of storage will require battery manufactures and storage vendors to provide performance guarantees for the life of the project (typically 10-15 years). If the battery company and storage system company are not very deep pocket firms with multiple lines of business, it is highly likely an independent guarantor (or insurance for) the performance guarantee will be required by the project financing source.

These types of guarantees can be arranged for some of the more proven storage technologies, but they are a complicating factor, and particularly for younger storage technologies, can serve as a substantial barrier. This is one of the reasons that transitioning a new storage breakthrough to grid scale deployment can take decades.

23. Lack of standard product for some storage technologies

For some storage technologies, such as lead acid, there is a lack of a standard storage system that can be deployed in megawatt sized units. These standard building blocks are available for NAS and from some Li Ion storage vendors.

24. Incentives not carefully targeting storage. Confusion between storage and demand response.

Storage that provides electricity-in and electricity-out is fundamentally different from types of energy storage that only have electricity-out (for example fossil fuel storage) or only have

electricity-in (for example, thermal storage, both for chilling and for heat, such as hot water heaters.)

Storage incentives typically lump all these types of storage together, so regulatory bodies lose the opportunity to specifically target electricity-in-electricity-out storage for incentives that would lead to wider-spread commercialization and innovative deployments. Frankly, without these incentives for batteries and flywheels, it is easier to just install another hot water heater or ice chiller on an air conditioner. These thermal technologies can double dip in both storage and demand response incentives, so they crowd electricity-in-electricity-out storage out of the market.

Unfortunately AB 2514 includes both electricity-in-electricity-out and thermal storage. We strongly encourage the CPUC to set distinct goals for each to allow it to ensure precision application of its policy objectives.

25. Manufacturing capacity

Due to the above uncertainties, there has been little incentive for battery manufacturers to add capacity for the grid-scale market. It will be difficult to get 4 GW installed by 2020 in the absence of significant capacity expansion, especially if other regions also start buying large quantities of storage.

If the CPUC moves expeditiously with a clear portfolio standard for electricity-in-electricity-out storage, manufacturers still have sufficient lead time to ramp capacity to meet California's needs.

Summary

As outlined above, there are substantial barriers to deploying storage using the existing deployment models. For that reason, MegaWatt has been advocating a storage portfolio standard. We applaud Governor Jerry Brown, Representative Nancy Skinner, former Governor Schwarzenegger and the CA Legislature for their foresight in drafting and approving AB 2514. We look forward to the CPUC delivering an implementation plan that will prove to be visionary and pro-storage, which will prove to be pivotal in CA meeting its 33% RPS and continuing to provide world leadership in providing a clean, green grid.

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Dated August 29, 2011

Respectfully submitted,

_____/s/_____

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List of Attachments:

Exhibit A - Cazalet Editorial "Evening Out Renewables", Ed Cazalet, from *California Energy Circuit,* April 17, 2009 (3 pages)

Exhibit B - "California 2020 Vision: GigaWatts of Clean, Fast and Deep Electric Storage" - California Energy Commission Staff Workshop - Energy Storage Technologies and Policies

Needed to Support California's Renewable Portfolio Standard (RPS) Goals of 2020, Ed Cazalet, April 2, 2009 (4 pages)

Exhibit C - Comments of MegaWatt on Rulemaking R.08-12-009 (11 pages)