DEPARTMENT OF ENERGY QUADRENNIAL ENERGY REVIEW
STAKEHOLDER MEETING ON ENERGY FINANCE

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WRITTEN STATEMENT OF JUDITH JUDSON
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Thank you for the invitation to address the Department of Energy as it contemplates policies to incent the financing and investment needed to modernize the nation's transmission, storage and distribution infrastructures. My name is Judith Judson. I serve as Director of Emerging Technologies for Customized Energy Solutions where I have worked with numerous storage developers and investors seeking to build electric storage infrastructure across the US power grid. Prior to this role I was Vice President of Asset Management and Market Development for a leading storage developer where I learned first-hand the challenges to finance commercial-scale energy storage facilities. Before that I served as Chairman and Commissioner of the Massachusetts Public Utilities Commission ("PUC") where I regulated utility infrastructure investment and determined rate treatment and cost recovery. My comments today focus on investment and financing of electric storage infrastructure, but I am happy to take questions on regulatory issues more broadly related to TS&D infrastructure.

BENEFITS OF STORAGE

As an emission-free technology, energy storage can enhance the efficiency, resiliency and cleanliness of the entire electric grid, modernizing the way we generate and deliver electricity. Traditionally electricity had to be produced, delivered, and consumed instantly, creating the need to size the power generation, transmission and distribution system for the highest peak demand creating inefficiencies, added cost, and underutilization of assets. Advances in electric storage technologies are enabling more efficient use of generation, transmission and distribution infrastructure.

More recently the growth of intermittent variable wind and solar generation has further increased the challenge for grid operators to reliably balance supply and demand. A study by Carnegie Mellon estimated that 20% of the CO2 emission reduction and up to 100% of the NOX emission reduction expected from introducing wind and solar power will be lost because of the additional ramping requirements these resources impose on traditional generation.[1] Storage provides the ramping capability to integrate renewables into the electric grid without consuming additional fossil fuels.

Over the past several years advanced energy storage technologies, such as batteries, flywheels, compressed air storage, and thermal storage have proven to be technically viable for applications

[1] Katzenstein, W., and Jay Apt. Air Emissions Due To Wind And Solar Power. *Environmental Science & Technology*. 2009, 43, 253-258. http://pubs.acs.org/doi/pdf/10.1021/es801437t

across the grid such as shifting low-cost off-peak power to periods with high demand, providing fast-ramping ancillary services, firming renewables, reducing transmission and distribution circuit and line overload, supplying voltage support, and enabling grid resiliency. As an emission-free technology, energy storage can enhance the effectiveness of the entire electric grid, maximizing the efficiency of traditional and renewable resources alike.

CHALLENGES TO FINANCING ELECTRIC STORAGE

However, there are several challenges to the financing modern energy storage, including perceived technology risk, lack of market compensation for all the value streams provided by storage, lack of long term contracts for services, and regulatory barriers to utility adoption. While many energy storage technologies have been proven to be viable resources, the investment community and utilities still view them as higher risk than conventional generation technologies.

POLICY LEVERS TO ATTRACT PRIVATE CAPITAL TO FINANCE STORAGE

There are several policy levers that can be used to attract private capital and utility investment in electric storage technologies. On the debt side, policies to enable revenue certainty through long-term contracts and government programs to reduce technology risk are needed to enable traditional project debt financing. On the equity side, market mechanisms to enable the full value of storage to be monetized, as well as favorable tax policies will encourage equity investment.

Policy recommendations:

- State or Federal Infrastructure Banks. Many of the early grid-scale battery and flywheel projects operating on the grid today were financed through the DOE loan guarantee program and/or through federal and state stimulus grants. These programs were essential to reducing technology risk and attracting private debt and equity capital needed to fully finance these projects. Such programs continue to be important to storage financing.
- Market products that fully value the benefits provided by storage and send appropriate price signals for investment. Many of the benefits of storage, such as improved efficiency and flexibility, are not compensated in today's wholesale electricity markets. A study by Carnegie Mellon showed that the use of large-scale storage could save consumers up to $4 billion annually in PJM due to reduced peak prices and reduced reliance on expensive peaking generators.[2] However, the only market construct to compensate storage for this service today in PJM is energy arbitrage where revenue declines as more storage is deployed. Storage assets should be eligible for capacity market payments in regions where these markets exist. Furthermore, market products for ramping and/or flexible capacity will be needed to attract investment in resources that can reliably integrate large amounts of renewable resources.[3] Without adequate compensation mechanisms to monetize the value created by storage it will be difficult to finance.

[2] Lueken R. and Apt, J. The effects of bulk electricity storage on the PJM Market. Received: 21 October 2013 / Accepted: 14 April 2014 Springer-Verlag Berlin Heidelberg.

[3] In 2015 the California ISO is implementing a flexible ramping product and new flexible capacity requirements in order to attract the resources necessary to reliably meet California's renewable energy target of 33% renewable generation by 2020.

- Storage Portfolio Standards and/or Procurement Targets to enable Long Term contracts for storage projects. Even where market compensation does capture the value of storage, such as in the frequency regulation market[4], the lack of long term contracts and reliance on short term volatile market revenue makes it difficult to obtain traditional project financing. Storage portfolio standards would enable storage projects to obtain long term contracts as it did for the wind and solar industry. In California, where the PUC has mandated utilities to procure 1.3 GWs of storage by 2020, investment in storage is booming.
- Federal/State Investment Tax Credits ("ITC") for storage. An ITC for storage would stimulate investment by reducing project development cost and investment risk.[5]
- Reduce regulatory barriers to storage used for multiple purposes: Storage doesn't fit neatly into the current infrastructure categories of generation, transmission, or distribution. For example, the same storage asset can be used by a utility to reduce distribution circuit overloads and provide frequency regulation to the wholesale market, but regulatory barriers in many places prohibit such dual uses for a single asset. One solution would be to enable utilities to contract with third-party storage providers for the T&D use of the storage asset while allowing the storage provider to sell wholesale services with the remaining portion of the asset. Such contracts would enable financing of these projects using private capital.
- Encourage storage to be investigated in all transmission, distribution and integrated resource planning studies conducted by utilities and regional transmission operators. Including storage in planning will help identify where storage investment could provide benefits to the transmission and distribution system, making investment less risky. In addition, this should be coupled with a clear signal from policy makers that storage solutions identified in planning will be eligible for rate treatment and cost recovery.
- Encourage regulatory policies that enable new technology investment, such as forward test years. Regulatory certainty is key to reducing investment risk.
- Clarify storage treatment for Property and Sales tax. Many developers of storage projects providing wholesale ancillary services today have run into unclear state and local tax policy for storage. Often property and sales tax is different for generation assets versus T&D assets. Given that storage fits neither category neatly, it requires developers to spend legal resources to work with local authorities on proper classification raising project costs and investment uncertainty. DOE leadership on guiding principles for such tax treatment would greatly facilitate storage development.

This concludes my remarks, thank you for the opportunity to provide comments.

[4] In 2011 FERC issued Order 755 which reformed the way storage resources were compensated to provide frequency regulation.

[5] A 2012 study by the Copper Development Association and KEMA shows that a storage ITC could nearly quadruple the amount of storage on the grid. http://www.copper.org/environment/sustainable-energy/energy-storage/education/KEMA-Report-for-CDA-US-Storage-Market.pdf

APPENDIX

The following figure summarizes policy levers to spur equity and debt financing of storage projects (source: Energy Storage Association).

	Revenues	Costs
Equity Profits	• Open markets • Pay For Performance • Multiple Value Streams ➢ **FERC/ISOs**	• Investment Tax Credit • Tax Policy • Energy ➢ **Congress/FERC/PUC**
	Revenue Certainty	**Technology Risk**
Debt Risk	• PPAs • Procurement Targets • Rate-base ➢ **State PUC/FERC/utilities**	• Loan guarantees • R&D funding ➢ **DOE, Congress**