Energy Storage: Framework for Developing Regulation[1]

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Energy storage projects could address numerous challenges facing utilities and their regulators. They could improve reliability in constrained areas. They represent an **alternative to the construction of new transmission** to import remote generation to load centers. They could add competition to markets for **ancillary services**. Finally, by firming variable-output electricity sources (such as wind and solar), storage could facilitate expanded **growth in renewable energy production, delivery, and use**. Though some storage technologies are tested, many are new, as are the types of services and transactions their use will necessarily entail.

Here we outline a framework for researchers and regulators to systematically account for the regulatory challenges associated with energy storage. We invite researchers, regulators, and others in the industry to provide their ideas on the questions or frameworks.

I. What Are the Possible Transactional Relationships Involving Electricity Storage?

Storage transactions can involve three distinct roles, although in some cases a single party can play more than one role. The three roles are: producers of the to-be-stored electricity, buyers of the stored electricity, and owners of the storage facilities. Each category contains multiple possibilities. Understanding these roles and possibilities, and their potential transactional relationships, is a prerequisite to: (a) designing tariffs that will serve to properly assign costs and benefits to each participating party such that their participation might be cost-effective for all economically viable energy storage technology options; and (b) tracing the jurisdictional responsibilities of regulators.

[1] This paper can be accessed online at http://www.nrri.org/pubs/electricity/NRRI_energy_storage_outline.pdf.

A. Producers of to-be-stored electricity

Electricity used to power storage projects could come from multiple sources. It could come from power produced by **utilities** and purchased at either the wholesale or retail level. **Parties that own storage** could produce the energy themselves. An example would be owners of wind generation using storage to "firm" their power. The power could also come from **other non-utility generators**, such as wind farms. Numerous states are wrestling with how to regulate renewable energy transactions among non-utilities, or between non-utilities and utilities. Such issues also arise when considering energy storage transactions.

B. Buyers of stored electricity

Different parties could also purchase stored electricity. Owners of stored electricity could sell it as conventional electricity in the **RTO day-ahead or real-time markets**, presumably to arbitrage between the lower off-peak and higher on-peak values of electricity. Storage owners could also transact in **other RTO markets, including capacity and ancillary services markets**. Alternatively, they could sell electricity directly, either to their **native utility or to any retail customer or both**. In such a case, could the price be negotiated, or should regulators establish a tariff to determine rates?

C. Ownership of the storage facilities

Storage projects could also vary by who owns them. Storage projects include **small retail customers**, such as owners of battery-electric or plug-in hybrid electric vehicles (PHEVs). Do net metering policies accommodate such owners? **Utilities** could also own storage projects. Finally, **independent parties**, such as the owners of the proposed Tres Amigas facility, could also own storage facilities. Should such parties receive market-based rate authority?

II. How Can Tariffs Best Reflect Costs Caused by and Benefits Received from Storage-Related Transactions?

Regulators must determine and apply cost-causality principles to storage transactions. Such principles apply to both the compensation provided to storage owners for the delivery of stored energy – be it from RTO markets, utilities, or third parties – and the valuation of power used to recharge storage projects.

A. What are the potential benefits of storage and how could tariffs reflect their value?

Electricity from storage could, much like pumped water storage, serve load by arbitraging differences in the peak and off-peak value of electricity. In **organized wholesale markets**, should such power be sold in the day-ahead or real-time markets? Similarly, in such markets, what is the proper valuation of ancillary services provided by stored energy? **Ancillary**

services could follow naturally if spot market prices are applied, but operational requirements and pricing might need to be added if storage were to be utilized in place of spinning reserve. Additionally, should stored energy receive the same compensation as **demand response** resources, or do their physical characteristics differ such that they should be treated differently? How should any of these transactions and their associated tariffs differentiate between the **various types of storage**? Finally, who should **publish rates** in machine-readable form for real-time use in managing storage operations: the RTO/ISO, utility, or PSC?

B. What should storage projects pay, for both the electricity they store and their use of the transmission and distribution systems?

As described in Section One above, storage projects differ in their source of energy. Should utility tariffs treat them as a **distinct customer class** with different rate structures if they purchase utility-generated electricity? If so, under what rates should they operate (e.g., **real-time or time-of-use rates**)? How would such rates differ between those in organized wholesale markets with locational marginal pricing and those in the service territories of traditionally regulated utilities? Where storage projects purchase electricity from non-utility generators, should regulators permit negotiated rates or require that rates follow commission-approved tariffs?

What responsibility do storage projects have for interconnection costs? How, if at all, should their interconnection processes and allocated costs differ from that of generators? How much of system **transmission or distribution** costs should third-party owned storage projects be allocated? Should such cost allocations differ for different classes of storage projects? Additionally, how should we account for any increases or decreases in transmission and distribution **losses that occur as the result of new storage capabilities being added to a utility system?**

C. How should regulators account for location-specific costs and benefits of storage facilities?

Depending on where they are located, storage facilities could produce additional costs or benefits to transmission and distribution systems. If they locate on the constrained side of load pockets, for instance, they could alleviate congestion and improve reliability. Alternatively, they could create or exacerbate transmission or distribution bottlenecks. Should regulators rely on locational marginal prices to send market signals, or should they consider a fee-bate approach in which the utility makes public the fees or rebates that would be given or assessed to projects that are located in specific places based on their effects on the transmission system?

III. Between State and Federal Regulators, Who Has Jurisdiction Over Which Aspects of Storage-Related Transactions? Will the Status Quo Work Without Modification?

Part III would begin with a straightforward analysis of each type of transaction, explaining where jurisdiction would lie under present statutes. It then would assess whether current law produces rational jurisdictional results. Among other things, it would:

A. Explore, where relevant, the distinctions between **RTO and non-RTO contexts**, and between states with and without retail competition;

B. From the retail customer's perspective, explain the difference between transactions that do not subject them to state regulation, transactions that do involve state regulation, and potentially transactions involving **FERC regulation**;

C. Perform a similar analysis for owners of storage who wish to sell their stored electricity at **retail or wholesale** (such as to utilities and buyers in RTO markets);

D. Assess the legal paths already created by FERC and states for **net metering** and for **DSM aggregation**, exploring the applicability of those precedents to storage-related transactions;

E. Assess the extent to which state-jurisdictional net metering tariffs could accommodate **small-scale storage**; and

F. Examine the distinctions between **interconnection policies** and practices at the state and FERC levels, to assess their appropriateness for various storage transactions.