Electricity Storage: Policy Issues

Summary

Energy storage offers benefits by "time shifting" electricity – allowing it to be produced at one time for consumption at another. Emerging energy storage technologies can have different applications within the electric grid system, delivering a number of different benefits in combination.

Policy questions arise in various forms depending on the context of where and how storage is being used -- T&D owner / operator, wind farm operator, merchant storage provider and community storage. The nature of storage blurs the current "bright lines" that separate one value chain position from another for purposes of regulatory treatment, market participation, and allowed business application. Most incentive, cost recovery, market regulation, and tariff decisions classify assets narrowly into the familiar spaces of generation, transmission, distribution, and consumer.

Possible solutions to the storage policy questions include investment tax credits, new cost recovery models and creating a favorable environment to bring distributed / community applications of storage to market.

Current policy status

Senator Wyden's Storage Technology of Renewable and Green Energy (STORAGE) Act of 2009 (S.1091) extends investment tax credits to electricity storage. The ARRA will fund a number of large scale storage demonstration projects. It also provides for loans and other funding for storage manufacturing as well as expanded R&D in storage technologies.

Despite these very significant efforts in developing and promoting electricity storage there are a number of broad policy issues that are barriers to adoption of storage by the electric energy industry.

Background

The DOE Energy Advisory Committee Storage Subcommittee report on Storage is an excellent reference document for the current state of affairs, potential benefits, technology needs, and policy issues around electricity storage (see: www.oe.energy.gov/1158.htm).

Storage provides benefits across all parts of the electricity value chain: generation; trading; transmission; distribution; and consumption / conservation.

Storage "time shifting" benefits alone can be numerous and cut across the entire utility. For example:

- A two megawatt storage battery on a distribution system can be used to unload a distribution main feeder, defer the installation of a new station transformer, unload a transmission line and marginally defer the need for additional generation.
- It also can provide delivery of energy from a local storage device when the area around that device is temporarily disconnected from the grid. In these regards storage provides similar benefits as storage facilities provide to other commodities in many fields.
- Large grid-connected storage also can be used to enhance grid reliability via a number of technical approaches that are unique to electricity (as opposed to other commodity storage).

- And finally, the time shifting aspect makes it particularly useful in dealing with the uncontrollable variability or volatility of renewable energy resources, especially wind and solar – storage can smooth out renewable production across a wide range of time frames and greatly assist in grid integration and overall cost reduction.

Depending upon where it is connected to the grid, one storage asset can provide a number of these benefits in combination. This is where the policy issues come into play as most incentive, cost recovery, market regulation, and tariff decisions classify assets narrowly into the familiar spaces of generation, transmission, distribution, and consumer – and built into these classifications are explicit and implicit assumptions about the technical and functional capabilities of the assets all of which originate in a paradigm of “electricity can't be stored."

Policy and regulatory issues

Specific policy and regulatory issues that arise with storage include:

- **T&D owner / operator –** Transmission owners and distribution system owners are seen as a regulated, cost recovery based delivery service that instantaneously delivers energy from generation to consumers. As such, they have no equity interest in the energy commodity and are only paid a transportation charge; which is calculated to recover allowed costs and adjusted after the fact.

  However, a T&D owner / operator that employs a storage device to enhance reliability is arguably taking control and possibly "ownership" of the energy between the time when it is stored and when it is discharge/delivered back to the grid. Depending upon the circumstances, the relative value of the energy may be altered (usually increased) between the storage and discharge times.

  This blurs the line between the energy generator or trader and the wires owner / operator. When that value is changed, who should realize the gain or loss? How should that be factored into allowed cost recovery for the storage device? How does a storage device connected to the transmission system and used primarily for reliability on a cost recovery basis relate to a similar device similarly installed but used by a merchant entity for arbitraging energy prices over time? If a storage asset is classified as one or the other, what financial rules should apply when it is used for the other purpose either out of necessity, opportunity, or inadvertently?

  This particular issue has actually arisen in practice already in applications of storage such as an American Electric Power (AEP) project in Presidio, Texas. In the AEP Presidio project, the storage device was being installed to economically improve reliability in Presidio which is located at the border with Mexico. Since generation is a competitive business in Texas, it raised questions about the energy in and out of the storage device. In the end however, the project was approved as regulatory bodies in Texas understood the important benefits.

- **Wind farm operator** – A wind farm operator lives and dies by the Production Tax Credit today – a credit paid on the actual production of wind energy and delivery to the grid. When wind farm production is limited by transmission congestion—which frequently occurs today and will grow as an issue until transmission is fully built out—storage is an attractive option for alleviating the problem. In effect, the storage device will increase the PTC payments for the wind operator by avoiding "dumped" energy due to transmission congestion or lack of demand or both.

  If that storage device is already receiving a storage investment tax credit, is this double dipping? And, if the storage device is a regulated transmission asset that is relieving congestion, who "owns" the energy in it and realizes the gain/loss on the energy from time variable pricing? Is the current regulatory model for gas storage appropriate in this instance?

- **Merchant storage operator** – The only "clear" regulatory case today is if the storage asset is owned by a merchant storage provider and is neither the wind farm operator nor the transmission owner. Presumably in this case, any use of the asset by the grid operator for reliability purposes will be addressed appropriately via the ancillary services mechanisms in place or under development. But if the asset is a transmission asset owned by the transmission owner – thus the congestion relief application being paid for by cost recovery and the financial gain accruing to the wind farm operator – should the transmission owner be able to access ancillary services revenues and on what basis?

- **Utility "community storage"** – The concept of "community storage" as espoused by AEP is another example. AEP makes a convincing case that small scale storage deployed on the distribution secondary (hypothetically adjacent to each pad mount transformer) can be used to greatly improve the distribution system reliability as seen by the consumer – a few homes can each be carried by the storage for the hour or two it takes the utility to restore service.

  AEP's vision, shared by more and more people, is that batteries which have reached an end of useful life in electric vehicles (when the battery degrades to 70-80% of original charge capacity) are still useful for stationary utility storage and can be economically redeployed into community storage.

  In the longer term, "community storage" could also mitigate the issues on a distribution system created by widespread residential and commercial solar energy. Widespread solar energy will create problems on distribution circuits that are analogous to wind energy on transmission systems. As the price improves with volume and technology, "community storage" could become an attractive option for ownership by home owners, businesses and commercial third parties as well as utilities.

  The regulatory issues around community storage will be first to establish principles of forward cost recovery by utilities and second the issue of time shifting energy delivery (again). The cost recovery question is critical as it will establish the battery end of life value – which will directly affect the purchase / lease cost of an Electric Vehicle.

Proposed policy solutions

Addressing electricity storage policy questions hinges, in part, on defining a new asset class. A proposed storage asset description could be based on the following key points:

An Electricity Storage Device (ESD) is a depreciable capital asset with the following characteristics:

1. *Has the ability to store (receive and supply back) a definable amount of energy (joules or gigajoules) to an electrical network or electrical grid*

2. *Has a definable rate of both storing and providing the stored energy (watts and watt-hours respectively)*

3. *Has a definable calendar life (years) under specified conditions*

4. *Has a definable cycle life (total kWh transferred) under specified conditions*

5. *Has definable maintenance criteria and schedule*

6. *Has a definable round trip efficiency (including parasitic losses) to be used for economic analysis*

7. *Can be designed for use in one or more specific applications to optimize grid operation and energy economics*

In addition to defining storage assets for the purpose of regulation and tax treatment, some proposed solutions to these policy questions could include:

- **Establishing investment tax credits** that will effectively stimulate storage investment in applications such as wind farms, transmission stations, and community storage and which will not be negated by other regulatory or tax credit effects.

- **Establishing a model similar to the gas storage model** for transmission connected storage that allowed cost recovery on a regulated basis by the utility; a reasonable charge for the use of the storage; and ownership of the energy by merchant organizations – or integration of arbitrage net gains with regulated financials.

- **Creating a favorable environment for utilities** to arrange future sale/lease arrangements with electric vehicle manufacturers and financial third parties such that today's EV sales can benefit from the community storage application; and such that utilities are protected from after-the-fact recovery adjustments triggered by declining battery costs, for instance. Independent of the EV question, storage investments should not be subject to after-the-fact recovery adjustments triggered by inevitable technology improvements.

For additional information, contact:

KEMA
info.consulting@kema.com
T: +1 781 273 5714