Storage: threat or opportunity for electricity distribution utilities?

Given the potential for energy storage to disrupt demand and affect all segments of the value chain, how can electricity distribution utilities turn it to their advantage?
Introduction: Why utilities must not get blindsided by storage

A few years ago, electricity utilities across the world were caught off guard by the advent of mass market solar photovoltaics (PV). Opportunities for investment were missed and demand was disrupted before the required interconnection details and regulatory constructs were developed. Now another disruptive new technology is coming onto the scene: battery storage. If the industry lets itself get blindsided again, the impacts and lost opportunities could be even greater.

Why? Because, while PV has been disruptive to total energy usage and interconnections, battery storage could be more disruptive by impacting peak demand. And whether this disruption poses a threat or opportunity to today’s utilities depends on several factors – especially the extent to which regulatory regimes and the industry’s business models can be adapted to a world of widespread storage.

For distribution utilities there are two urgent questions. First, how will mass deployment of storage-related technologies impact the business and how can this be steered to provide benefits to the operations of the network and ultimately the broader consumer base? Second, how can direct deployment of storage by the distribution business itself help to transform the business?
An evolving landscape of declining costs and improving controls

These imperatives are playing out in a fast-changing storage landscape characterized by two main trends. The first is that the costs of storage technologies are continuing to fall steadily, particularly for Lithium-Ion and Flow batteries. Reducing costs are bringing storage solutions within reach of end-consumers, making deployment economic for systems that optimize demand in environments with varying tariffs. Potentially, the largest deployment opportunity for storage globally is through electric vehicles, which are moving inexorably towards mass deployment as costs reduce and ranges increase. Additionally, large scale front-of-the-meter deployments could provide significant benefits to the grid, and unsubsidized Lithium-Ion is already cost-competitive for frequency regulation services in some locations.

The other trend is that the control systems for energy storage are becoming increasingly sophisticated, opening up opportunities beyond the traditional storage applications such as energy arbitrage, renewables integration and backup. The challenge for utilities is working out which use cases are applicable to their own business, and which levers they can pull to generate revenue gains and cost savings.

Sophisticated control systems for storage open up stackable benefits across multiple use cases. As Figure 1 illustrates, the ability to deliver alternative services through smart inverters could open up new revenue streams. In this case, revenues from the core service of frequency regulation can be augmented by energy arbitrage and solar integration services – with each use case adding to the overall benefits. Over two dozen quantifiable use cases have been identified, requiring analyses to see which ones can be stacked for maximum value.

Unlike PV, storage solutions can reduce, or increase peak demand...

While PV has the effect of reducing overall load, it tends to have little effect on peak demand, which is the main driver of distribution network investments and costs. However, storage changes the game, by opening up the potential for energy generated from sources such as solar PV to be stored and consumed at peak times. In contrast, the charging of storage for electric vehicles opens up a potentially vast new source of consumption that could drive peak demand much higher if uncontrolled.

This shift could be positive or negative for distribution utilities, depending on the regulatory regime and their operational model. And it raises a host of questions about the control, ownership and location of storage, including whether it’s “in front of” or “beyond” the meter, and whether utilities should own and/or control storage themselves or access it from third-parties.
So, is storage a threat to utilities...?

As energy storage technologies improve and deployment accelerates, we are in a situation where utilities, industry regulators and battery manufacturers are all seeking the best way to value storage. But does its roll-out fundamentally pose a threat to utilities?

Accenture’s latest annual *Digitally Enabled Grid* research indicates that over a third of distribution utilities regard energy storage as a growing threat to their revenues. As Figure 2 shows, when we presented utility executives globally with a range of threats, storage was the only one showing an upward trend over the past three years. However, many distribution companies also see storage as a significant opportunity area with 47% of respondents seeing storage as a source of moderate to significant revenue upside. This raises the question of why is there such uncertainty about the revenue impacts of storage on distribution companies?

To the extent that storage does pose a threat, its nature varies between different types of utility. For “pure-play” distribution companies, beyond-the-meter storage potentially impacts demand—and if their revenues are dependent on total demand, their revenues will suffer. However, this is largely a tariff design issue arising out of the coupling of demand with revenues—an approach that drives perverse incentives for distribution businesses.

Accenture’s *Digitally Enabled Grid* research indicated that 84% of respondents believe that a new tariff model for distribution should be a priority regulatory change within the next ten years. This could potentially allow distribution companies to incorporate beyond-the-meter storage deployment by consumers into a more efficient network design without taking a hit on their revenues.

As we have highlighted, the answer is shaped by the regulations applied. For example, experience in Hawaii and Germany has demonstrated the benefits of having clear regulatory mechanisms in place governing the deployment of storage by customers. In Hawaii, customers can get rapid approval for storage deployments linked with PV if they don’t export power to the grid. This approach can limit the integration costs of increased PV deployment by reducing the shedding of excess generation on to the network at times of low demand.

![Figure 2: What impact will the following network assets have on your organization by 2030?](image-url)

**Moderate to significant revenue reduction (%)**

<table>
<thead>
<tr>
<th>Anticipated revenue reduction</th>
<th>PEVs and charging stations</th>
<th>Energy storage solutions</th>
<th>Microgrids</th>
<th>Distributed generation (eg. PV, fuel cells)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>19</td>
<td>23</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>2014</td>
<td>29</td>
<td>32</td>
<td>61</td>
<td>61</td>
</tr>
<tr>
<td>2016</td>
<td>6</td>
<td>36</td>
<td>58</td>
<td>58</td>
</tr>
</tbody>
</table>

*Base: All respondents; excludes “Not applicable” answers. Source: Accenture’s Digitally Enabled Grid program, 2016 executive survey.*
Risks posed by beyond-the-meter storage

For vertically integrated utilities, the threat of beyond-the-meter storage has significant structural implications, with load shape and peak load changes impacting existing and future generation portfolios. For merchant generators, the main exposure could be commercial & industrial (C&I) customers reducing their consumption at higher-priced peak times.

A further risk is that storage may act counter to utilities’ demand response schemes. Faced with a choice between using battery storage to time-shift their usage or changing their consumption habits, many customers might choose to use storage and carry on behaving as they’ve always done.
...or a major opportunity?

Overall, the context in which energy storage presents a threat to utilities is where traditional utilities are running traditional operating models within a traditional regulatory regime. But what if these traditional constructs are replaced by new ones that reflect the realities of a world that’s both digitized and more advanced in terms of storage technologies?

In a previous point of view paper in this series – Evolution is no longer optional for utility distribution companies – we have already mapped out what we think the successful distribution business of the future will look like.

We envision the emergence of a range of potential models, including the decoupled integrated utility, the specialized smart grid operator, and the platform access provider. But in our view the most sustainable model will be the “distribution platform optimizer” – managing and coordinating all elements of the energy distribution system end-to-end to provide the optimal overall outcome.

In such a new construct, the opportunities presented by storage become clearer. Nevertheless, this reshaping of the industry and energy system will require fundamental changes to the prevailing regulatory structures, freeing up utilities to make the optimal decisions on investment, ownership and access to storage. In their new distribution role it should be largely irrelevant whether storage is owned by the distribution company, embedded but owned by a third party provider or beyond-the-meter as part of a consumer installation – the only consideration is how the asset can provide services to improve network optimization and the broader electricity system.

These changes should also avoid the risks to energy networks posed by uncontrolled and un-incentivized customer deployments of storage, and open up a growing array of potential use cases. Some examples of current use cases are summarized in the accompanying information panel.

As storage deployments accelerate and viable use cases proliferate, this will support the creation of power grids fit for the 21st century: networks able to harness the full potential of distributed resources including energy storage, solar PV, smart inverters and more, while also ensuring greater energy efficiency and more controllable loads. Today’s centralized design could be replaced with a system that generates higher economic benefits at lower cost, offers customers greater choice and value, makes grid planning and operations more flexible, and supports de-carbonization. In a recent research report, SolarCity estimated the net societal benefits resulting from such a transformation at more than US$1.4 billion a year by 2020 for California alone.
Some sample use cases for storage

Generation Example: Renewable integration and firming

In this use case, storage is used to optimize the output and reactive power capabilities from renewables generation, as well as to mitigate rapid output changes by charging when there is excess renewable generation and discharging when output falls. Value levers include:

- Reduced/eliminated renewable energy curtailment during spikes
- Improved predictability/firmed output, avoiding penalties from not meeting scheduled output
- Reduced generation opex from avoided ramp-up/ramp-down of thermal plants
- Increased power quality (e.g., frequency, voltage control)
- Reduced emissions and emissions costs.

T&D Example: Asset investment optimization and reduced wear and tear

Here storage is used to reduce/defer the need for transmission, substation and other T&D investments through co-located energy storage supporting end-user peak demand and improved utilization of assets. This reduces wear and tear on T&D equipment through improved voltage and frequency regulation and reduced peak load. Value levers include:

- Optimized capital from T&D investment deferral
- Reduced O&M cost
- Increased asset life
- Reduced outage rates.
These opportunities are already on utilities’ radar as underlined by our Digitally Enabled Grid research.* As Figure 3 shows, many utilities expect network-related storage to play an increasingly important role in active management of the network. Countries such as Australia and Germany, as well as US States like Hawaii and California, are already experiencing growing interest and deployment of such solutions.

Utilities also acknowledge that progress towards a more optimized distribution grid will depend on the development of a new regulatory model – one that enables distribution businesses to put optimization of the network before capital investment. In particular, they see tighter collaboration with regulators as an imperative to realize the full benefits of storage and other emerging technologies (see Figure 4). Similarly, many respondents also expect to deploy smart charging approaches for electric vehicles, with 75% seeing moderate to significant growth in such approaches over the next ten years.

In our view, a first step for distribution utilities could be to modify their tariff structures to start embedding a new way of managing the network – breaking the volume-revenue linkage, and providing incentives to use innovative solutions to reduce costs for customers. As they plan out such moves, the momentum of investments in storage looks unstoppable: as Figure 5 shows, storage is emerging as a critical investment area, with over three-quarters of respondents already investing or expecting to invest in storage in the next ten years. Indeed, this wave of investment is already gaining pace in markets like the US and UK.

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Figure 3: Please indicate the extent of growth you expect to see in the following types of storage on your network, 10 years from now?

<table>
<thead>
<tr>
<th>Storage type</th>
<th>Moderate growth</th>
<th>Significant growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage to support renewable integration/optimization (e.g. smoothing PV exports)</td>
<td>44</td>
<td>21</td>
</tr>
<tr>
<td>Storage to improve network operations/power management (e.g. frequency regulation, voltage)</td>
<td>45</td>
<td>12</td>
</tr>
<tr>
<td>Storage to allow deferral of network capital</td>
<td>34</td>
<td>6</td>
</tr>
</tbody>
</table>

* Base: All respondents  
Source: Accenture’s Digitally Enabled Grid program, 2016 executive survey

Figure 4: Which of the following regulatory changes do you believe will be necessary in the next 10 years?

<table>
<thead>
<tr>
<th>Regulatory change</th>
<th>No</th>
<th>Yes</th>
<th>Already in place</th>
</tr>
</thead>
<tbody>
<tr>
<td>New tariff/pricing model</td>
<td>9</td>
<td>84</td>
<td>7</td>
</tr>
<tr>
<td>Greater role for the distribution business in the permitting and authorization of distributed energy resource connections</td>
<td>22</td>
<td>66</td>
<td>12</td>
</tr>
<tr>
<td>Incentives for the deployment of innovative technologies in the network</td>
<td>23</td>
<td>64</td>
<td>13</td>
</tr>
<tr>
<td>Mandate to invest in distributed generation and/or storage to be used for network optimization</td>
<td>41</td>
<td>57</td>
<td>2</td>
</tr>
<tr>
<td>Mandate to use demand response to optimize the network/ manage constraints</td>
<td>25</td>
<td>56</td>
<td>19</td>
</tr>
<tr>
<td>Locational pricing for new distributed generation (medium or low voltage connection)</td>
<td>35</td>
<td>56</td>
<td>9</td>
</tr>
<tr>
<td>Mandate to apply operational controls on third-party distributed generation and/or storage</td>
<td>34</td>
<td>55</td>
<td>11</td>
</tr>
<tr>
<td>The implementation of an outcome-based/competitive revenue model</td>
<td>41</td>
<td>44</td>
<td>15</td>
</tr>
</tbody>
</table>

* Base: All respondents  
Source: Accenture’s Digitally Enabled Grid program, 2016 executive survey
Particular areas of opportunity for utilities include community solar plus storage installations that can be owned either by the utility or locally, and controlled by the utility. And as utilities gain the ability to manage customers’ equipment to reduce their own costs, they will be able to boost network efficiency further by using smart control solutions to provide new services back to the network - investing in “bits instead of kit”. Additionally, if utilities could defer investment in their network by deploying battery storage, they should be incentivized to do so.

Also, while customers’ beyond-the-meter storage may appear a blunt tool for network optimization at the moment, it could play a valuable role in the future. In particular, it could act part of a multi-layered structure where utilities deploy their own storage on the medium and higher-voltage parts of the network, while ensuring local optimization at lower voltages through a combination of beyond-the-meter storage services and demand response that are delivered via direct digital control or economic incentives to customers.
Conclusion: Time to embrace storage opportunities

The mass deployment of beyond-the-meter storage is not in doubt. Distribution businesses need to work with policy makers to ensure that all customers of the network will benefit from this trend through a more optimized and cost-effective system. Evolving the role of the distribution business towards a distribution platform optimizer will help to break the disincentives that currently prevent third-party assets from contributing fully to a more optimized network.

The opportunities created by storage for grid-based deployment are also becoming clearer. The task now is to translate these opportunities into concrete use cases that deliver value both for them and their customers – while also working out how the regulations need to change to enable this to happen.

Today’s regulatory regimes are mostly aimed at fostering prudent investment. The problem is that most regulatory models are unable to appropriately recognize the full value of storage services. Overcoming this hurdle requires new approaches both from utilities and regulators – with regulators moving to more outcomes-based approaches, and utilities taking action to determine the value in storage, assess the regulatory barriers, and develop roadmaps to optimize their systems, with storage as a key part of the mix.

Threat or opportunity for distribution? We think the answer is increasingly clear. It’s time for utilities to embrace the opportunity in storage.
About the Accenture's Digitally Enabled Grid research program

Accenture’s Digitally Enabled Grid program provides actionable insights and recommendations around the challenges and opportunities utilities face along the path to a smarter grid. Drawing upon primary research insights from utilities executives around the world as well as Accenture analysis, The Digitally Enabled Grid examines how utilities executives expect smart grid technologies and solutions to contribute to their future networks.

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References

1. Accenture's Digitally Enabled Grid research program


4. Accenture's Digitally Enabled Grid research program

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Accenture Smart Grid Services focuses on delivering innovative business solutions supporting the modernization of electric, gas and water network infrastructures to improve capital efficiency and effectiveness, increase crew safety and productivity, optimize the operations of the grid and achieve the full value from advanced metering infrastructure (AMI) data and capabilities. It includes four offering areas: Digital Asset Management, Digital Field Worker, Intelligent Grid Operations and Advanced Metering Operations.

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