REDDAL

Energy storage systems (ESS) – disrupting industries

Reddal Insights — 31 July 2015
Per Stenius

Energy storage systems (ESS) are one of the most critical components that is leading the change of the entire energy industry. As technology continues to develop the industry dynamics, the energy sector is likely to be very active, offering opportunities to players with a clear strategy.

This article originally appeared as a post in LG CNS BLOG (www.lgcnsblog.com) on 28.04.2016. Reproduced here with the kind permission of LG CNS.

In my previous post, I gave a general introduction to the smart energy sector and how it is changing. In this blog we focus on one of the most critical components that is leading the change of the entire energy industry (and many other large industries, such as the auto industry), namely energy storage systems (ESS). The changes that ESS is bringing about are so big that there is talk about "utility death spiral"[1][2][3], in which traditional power generation companies see their revenues dwindle and their ability to invest disappear. A vicious cycle is at work – the more utilities lose customers, the higher the cost of their service becomes to those that remain, creating incentives for more customers to depart. Meanwhile, the industry landscape is changing as well; consider the case of Tesla, a leading electrical vehicle producer, that is now stepping into become a major player in the energy industry both through its Li-ion batteries as well as its collaboration with solar power systems providers.This is big business. According to some industry analysts, grid-scale energy storage is expected to generate close to 70 billion USD in revenue over the next decade[4]

Landscape of oil refinery industry with oil storage tank

Beyond simple storage – a new level of advanced functionalities

One usually thinks about energy storage as a simple process of charging energy and then

using it later on – the way a mobile phone battery works. Today's energy storage is more than "charge-n-go", however. With cost effective and reliable energy storage, the way energy distribution works has the potential to change fundamentally. Yet, this requires that energy storage is combined with software that can intelligently manage the overall energy flow and usage.

The advancements in energy storage systems are observed both within the grid, as well as at the end user. Within the grid, it can be tied to energy generation (grid scale energy storage[5]), or to the consumption (behind the meter storage[6]). Grid scale energy storage functions include peak management and smart storage to compensate changes in supply and demand. Behind the meter storage functions include optimizing energy usage based on availability, or fast response to emergency blackouts. Indeed, the full scope of technologies and functionalities are quite diverse, as noted in an earlier LG CNS blog[7].At the end user, having energy storage combined with alternative energy sources and software that can intelligently control what sources of energy is used provides increased flexibility, be that a business or residential user. In general, intelligent control is absolutely crucial for all players in the grid, since without it the grid cannot function anymore. This also opens up a critical role for systems integrators in the energy market, as specialized skills and ability to implement large projects are needed[8].

Continued technical development drives cost down

Energy storage is a wide field. Technologies used include solid state batteries (such as the much talked about Li-ion), flow batteries, flywheels, compressed air, thermal (including hydrogen energy storage) and pumped hydro-power[9]. While many technologies are primarily suitable for "utility scale" deployment within the grid or grid-edges, we can expect that as technologies evolve alternative solutions will emerge also for residential or small scale applications. A key driver is the cost of energy from the ESS[10][11]. This is a function of the initial investment cost, but also the lifetime of the energy source (in practice, how many cycles of charge-discharge the ESS can handle). Solutions such as flow batteries, compressed air and flywheels have longer lifetime (more cycles), whereas the Li-ion battery is more limited. The reason ESS is now so much talked about is that the cost of energy provided is starting to become truly competitive (note that here the cost of the ESS is calculated on top of the cost of the primary cost of energy). For example, the current claim of Tesla[12] selling its Li-ion battery at a about 350USD/kWh (capacity) is getting close what is considered economically viable. Once the price reaches 200-300USD/kWh (capacity) as is expected to happen in the next years, end-user cost becomes quite attractive, reaching roughly 0.20-0.30USD/kWh (power delivered, that is, using the same units that end-users pay for their energy). For residential use in the US a price point of 0.10USD/kWh is considered very competitive, and thus Tesla is approaching that. However, in some markets such as Germany even the current price level is already competitive for residential use, and more importantly, for utilities the business case is quite attractive. It should also be noted that the decline in battery cost has been steady over the last decades, and that this development is expected to continue.

Thus the economic feasibility for the foreseen industry disruption is there. The effects are already visible. A large number of major players are entering, both from the traditional electronics industry, as well as incumbent utilities changing their business model, and players from the auto industry (Mercedes Benz[13] recently announced a solution similar to Tesla's). However, a critical factor for success is that the ESS solutions offered provide a simple means to build a complete functioning system, with all the intelligence features required for easy operation.

As ESS' functions and demand grows, industry players are moving fast to adopt technology and seize the opportunity

The current market's major players are mostly power electronic vendors and system integrators, but this trend is slowly moving to include pure play software-centric companies as well, such as suppliers of energy intelligence software (EIS[14].One example showing this shift could be the growth of Greensmith, an early stage energy storage software company, which has recently raised $4.9M of growth capital[15]. Founded in 2008 and receiving its first angel fund in 2012, this relatively young energy storage software company delivered over one-third of all U.S. energy storage deployments in 2014[16]. Industry analysts are busy graphing "leader boards" for various categories, and a quick look at some of these show the range of players and the intensity of competition[17[18].

Clearly there are a multitude of business models and offerings that are feasible in this sector. The hardware and software suppliers for residential energy production and storage (solar cells, small scale wind power units, and residential batteries) continue to fight for lower cost solutions that will attract broader deployment, and at the same time there is a clear need (and business case, as experiences from Germany show[19]) for new type of grid-scale investments. No wonder then that the competitive landscape is so dynamic and is expected to continue evolving.

Manufacturing facilities, offices, and residential buildings transforming through smarter energy storage

Advanced energy storage technology provides three key benefits for businesses and residences – cost reduction, improved flexibility and increased protection against disruptions. Manufacturing facilities are able to reduce energy cost by storing energy while it is available cheap, and utilizing that stored energy when energy costs are higher—at energy peak times. For many manufacturing facilities, the value of uninterrupted energy supply is also significant. Imagine a hospital or stock exchange system, where a sudden power outage could mean a loss of a human's life, or millions of dollars. Companies such as Apple and Google realize the importance of uninterrupted energy supply, and have already invested significant sumsinto their own energy infrastructure. Commercial buildings also benefit from smart energy storage. Other than the reduced energy bill, smart storage can prevent or quickly overcome blackouts.

While this new technology generally means a smoother connection to the larger grid, it also

is opening up a chance to live “off the grid” in a residential setting. We already covered the concept of a micro-grid in the last blog post—the concept of generating energy and consuming it in a distributed manner. With cost effective ESS, living completely off the grid is becoming increasingly viable (while some industry experts are sceptical of this being true in the near term, others are more optimistic[20]). However, being “off the grid” is not the only way; apparently in Germany the conditions for residential energy production are so favourable that for example farmers can make more money selling their locally produced excess renewable energy back to the grid, than what they make from their commercial farming business[21]

Expect new business opportunities and modelsto appear

While companies such as Tesla, Mercedes, large electronics manufacturers such as Sony[22], as well as IT system integrators including LG CNS and many others are seeing completely new opportunities opening up to them, utilities are thinking hard about their future. From the current centralized power plant operation and maintaining a well working grid, their model needs to adapt in order to avoid the death spiral of reduced revenue and consequent inability to invest.

RWE, Germany’s second-largest utility company officially announced plans to pivot their business model to incorporate the growing distributed energy industry. Among a dozen pilot programs being deployed across Europe, three projects are focused on new energy storage technologies, some even pulling inspiration from Silicon Valley startups[23]. Similarly in Germany, E.ON is investing heavily into renewable energy production. Europe and US will be the leading battle grounds where we can expect industry changes in the coming years, but the battle is rapidly expanding to most of the key markets globally.

The polar ends of this development are two distinct worlds – one in which the ubiquitous grid prevails, albeit with increased intelligence and flexibility, and with new players and business models. At the other end is the world of residential and local modular energy production and microgrids, in which traditional utilities have a limited role to play. It seems even transformative players as aggressive as Tesla are unwilling to place their bets yet, and thus offer solutions both for residential needs as well as utilities. Meanwhile, some companies such as Sharp[24], are more focused at one end of the spectrum. The end-game is likely to be a hybrid of sorts, but one thing is certain – as technology continues to develop the industry dynamics in the energy sector is likely to be very active, offering opportunities to players with a clear strategy.

[1]http://www.greentechmedia.com/articles/read/this-is-what-the-utility-death-spiral-looks-like

[2]http://motherboard.vice.com/read/why-morgan-stanley-is-betting-that-tesla-will-kill-your-power-company

[3]http://www.economist.com/news/briefing/21587782-europes-electricity-providers-face-existential-threat-how-lose-half-trillion-euros

[4]http://cleantechnica.com/2015/01/13/grid-scale-energy-storage-expected-generate-68-billion-revenue-2014-2024-according-navigant-research/

[5]https://en.wikipedia.org/wiki/Grid_energy_storage

[6]http://www.greentechmedia.com/articles/read/the-future-of-energy-storage-is-behind-the-meter

[7]http://www.lgcnsblog.com/features/all-about-ess-from-definition-to-key-technologies/

[8]http://www.lgcnsblog.com/whats-new/lg-cns-taking-step-into-the-american-energy-storage-market/

[9]http://energystorage.org/energy-storage/energy-storage-technologies

[10]http://rameznaam.com/2015/04/14/energy-storage-about-to-get-big-and-cheap/

[11]http://rameznaam.com/2013/09/25/energy-storage-gets-exponentially-cheaper-too/

[12]http://www.gizmag.com/tesla-battery-powerwall/37283/

[13]http://www.gizmag.com/daimler-mercedes-benz-energy-storage-battery/37909/

[14]http://www.interfacecutthefluff.com/wp-content/uploads/2012/09/Forbes-No-More-Wasted-Energy-Report.pdf

[15]http://www.greentechmedia.com/articles/read/greensmith-raises-4.9m-to-scale-up-energy-storage-software

[16]http://www.greensmithenergy.com/news/64-greensmith-delivers-over-one-third-of-all-u-s-energy-storage-deployments-in-2014

[17]http://www.navigantresearch.com/research/navigant-research-leaderboard-report-energy-storage-systems-integrators

[18]http://www.navigantresearch.com/research/navigant-research-leaderboard-report-li-ion-grid-storage

[19]http://www.gtai.de/GTAI/Content/EN/Meta/Events/Invest/2014/Reviews/Powerhouse/Media/grigoleit-seattle.pdf.pdf

[20]http://www.greentechmedia.com/articles/read/Tipping-Point-Nears-for-Abandoning-the-Utility-and-Going-Off-Grid

[21]http://www.greentechmedia.com/articles/read/rwe-looks-to-grid-edge-technologies-to-combat-death-spiral

[22]http://www.greentechmedia.com/articles/read/sony-launches-joint-venture-with-canadian-utility-to-test-grid-scale-storage

[23]http://www.rwe.com/web/cms/en/1464054/rwe/innovation/sitemap/

[24]http://energystoragereport.info/sharp-energy-storage-smartstorage/