Distributed Energy Storage

A Case for National and International Collaboration

By Lewis Milford, Seth Mullendore, and Todd Olinsky-Paul
Clean Energy Group

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CONCEPT NOTE

ABOUT CLEAN ENERGY GROUP

Clean Energy Group (CEG) is a national, nonprofit organization that promotes effective clean energy policies, develops low-carbon technology innovation strategies, and works on new financial tools to advance clean energy markets. CEG works at the state, national, and international levels with stakeholders from government, the private sector, and nonprofit organizations. CEG promotes clean energy technologies in several different market segments, including resilient power, energy storage, solar, and offshore wind. Above all, CEG also works to create comprehensive policy and finance strategies to scale up clean energy technologies through smart market mechanisms, commercialization pathways, and financial engineering. CEG created and now manages a sister organization, the Clean Energy States Alliance, a national nonprofit coalition of public agencies and organizations working together to advance clean energy through public funding initiatives.

Clean Energy Group
50 State Street, Suite 1
Montpelier, VT 05602
USA
Phone: 1-802-223-2554
Email: info@cleanegroup.org

www.cleanegroup.org
www.cesa.org
www.resilient-power.org

Introduction

We view energy storage as a technological advancement that can tie together all the other disruptive changes that we have seen in the energy markets…[1]

INVESTMENT THEMES IN 2015 - Dealing with Divergence
Citi GPS: Global Perspectives & Solutions, January 2015

Energy storage is one of the most promising new trends in the clean energy field today, especially batteries when combined with distributed solar (solar+storage). With the array of benefits that energy storage has to offer—power system resiliency, renewables integration, instantaneous load balancing—it's not surprising that the recent trend in solar with storage deployment has been heralded as one of the key energy industry developments that will revolutionize the way we produce and use electricity, on both sides of the meter. We are in the early stages of this new energy era, with various companies and countries vying for market position.

Clean Energy Group, a U.S. nonprofit advocacy organization working on innovative technology, finance, and policy programs in the areas of clean energy and climate change, believes this might be an opportune time for various parties—NGOs, companies, policy makers, and investors—to start working together to accelerate the trend towards a robust commercial market. We think it is time to create an international network around the next generation of clean energy innovation—combining energy storage with small-scale clean energy generation at the customer level.

We therefore propose the creation of networks for national and international collaboration, which would be tasked with advancing the policy and advocacy of distributed energy storage systems.

Why is this needed and why now?

The U.S., and most of the international community, currently has the capacity to store no more than a small fraction of electricity generated, and most of the storage that does exist is limited to large, geographically specific pumped-hydro facilities. Lack of electricity storage translates into a lack of flexibility, meaning the power system must always be producing exactly the right amount of electricity to match fluctuating demand. This is a particularly difficult task when power production is also variable, as is the case with most renewable resources.

Energy storage solves this problem, seamlessly balancing variable load with variable generators, such as solar and wind. This is why energy storage is poised to play a unique and indispensable role in the clean energy transformation currently underway.

Small-scale, distributed energy storage is a particularly valuable asset. Utilities across the U.S. and internationally are already turning to distributed energy storage as a cost-effective alternative to transmission and distribution upgrades, and as a way to avoid or defer construction and use of expensive, inefficient fossil-fueled peaker plants. Small energy storage systems can be conveniently located behind-the-meter at the customer site, allowing for relief of grid congestion even in densely populated areas where space may be at a premium.

In addition to grid benefits, when combined with renewable generation, such as solar photovoltaic (PV) panels and islanding equipment, these systems can provide companies and communities with resilient power when the utility grid is unavailable due to equipment failure, natural disaster, or for other reasons.

Because small-scale, distributed storage systems are cheaper and less complicated than grid-scale undertakings, the technology has the potential to get to scale faster, driving down costs and accelerating efficiencies. More distributed storage also speeds the transition to a less centralized power system, allowing communities, businesses, and individual households to directly benefit, not just big utilities.

A more decentralized system of energy generation and storage will allow us the flexibility not only to incrementally improve our current power system, but to completely re-envision how power is produced and delivered.

According to a recent report[2] by the global information company IHS, the global market for residential solar PV paired with energy storage is forecast to grow by a factor of ten by the year 2018.

The U.S. has made some good initial steps to position itself in this burgeoning market and create policy around energy storage, but it still has a long way to go and a few things to learn from international storage leaders. Unfortunately, there is no clear federal agenda for energy storage development in the U.S. As in other clean energy areas, the states are leading the way.

The State of California's mandate for utilities to procure 1.3 gigawatts of energy storage by 2020 was a nice start, but the policy primarily benefits large, grid-scale storage projects and does less to support the deployment of smaller, distributed solar+storage systems. However, Southern California Edison's recent call to fulfill local capacity requirements did result in the procurement of five times the minimum requirement of energy storage capacity, including a significant amount of behind-the-meter batteries.

A collaborative effort between the California Independent System Operator (ISO), California Public Utilities Commission, and California Energy Commission along with feedback from utilities, energy storage developers, generators, environmental groups and other industry stakeholders has produced a roadmap[3] for advancing energy storage deployment within the state.

While the paper doesn't layout a specific timeline, it does identify barriers to energy storage project development in California and tasks parties with addressing those issues. The roadmap can serve as a good framework for other states seeking to encourage more widespread adoption of energy storage technologies.

Thus far, California remains the only state with a specific energy storage mandate. A few other states have issued resilient power or microgrid solicitations that include energy storage as an eligible technology, including New Jersey, which issued an energy storage-specific solicitation. However, widespread support for distributed energy storage installations has yet to emerge.

Despite this slow start, GTM Research estimates that the annual U.S. solar+ storage market will rise from US$42 million in 2014 to more than $1 billion by 2018. The report[4] cites the California mandate and other state incentives as drivers of growth, along with falling costs of solar systems and batteries and some changes to state net metering policies.

The report also points to electric vehicle manufacturer Tesla's much anticipated Gigafactory, now under development in Nevada, which is expected to become the world's largest lithium-ion battery production facility, with a chunk of capacity set aside for stationary storage applications.

Roadblocks to Market Uptake

Despite these promising market developments, there are some roadblocks in the way of an energy storage bonanza in the U.S.

How to Monetize Benefits?

The value streams for energy storage benefits remain fragmented between separate entities: utilities, grid operators, and system owners. This makes it difficult for any single entity to monetize the full value of storage without changes to current power system regulations or policy intervention. The Brattle Group did an excellent analysis of this value fragmentation in its 2014 report, The Value of Distributed Electricity Storage in Texas, prepared for the Texas utility Oncor.[5]

The U.S. Federal Energy Regulatory Commission (FERC) has acknowledged this market failure as it pertains to grid frequency regulation services and has issued orders to remedy the situation. Unfortunately, to date the PJM Interconnection stands as the only region to have implemented a market structure that effectively and adequately rewards the participation of quick-response energy storage applications. Even in PJM, it is difficult for smaller systems (<100 kilowatts) to participate in the market.

How to Finance Deployment?

Another problem facing U.S. solar+storage deployment is financing. Solar has begun to lay down a proven track record of performance and investment returns, and it benefits from a well-established leasing model that eliminates first-cost barriers for customers. Storage, on the other hand, is relatively new on the scene, represents an unwelcome risk proposition for many investors, and as yet has not developed a widespread financing model that would overcome first costs for most customers.

The newness and uncertainty of energy storage markets often make it difficult for projects to secure financing. On a positive note, the U.S. Internal Revenue Service has ruled that storage systems coupled with solar are eligible for the 30 percent federal Investment Tax Credit (ITC), as long as at least 75 percent of the stored energy can be shown to be supplied by solar power.

To summarize, the U.S. has some momentum developing in the energy storage arena, despite needing to address some significant barriers. However, the coupling of small-scale, clean energy production combined with energy storage is underserved in U.S. policy considerations.

The newness and uncertainty of energy storage markets also make it difficult for projects to secure financing.

Learning from Others to Move the Market

It's a Global Market

Valuable lessons can be learned by taking a look at energy storage programs and policies in other areas of the world. There are interesting developments across the globe, but three countries are emerging as clear contenders for energy storage leadership: Germany, Japan, and Australia.

Germany

Germany, already known for its aggressive solar policies, looks to be the front-runner in energy storage as well. The German Solar Industry Association (BSW-Solar) reported[6] that prices for German solar+storage systems fell 25 percent in 2014. The price drop is due to a combination of technological advances in storage systems and growing demand by residential customers. According to BSW-Solar, about 15,000 German homes have already installed solar+storage systems.

Arguably, one of the reasons behind these high adoption rates, as compared to the U.S. where home energy storage systems are rare, is the higher cost of electricity in Germany. But electricity prices are only part of the story.

Since 2013, Germany has had a subsidy program in place specifically targeting the costs of storage associated with solar PV. The subsidy covers 30 percent of the cost of storage systems. In addition to subsidies, KfW, Germany's development bank, provides low interest rate loans to finance solar+storage systems. And Energiewende, the country's energy transition program, has eliminated grid usage fees for new energy storage projects. By contrast, an inconsistent system of fees and regulations still poses a problem for many U.S. storage projects. For example, some utilities in the U.S. have refused to allow households with solar+storage systems interconnection under net metering contracts.

Japan

Japan is also leading the drive for solar with storage. The Japanese government currently subsidizes up to two-thirds of the purchase price for residential and commercial solar+storage systems. It was recently reported that the government is considering the allocation of an additional US$700 million[7] to help utilities and solar power producers install energy storage systems as part of a supplementary budget for the fiscal year. Such government support has helped enable groundbreaking projects, such as the Fujisawa Sustainable Smart Town.[8] This experimental town of 1,000 households, located just outside Tokyo, will be based largely around solar+storage technologies.

Australia

Australia is also looking to harness these technologies in creating 100 percent renewable energy towns. The Victorian Labor Party has vowed to help the town of Newstead become the state's first town completely powered with solar+storage by 2017. Following close behind, the town of Yackandandah is seeking to go entirely renewable by 2022. In South Australia, the grid operator SA Power Networks plans to implement solar+storage microgrids as a cost-effective alternative to building or replacing infrastructure.

Unlike in Germany and Japan, the current leadership of Australia's federal government has not been particularly pro-renewable. However, the government has begun to show signs of support for innovative storage projects.

The Australian Renewable Energy Agency (ARENA) has pledged US$365,000 to a fund a pilot electricity trading project developed by the energy storage company Reposit Power. The project, known as GridCredits, aims to expand the role of buying and selling electricity to homes and businesses with solar+storage systems. It allows customers with these systems to place bids into

the energy market, selling electricity back to the grid. The project will essentially turn solar+storage utility customers into "micro power plants."

Electricity prices are higher in Australia than in the U.S. A study[9] from the investment bank UBS found that solar with storage already makes economic sense for Australian households. This is not true for the majority of U.S. households under current market conditions (Hawaii, with lots of solar and high electricity prices, is the obvious exception). However, several recent studies (Lawrence Berkeley National Laboratory[10], Rocky Mountain Institute[11]) have concluded that solar+ storage is approaching grid parity in many parts of the U.S. due to increasing grid power costs and declining costs of PV and batteries, and a number of states are expected to reach the break-even point in the next decade.

England

In England, the Electricity Storage Network released a short paper[12] in 2014 laying out a framework for energy storage development. Its core recommendations are equally applicable to the U.S. or any country interested in becoming a global leader in distributed energy storage. The paper includes five key recommendations that policymakers should note:

1. Develop a national strategy for energy storage.
2. Allow energy storage to receive the same support as other sustainable energy technologies.
3. Simplify regulations to encourage deployment of energy storage.
4. Ensure market reform supports the deployment of energy storage.
5. Continue support for demonstration and innovation projects

How to Accelerate Energy Storage Markets?

Only a few states have implemented the policy recommendations similar to those noted above, and only to varying degrees. And it is unlikely that we will see a major federal legislative push to create a predictable regulatory environment in which energy storage investment can flourish.

In fact, there is currently no systematic U.S. policy approach to support the scale-up of distributed, behind-the-meter energy storage.

At present, support for energy storage in the U.S. is similar to the support for solar power about 15 years ago, with incentives for one-off projects but no clear path to achieve cost reductions or encourage market uptake. Given the many benefits of distributed energy storage, a systematic policy strategy at the federal, state, and local levels is needed now to overcome the challenges impeding significant market penetration.

So what can be done to accelerate change?

Clean Energy Group is currently exploring a promising collaboration between U.S. storage industry and advocacy groups to create the groundwork for a national distributed energy storage policy framework. However, it would be short-sighted to focus efforts entirely within U.S. borders.

The goal … would be to expand access to energy storage information and implement a framework that enables storage technologies to reach a broader market.

There are markets outside of the U.S. struggling with many of the same distributed energy storage market development issues. International exchange of information, policy directions, market intelligence, and basic know-how could go a long way towards moving these technologies to market. In this early stage of market development, such international cooperation, combined with a national effort, could be one of the most effective ways to make a difference.

The goal of establishing an international network of energy storage experts would be to expand access to energy storage information and implement a framework that enables storage technologies to reach a broader market. The network would develop a strategy to help shape energy storage policy and aid storage companies in developing successful financing models.

In working towards these goals, specific efforts would include:

Technology exchange

A technology exchange would help participants from different countries keep abreast of energy storage advances such as new battery chemistries, smart inverters, and integrated controls. A useful product would be a "catalog" of commercialized distributed storage equipment.

Policy exchange

Countries take different policy approaches to clean energy (for example, feed-in tariffs are popular in Europe but not used as much in the U.S.). An international policy exchange would allow for policy-makers to share ideas and experience across national borders. It would also help participants stay current on major tax incentives, rebates and market supports. A result of the exchange could be a compilation of policies and model legislation and an ongoing dialogue on policy proposals.

Markets watch

This effort would keep participants abreast of market evolution in various countries and regions, as it affects distributed energy storage. This would include electricity pricing, ancillary services markets, installed system costs, and related market developments.

Standards and testing protocols

As the distributed storage field becomes more populated, there will be an increased need for agreed-upon performance and safety standards, and testing protocols. We should seize the opportunity to create an international effort early, before markets become fragmented.

International program database

This database would track distributed storage programs and deployment progress around the globe.

International industry database

A new database would list companies involved in distributed storage and associated industries.

International distributed storage newsletter

A monthly e-newsletter would keep readers up to date on distributed energy storage developments around the globe.

Each of these efforts is readily achievable and much of the work is already underway on a regional level. Now it's time to see what can be done if global interests work in tandem to transform our energy system.

Summary and Next Steps

Distributed energy storage systems are advancing quickly and show great promise for a wide variety of applications and markets. However, energy storage markets are at an early stage, and policy makers have only begun to develop programs to help advance these technologies.

This early stage of the policy development on energy storage is the right time for more collaborative discussions on the best policy approaches to drive the technologies to scale.

Getting energy storage policies right presents a clean, efficient, fast-scaling solution to a myriad of problems:

- It can help to integrate renewables by providing fast ramping of power to balance variable generation resources and prevent overbuilding of fossil fuel peaker plants.
- It can reduce energy costs when paired with solar PV, through load shifting and the reduction of demand charges.
- It can provide resilient power to keep the lights on when the grid goes down.
- It can help to alleviate grid congestion, avoiding the need for expensive transmission and distribution system investments.
- And it can allow small distributed generators to access markets that would otherwise be inaccessible to them.

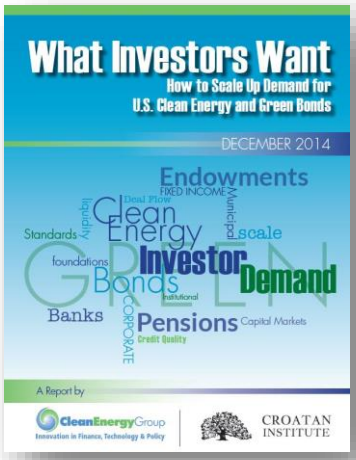
Distributed energy storage is the key enabling technology for renewables such as solar PV, and it is the key to grid modernization. And though these technologies have arrived, financing, markets, policies and regulations to support these technologies have not.

Clean Energy Group sees an opportunity for national and international networks to share knowledge and experience, accelerate the development of needed policies, and stimulate markets. Cooperation and collaboration can help us avoid the kinds of patchwork policies that have kept other promising new energy technologies from reaching scale quickly and efficiently.

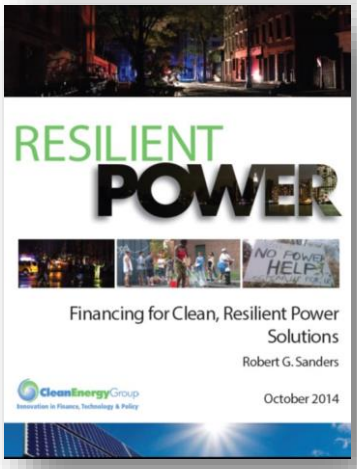
If you represent a government agency and would like to work with Clean Energy Group on this concept, we would like to hear from you.

Please contact Lewis Milford, Clean Energy Group President, at LMilford@cleanegroup.org for more information, or sign up to be added to our e-Distribution list for Energy Storage at http://bit.ly/EnergyStorageList.

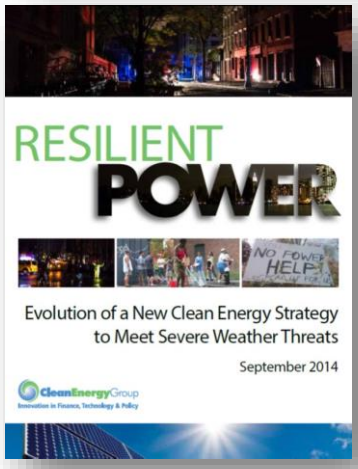
Recent Clean Energy Group Reports



[What Investors Want: How to Scale Up Demand for U.S. Clean Energy and Green Bonds], by Robert Sanders, Clean Energy Group, and Joshua Humphreys, Croatan Institute. This study explains the nature of investor demand for clean energy bond finance in the U.S., and provides a blueprint for growing the market for fixed-income securities to finance clean energy projects and solve climate problems. December 2014.



[Financing for Clean, Resilient Power Solutions], by Rob Sanders, Senior Finance Director, Clean Energy Group. This paper describes a broad range of financing mechanisms that are either just beginning to be used or that have a strong potential for providing low-cost, long-term financing for solar with energy storage (solar + storage). The goal is to identify financing tools that can be used to implement projects and that will attract private capital on highly favorable terms, thereby reducing the cost of solar and resilient power installations. October 2014.



[Resilient Power: Evolution of a New Clean Energy Strategy to Meet Severe Weather Threats], by Clean Energy Group. This paper describes the progress of "resilient power" efforts from the New York City blackouts in 1999 to Superstorm Sandy. The paper outlines the dangers that power outages can pose to our most vulnerable populations, the failures of traditional backup power sources, and the opportunities to develop distributed energy systems with clean and dependable energy technologies. The paper goes on to announce the launch of the Resilient Power Project and describes the importance of new technologies like solar PV with energy storage to provide resilient power as weather patterns become increasingly volatile and longer power outages become more frequent. September 2014.

More Clean Energy Group reports can be found at http://www.cleanegroup.org/ceg-resources/recent-ceg-reports/.

Endnotes

[1] See https://ir.citi.com/20AykGw9ptuHn0MbsxZVgmFyyppuQUUt3HVhTrcjz4ibR%2Bx79LajBxIyoHIoSDJ3S%2BWRSMg8WOc%3D, p. 52

[2] See https://technology.ihs.com/461779

[3] See http://www.caiso.com/Documents/Advancing-MaximizingValueofEnergyStorageTechnology_CaliforniaRoadmap.pdf

[4] See http://www.greentechmedia.com/research/report/us-solar-plus-storage

[5] See http://www.brattle.com/system/news/pdfs/000/000/749/original/The_Value_of_Distributed_Electricity_Storage_in_Texas.pdf

[6] See http://www.solarwirtschaft.de/fileadmin/media/pdf/141211_Speicherpreis_final_EN.pdf

[7] See http://www.greentechmedia.com/articles/read/japan-pumps-cash-into-energy-storage

[8] See http://fujisawasst.com/EN/

[9] See http://reneweconomy.com.au/2014/ubs-solar-storage-is-cost-effective-already-in-australia-20949

[10] See http://emp.lbl.gov/publications/financial-impacts-net-metered-pv-utilities-and-ratepayers-scoping-study-two-prototypica

[11] See http://www.rmi.org/electricity_grid_defection

[12] See http://www.electricitystorage.co.uk/files/7814/1641/4529/140509_ESN_Elec_Storage_in_the_National_Interest_Report_final_web.pdf

Clean Energy Group

50 State Street, Suite 1 ♦ Montpelier, VT 05602

www.cleanegroup.org

info@cleanegroup.org