

WHITE PAPER

Understanding the Hidden Costs of Self-Integrating Your Energy Storage Solution



Building your own computer is easier than ever today—the instructions, user manuals and required components are just a click away. Even so, most companies don't go this route, even when their core business is computer technology or software. **So why is that?**

One of the main reasons is that do-it-yourself (DIY) integration of complex technologies, from personal computers to automobiles, is fraught with hidden challenges that impact the design, software capability and performance of the system over time. It is easier, lower risk, and often lower cost to partner with a seasoned technology provider than it is to build the technology yourself.

Over the past few years, the solar industry has bucked this trend. Solar developers shifted to self-integration of their solar plants to great success and many are now looking to do the same with energy storage technology.





The reality is that solar integration and energy storage integration are very different. While solar is largely a plug-and-play integration that is optimized for maximum energy production, energy storage technology is exponentially more complex.

The complexity comes from numerous factors:

- Energy storage is bidirectional—both absorbing and discharging energy.
- Modeling battery degradation and augmentation strategies across different operating profiles requires unique knowledge.
- Software and hardware architecture are critical to system reliability and performance and there are no well defined standards.
- The energy storage industry is in the middle of rapid growth where everything is changing, from module and inverter design to new market rules.

Unfortunately, a number of project developers around the world are learning the hard way about the hidden costs of self-integration. To help shine a little light into this opaque world, this paper identifies how to quantify some of the risks and hidden costs of self-integration.

Factors that Impact Overall Energy Storage Project Success

| | FACTORS INFLUENCING ECONOMICS | | | |
|---|--|---|---|--|
| | Revenue  | Capital Expenditure (CAPEX)  | Operating Expenditure (OPEX)  | Transaction Costs  |
| Working with One Trusted Partner | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Adaptive Technology Platform | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Long-Term Value Maximization | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Collaborative Supplier Relationships | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

FACTORS INFLUENCING SUCCESS

One Trusted Partner

Integrating components and software into a finished product that works around the clock is challenging. Let's take the example of computers—you buy the motherboard, processor, hard drive, memory, graphics cards, power supply and operating system and piece them together into a system. But then when you go to power up, you find that it doesn't work. Where do you turn for help? Each of the component manufacturers is not responsible for the success of the overall system. The system-level responsibility ultimately falls to you.

Our homes are another good example. The duct system, plumbing, electrical and several other sub-systems must work together seamlessly to provide a comfortable condition within the home. If you work with a home builder who is responsible for the integration, you have a contact who will support you if something fails anywhere within the home.

The DIY approach to energy storage has several commonly overlooked risks:

- No single supplier is responsible for system performance. When system-level problems arise, conflict and finger pointing between component suppliers are common and it can be difficult to determine responsibility and fix the problem quickly.
- Resolution of system-level issues can be time consuming because of lack of access to leadership at the component suppliers. The ability to mobilize the right set of

people with the needed technical capabilities is critical.

- Upgrades to a DIY system will likely be one-off and highly customized.

All parts of an energy storage system must work together smoothly as a coherent whole to earn revenue from the asset. However, with the energy storage industry still in its early stages, there are no set standards for the integration of subsystems. Incompatibility issues can occur across multiple layers within a given storage system resulting in delays, downtime and lost revenue.

Additionally, self-integrators run the risk that routine software upgrades may not be backwards compatible with other components in their system. Integration issues can even result in safety-related incidents stemming from unrecognized incompatibility of components.

Look for a solution provider that has access to best-in-class components that have been pre-integrated, tested and are guaranteed to work together. Leading solution providers should be able to demonstrate that they have qualified, credible vendors and have tested their components in a laboratory setting to ensure that the deployed energy storage system will perform safely and correctly from day one.

Working with one company that is responsible for complete system performance delivers peace of mind. Instead of chasing down multiple vendors and troubleshooting the

Questions to Ask:

- Whose job is it to perform a root cause analysis when things go wrong?
- If the different suppliers aren't in agreement, whose responsibility is it to fix the system?
- If the system does not pass the qualification tests or interconnection certification, who is responsible for resolving these items?
- What type of defects on components purchased are covered under the warranty?
- What type of risk exposure exists on the purchases?
- What happens if a component supplier goes bankrupt?
- What happens if the standards change and you can't get access to specific spares needed for the system over the next 15-20 years?

system directly, customers can relax in knowing that seasoned energy storage professionals, backed by fleet-wide data and insights, are resolving the highly technical challenges of the system.

IMPACT ON FINANCIALS

- **Revenue loss** due to safety or incompatibility-related challenges or due to lack of timely tech support to resolve an issue.
- **Increase in OPEX costs** due to lack of optionality in components or due to custom upgrades required for the system in the future.
- **Increase in transaction costs** from product design changes needed to resolve incompatibility issues.



Adaptive Technology Platform

Building the capabilities to design and deploy energy storage technology requires significant investments over time, similar to those needed for building gas or wind turbines in the generation industry.

Energy storage technology requires a broad range of expertise, ranging from battery modeling and application algorithms to experience with interconnections, in order to create a customized solution that works well for customers over the full life of the system.

The leading energy storage solution providers typically invest significant capital to build these capabilities up over time. This process takes several years due to the complexity of getting energy storage right.

Seasoned solution providers have learned lessons from what has worked in the field and what has not and can apply these insights to future storage platform designs. Customers of these solution providers receive this continuous learning benefit at zero cost. By using market and customer feedback to continuously inform technical product design road maps, algorithm designs, battery performance and warranty/terms discussions, experienced providers can deliver better solutions. This feedback mechanism for improving product design adds significant value for end customers and is not replicable with a DIY approach to system integration.

The time and effort required to deliver a self-integrated solution that works and remains competitive in the market for the next 15-20 years would be significant.

Bringing together a global supply chain of components under a common

architecture allows end customers to access the best available technology at the best prices. In contrast, vertically integrated suppliers typically lock customers in for the long term, removing optionality from the underlying components in their storage system.

IMPACT ON FINANCIALS

- **Revenue loss** due to market rule changes and inability of software to adapt to the changes.
- **Increase in OPEX** due to increased system wear and tear resulting from inability of system design to adapt to new market conditions.

NOTES FROM THE FIELD

Fluence was one of the first companies that developed the algorithms required for an energy storage system to perform services in Europe, at Kilroot Power Station in Northern Ireland. The Irish Single Electricity Market rewards a response time of less than 150 milliseconds, which Fluence's platform had validated by independent parties. Fluence's engineers started with an initial algorithm design that was deployed in a project in Chile and further advanced it to provide a response time of less than one second. This control logic is now available at no cost to Fluence customers worldwide.



Key Questions to Ask:

- What options exist within the technology platform for providing additional market services over time?
- Is the architecture of the system set up in a manner to provide long-term risk diversification?
- Is there a demonstrated history of performance of the system?
- Have there been design improvements made to the system based on historical experience and feedback from the market?
- Does the software architecture allow for the interoperability of different components over the life of the system?
- How many versions of software have you deployed for assets already being served by your solution?

Long-Term Value Maximization

Delivering turnkey storage solutions is not just a question of cost. Successful energy storage project delivery requires a deep understanding of the market value that the storage system is expected to provide. Market needs and requirements always change over time, therefore the energy storage system must be able to adapt to new market conditions.

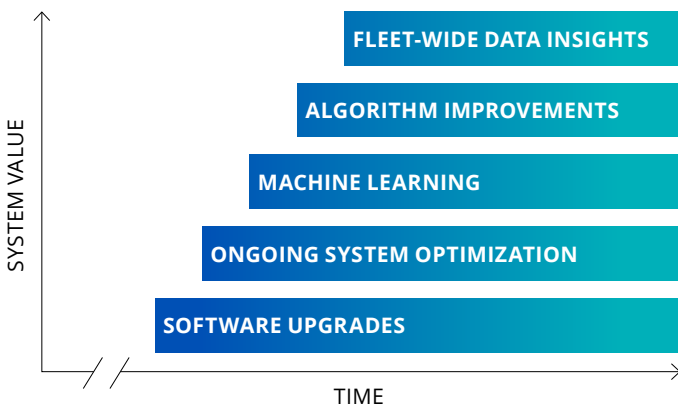
Look for a storage solution provider with a specialized team that brings deep expertise in energy markets. Make sure you have access to the right set of capabilities ranging from technical solutions to wholesale markets to system operations. High quality solution providers should be able to demonstrate access to broad information data sets from the technology side, fleet-wide storage performance, market information, and expertise in the complex decision-making required to optimize overall system performance.

IMPACT ON FINANCIALS

- **Increase in CAPEX** due to overdesign in comparison to market requirements.
- **Reduction in revenue** because of inability to deliver multiple services as required in the market.
- **Increase in OPEX** due to new market pulls from system that could not be addressed effectively by the dispatch software.

NOTES FROM THE FIELD

For the Zealand 10 MW energy storage project, the software was initially designed to provide frequency control services. Due to changing market conditions, the Fluence team updated the algorithms so that the project could earn additional revenues from the R2/ balancing market. Being adaptable to changing market conditions is a key success factor.



Key Questions to Ask:

- What are the market services the project should deliver today?
- What services can be delivered simultaneously?
- How should the system be dispatched to meet market needs while not deteriorating battery performance?
- How can you get maximum performance from each battery module and still deliver all possible services to the market?
- How can the software system interfacing with the hardware components be tuned continuously to deliver maximum performance to earn higher revenues in the market?



Collaborative Supplier Relationships

Grid-scale energy storage competes with the automotive and electronics industries for sourcing certain components, so having well established collaborative supplier partnerships is critical. When delivering a complete storage solution, access to quality supplier relationships and being able to source components at volume are important factors to consider.

Availability, price, terms (such as warranty, use profile, recourse, remedies) and time frame for delivery are all impacted by volume purchasing and supplier relationships. Each of these elements has a direct line item impact on the capital, operating and transactional cost of the complete storage solution.

Availability

It can be difficult to get access to Tier 1 suppliers if you aren't purchasing at scale, and it is expensive to manage and maintain relationships for future support or purchasing. In contrast, leading solution providers often have strong relationships with Tier 1 suppliers from working together for several years and solving problems along the way. Solution providers can even influence suppliers' future product design by providing insights from data sets from real use cases in the field.

Price of Components

Smaller purchasing volumes are subject to higher prices and lesser attention from suppliers. Solution providers who are at scale have greater purchasing power and volume which is reflected in price advantages for end customers.

Terms

Industry commercial terms on batteries and inverters are not

fully transparent and are changing rapidly. The less experience you have in negotiating terms with a specific supplier category the greater the transactional cost will be. The time investment for validating vendors and going through terms can be significant.

Experience

Inexperience with the complex details of warranty and usage terms can lead to unexpected surprises with suppliers if things go wrong on the storage project. Experienced providers have usually worked through these challenges and can demonstrate a clear path to resolution while continuing to provide a single point of contact for the customer.

Time Frame for Delivery

Leading solution providers get preferred delivery timelines and can meet aggressive project schedule requirements due to greater access to suppliers at the senior management level. This is also important when it comes to resolving any issues related to delivery or product quality.

IMPACT ON FINANCIALS

- **Reduction in CAPEX** due to volume purchasing of components and preferred relationship with suppliers.
- **Reduction in OPEX** due to clear and transparent way of resolving issues and cheaper pricing of components.
- **Reduction in transaction costs** due to a single vendor taking responsibility of the overall performance obligations of the system, with a clear warranty structure and established track record of financing projects.

NOTES FROM THE FIELD

"I was tasked by the project owner of ES Laurel Mountain to find replacement battery modules for the 32 MW battery energy storage system located in West Virginia. The first issue was that the original vendor of the battery modules used in this project had gone bankrupt and was bought by another company that doesn't manufacture these modules anymore. So even availability of parts was challenging. Eventually when I found the new company that makes the parts, the cost of these modules was extremely high. I can tell you that this was a real challenge for the project O&M."

Jeff Gibbons

DIRECTOR – SERVICES, FLUENCE

Key Questions to Ask:

- Do you have access to Tier 1 suppliers in order to purchase at scale?
- Do you have the capability to get guaranteed availability of components to deliver the project on a timely basis?
- Have you negotiated terms and conditions for purchasing with suppliers? Do those terms have provisions for handling warranty and usage of battery?
- Do you have a clear escalation path to suppliers' senior management if things go wrong on delivery or post-project installation?

Conclusion

Energy storage integration is complex, and it takes years to build up the capabilities and supplier relationships to get the job done right. Do-it-yourself integration or working with inexperienced solution providers who are simply integrators carries significant risks that may not be apparent at the outset. Working with a seasoned solution provider will minimize risks related to cost, revenue and safety and provide a more seamless experience. The best solutions providers should also be able to work with you to maximize the value of your system over its full life and realize the full potential of your energy storage solution.



ABOUT FLUENCE

Fluence Energy, Inc. (“Fluence”) (Nasdaq: FLNC) is a global market leader in energy storage products and services, and cloud-based software for renewables and storage. With a presence in over 40 markets globally, Fluence provides an ecosystem of offerings to drive the clean energy transition, including modular, scalable energy storage products, comprehensive service offerings, and the Fluence IQ Platform, which delivers AI-enabled SaaS products for managing and optimizing renewables and storage from any provider. The company is transforming the way we power our world by helping customers create more resilient and sustainable electric grids.

To learn more about Fluence, please visit [fluenceenergy.com](https://www.fluenceenergy.com).