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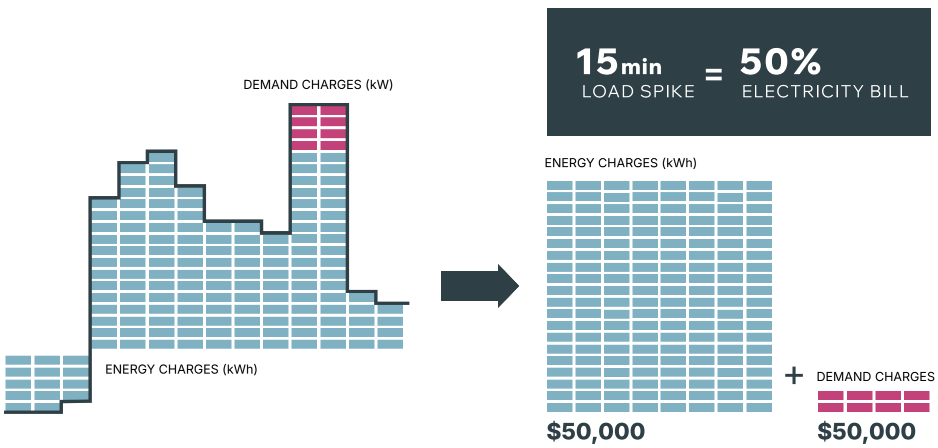
Thinking Outside the Box

Win More Energy Storage Projects with Better Design

Solar and energy storage deployment is less complicated when you have one user with simple usage patterns and electrical loads, as residential projects often do, or when you can sell energy to utilities leveraging big economies of scale and a clear off-taker with no on-site loads to worry about, as with utility-scale projects. Commercial and industrial (C&I) projects are completely different. Systems must be sized to dynamic loads that can change with the seasons, occupancy or manufacturing shifts. Many customer stakeholders, from the owner to the CFO to the facility managers, must keep building occupants happy. Crucially, projects need a clear economic use case that is better than alternative investments.

To properly design a C&I energy solution, you must fully understand the major electrical loads and usage patterns. How will load profiles vary seasonally with HVAC use? Are there planned site upgrades, like EV charging infrastructure? Are any of the loads flexible? Load variability and load flexibility may be unique for each specific load. These factors are especially important for loads that are essential to core operations. You also have to understand dynamic and time-based retail electricity rate schedules and grid services revenue opportunities. 'When' a site uses energy is often more important than 'how much' energy is used. In California, for example, solar exports to the grid often approach no value while customers can pay $90 per kilowatt-hour (kW) in demand charges during peak price periods. Grid services programs can open lucrative new revenue streams but vary greatly from one utility to the next.



The C&I market is changing quickly as more utilities recognize the value of batteries. With roughly 3,000 utilities in the US, the need to keep pace with change will only increase complexity (and opportunity to create value) in C&I projects.

Meanwhile, **"value stacking"** has become more than a buzzword. The strategic use of storage to deliver multiple services, stacking one after another and another, increases profitability and improves return on investment. This takes combining revenue streams, savings on energy costs, CAPEX reduction, and resilience values to maximize ROI. Software manages the provision of services according to market price, regulations, and operational constraints. A thoughtful exploration of project feasibility and intelligent project design will result in clear project goals that maximize the value stack.

This paper will discuss the importance of quality planning and feasibility, and what happens when you compromise on this effort. It will also highlight **a unique value opportunity now available to developers but often overlooked: load control. Understanding the value of load control as part of the value stack for C&I energy storage can improve project economics and reduce risk.** In some cases, it can tip the balance to satisfy the requirements for project feasibility.

Planning & Feasibility Analysis

During feasibility analysis, we regularly identify fundamental changes to the original project design that can optimize ROI, resilience, or other project success metrics. Compromising on this step could easily leave value on the table. Further, delays in the design and engineering process from what we consider "underdeveloped" projects are common. Delays of months, even years (which we have seen) can have significant impact on the viability of a project, possibly even the viability of a developer.

There are three pillars of planning & feasibility:

1. **Project goals**
2. **Facility/site information**
3. **Project plan**

All three are critical and are required for any project. The details of each can vary significantly by project.

Project goal definition is a step that is often overlooked, particularly with less experienced groups. When completed well, every expectation of the project is clearly articulated, and every stakeholder understands and agrees to the goals and implications of those goals.

Facility/site information requirements will vary between projects. Many projects, though, can benefit from deeper analysis of loads, operating requirements, and flexibilities. Adding site-specific capabilities as part of the project can provide significant benefits; one of the case studies below achieved project goals with a 33% reduction in energy storage capacity.

Project planning is where it comes together. All the goals, load information, and project information (a simplified list below) are used to create a model of the project. This modelling is the core of the feasibility analysis.

How feasible is the project? What are the performance impacts from solar panel soiling and seasonal variations that affect energy production and load, such as increased solar gain in summer and lower ambient temperature in winter? What is the optimal equipment size and configuration? How would dynamic load control affect this sizing? How do financing options affect the ROI and LCOE? What models or software are best used to answer these questions? Ultimately, the feasibility analysis will define the risk level of the project for different stakeholders (the developer, financiers, off-takers, etc.), and reduce uncertainty.

Step by step through a structured process, the planning and feasibility analysis points the way towards higher project revenues and lower costs through use case selection, value stacking, system design and optimization. **Project goals help determine key inputs for financial feasibility modeling to optimize the value stack and system design.**

Considerations may include:

Project Goals

Performance goals
Some projects value resiliency above all. Some seek to maximize financial performance through value stacking. Others fall somewhere in between.

Stakeholder alignment
Stakeholders need to agree on the goals and the implications of the goals.

Facility & Site Considerations

Site consumption
Some projects value resiliency above all. Some seek to maximize financial performance through value stacking. Others fall somewhere in between.

Building operational requirements
Operational requirements range from comfort to EV charging to critical loads that must continue running throughout a grid outage.

Building thermal behavior
Flexible load shifting brings energy management systems greater control to manage comfort for building occupants while reducing energy costs.

Operating costs & structure
Higher operating costs, peaky loads, and flexible loads create opportunities for projects to achieve a greater return on investment.

Project Plan Considerations

Financing structure, including tax credits & grants
Access to capital and expectations for cash flow go a long way to determine a project's scope and technical specifications.

Solar generation
On-site energy production affects how much a project can offset energy imports from the grid.

Equipment specifications
Every aspect of energy management in commercial buildings, from consumption to production and storage, is dictated by the equipment you use.

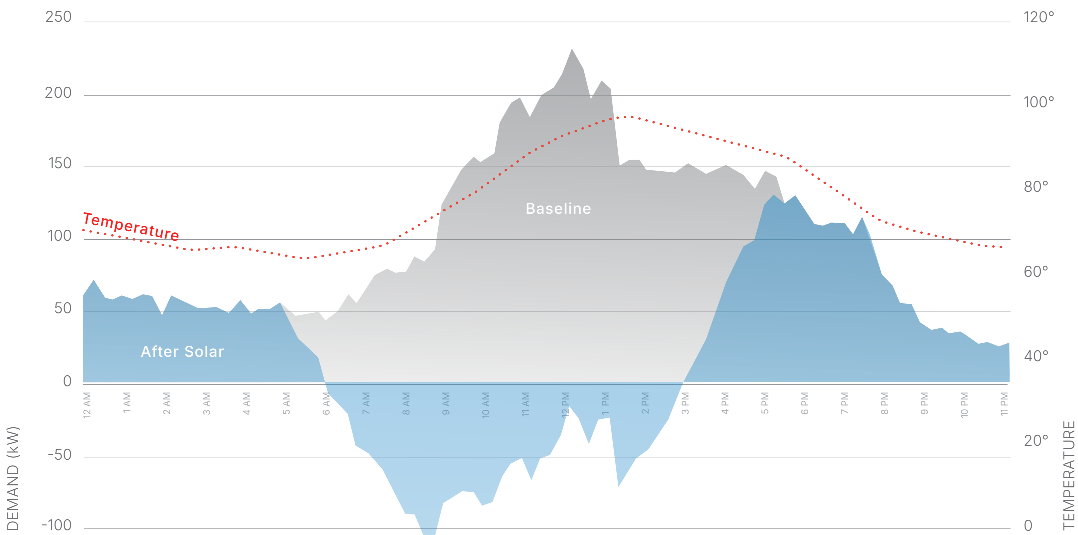
Utility programs & incentives
In addition to federal tax credits, many projects also qualify for compensation from utility programs that use batteries to support grid stability.

Repower costs
The cost of repowering systems depends on equipment service life and compatibility between old and new equipment, among other factors.

End-of-life planning
Service life of equipment and compatibility also come into play with end-of-life planning, as does the cost of decommissioning, recyclability, and more.

Quality early-stage planning reduces risk for developers, owners, and financiers. Complex utility rate structures have devalued solar and led the industry to underestimate the full value of projects with combinations of solar, storage and load control. Modeling is critical for developers to optimize the value stack through load shifting, grid services, demand-charge management, and more. As projects incorporate early-stage planning into the development process, they also gain insights about the stumbling blocks that might otherwise derail projects further down the line.

Site owners and financiers often will have greater confidence in feasibility analysis from an independent, product-agnostic engineering company. The involvement of a neutral third party can give extra assurance that projects have completed steps to maximize performance, reduce financial risk, and satisfy bankability requirements. Independent engineering also adds value for asset owners and financiers by guarding against developer bias.



Flexible Loads:

The Value Not Many Are Talking About (Yet)

C&I projects looking for new ways to stack more value on top of energy storage can look at incorporating load controls. Solar and storage can relieve many energy-related pain points in commercial buildings but not all of them. When heavy usage of HVAC systems are causing energy consumption to spike, buildings with solar and energy storage can partially mitigate the cost impact by using stored energy in place of energy from the grid. With load control, however, projects can go further, optimizing HVAC usage to prevent demand spikes in the first place. In addition, load control can increase flexibility in the design of commercial BESS and microgrid projects, delivering stakeholders more ways to achieve financial and operational goals.

Two recent projects by Elexity, a leader in the development of predictive energy controls for commercial buildings, showcase how to improve project performance across the board by managing building assets in concert with energy assets.

On-Grid Storage Case Study

At one commercial facility, a Southern California school building where HVAC often ranged from 60 percent to 70 percent of load, high outdoor temperatures caused peak load to hit 150-200 kW. Using a predictive energy management system, Elexity established load controls to effectively pre-cool the building during high solar generation periods so that by late afternoon, the hottest part of the day, the load controller could switch off HVAC units, shedding energy load. Because the building was already nice and cool, all thermal zones stayed within the customers comfort range during the load shedding event.

However, the energy management system doubled down on load shedding by discharging from an on-site battery system during an extended afternoon period, on some days reducing peak demand from a baseline of 150 kW all the way down to zero. All in all, solar plus storage and load control improved the net bill significantly. While the battery system saves the customer approximately $27k per year on average, load control boosts those savings by more than 50%, saving the customer an additional $17k per year.

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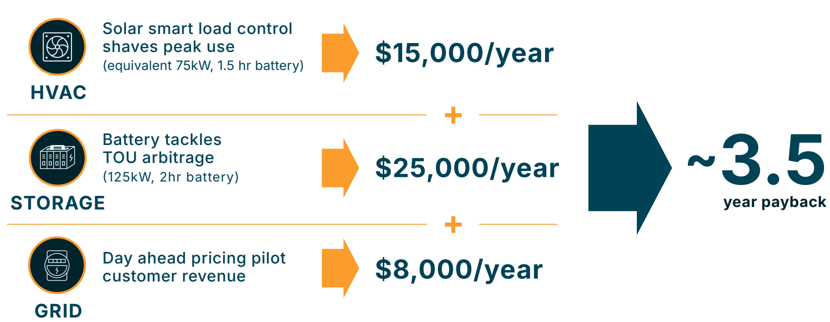

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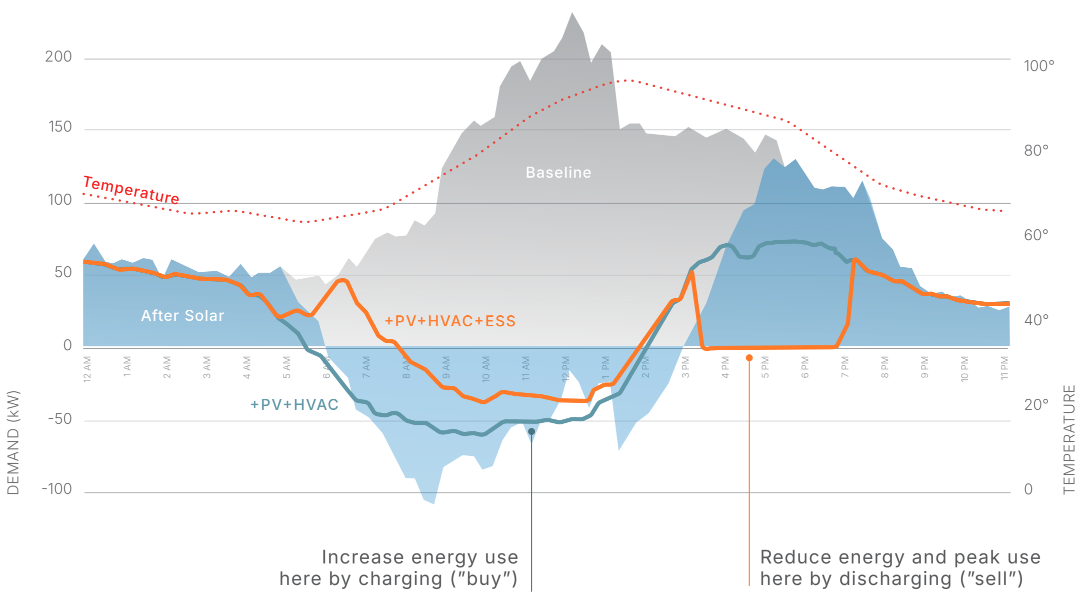
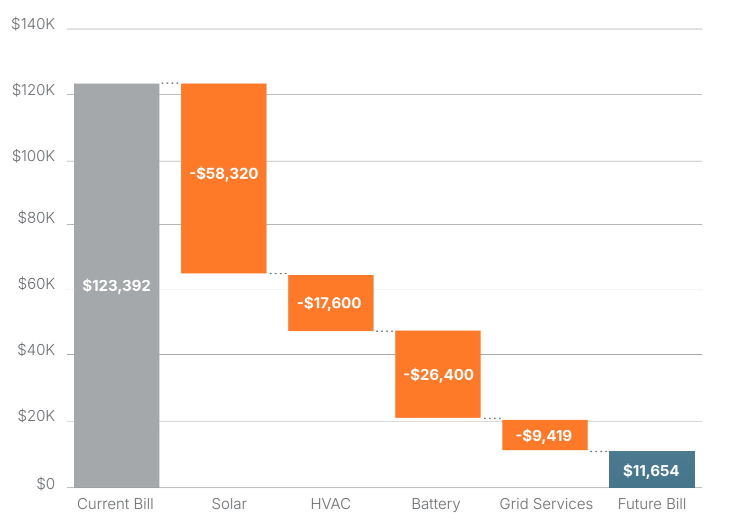
On-Grid Storage Case Study

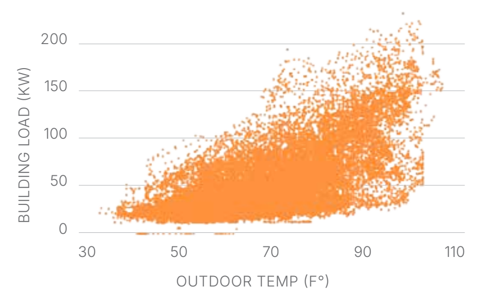
Southern California High School



Estimated Change in Utility Costs YR 1

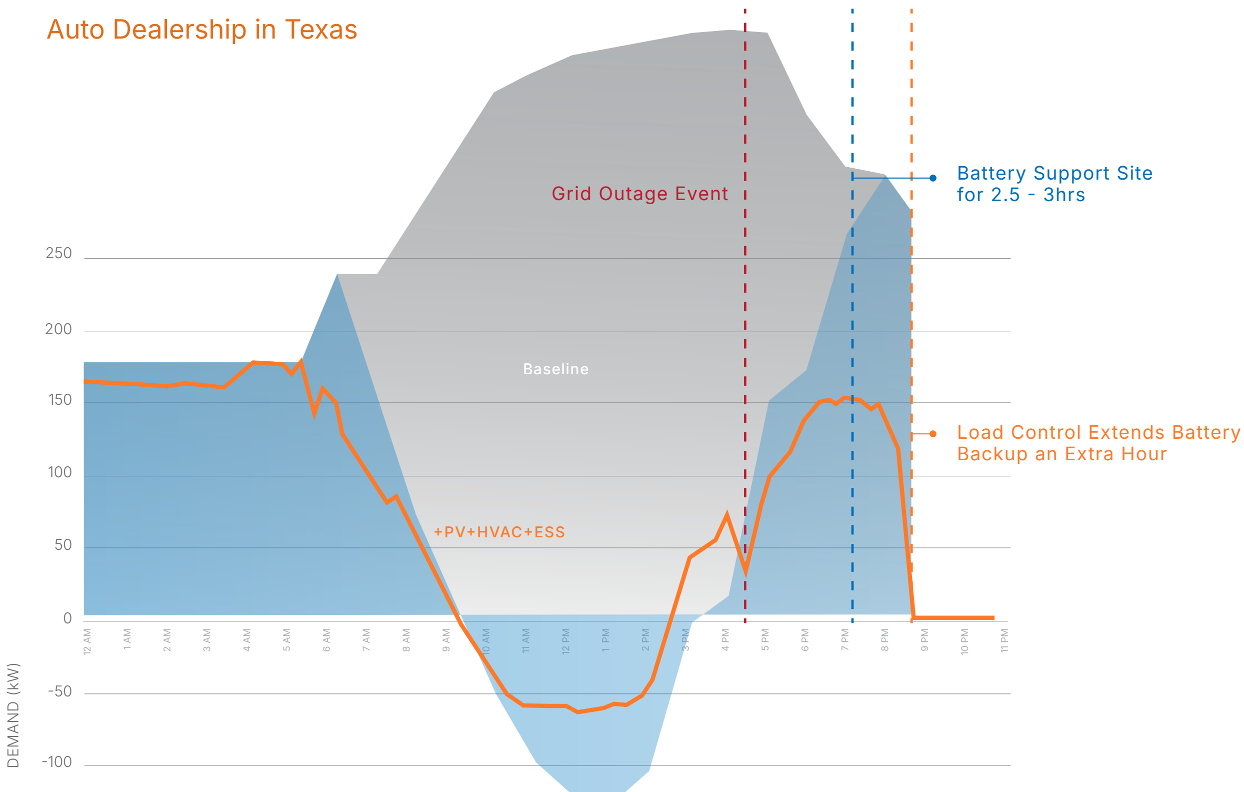


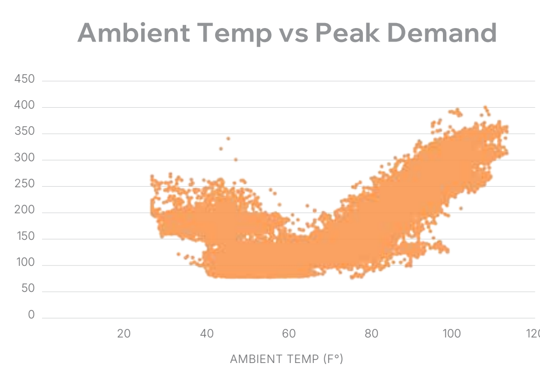
Building Load VS Outdoor Temperature



Microgrid Storage Case Study

For a project in development for an auto dealership in Texas, the goal was to enable a flexible microgrid to keep sales and repair operations running in the event of a grid outage. Paired with solar, energy storage, and a microgrid controller, the project will automatically reduce HVAC load based on available solar, battery capacity, grid status and the building occupant's comfort needs. Similar to the previous example, this project uses a zone-by-zone configuration to maintain comfort in key areas of the facility while reducing energy demand to achieve project goals.





The project is also programmed to coordinate a gradual reduction in EV charging at times when the grid goes down and available energy is limited. In this case, however, software-based load controls support the developer's goal to reduce CapEx by extending battery duration by 50 percent. Without load control, modeling showed that the project would have required a 3-hour battery to a ssure resiliency through an outage on the grid. With load controls, the project could achieve the same result with a 2-hour battery.

Improve Project Economics & Reduce Risk

With new building management and energy management tools now at our disposal, the two commercial projects cited in this paper represent the tip of the iceberg for commercial projects. Opportunities like these will open up microgrid value in more markets. The challenge will be in planning and feasibility. It's hard enough trying to understand time-of-use rate tariffs and demand charges that appear on the monthly energy bills before you even start to consider value-stacking opportunities from solar, storage, and load control.

This is why it's critical that commercial projects incorporate planning and feasibility analysis near the start of development. As utilities rely more heavily on distributed energy resources to help manage grid stability, we expect to see more value-stacking opportunities for BESS and microgrid system owners.

Are your commercial projects maximizing resilience and return on investment? Are you doing enough to reduce project risk and identify new opportunities?

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Visit Elexity at elexity.io for more information about the value of flexible building loads in microgrid systems.

Mayfield Renewables

Visit Mayfield Renewables, a provider of strategic support for solar-plus-storage and microgrid projects at mayfield.energy to learn more about planning and feasibility analysis for commercial energy projects.

Summary

The white paper, a collaboration between Mayfield Renewables and Elexity, is intended to provide commercial and industrial (C&I) developers with actionable insights and best practices for designing and engineering energy storage projects with complex electrical loads. It aims to help developers build projects that are safe, reliable, and financially viable in a dynamic market by addressing challenges like fluctuating markets and policy shifts, ultimately enabling them to secure more projects.

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