American-Made Solar Prize Round 7
Ready! Contest Submission

PV Batts

Pick the right amount of solar and batteries for your project

Keywords

Solar, batteries, software, storage, design, sizing tool, economics, utility rates, NEM3, optimization, VPP

Team

Names, geographic locations, contact info, and LinkedIn profiles, including 9 digit zip code

Partners and American-Made Network

N/A

Are you competing in the JEDI Contest?

No

Video Link

https://youtu.be/CskKNTILjBE

Four Question Written Narrative

Response to Question 1:

The solar industry is in crisis. Net-metering is under attack. California, the largest solar market in the USA, has slashed most residential solar-to-grid export compensation by over 75%. Batteries are the solution. Batteries help the system owner avoid peak electricity pricing as well as consume cheaper, off peak electricity. When added to solar, batteries also minimize solar exports to the grid and enable the user to power through significant grid outages.

The problem is the entire solar industry has become reliant upon net-metering, including the way that installers design and sell solar systems. It does not matter if batteries do all these wonderful things if the installer does not know how to adequately detail their benefits to an interested homeowner.

One major advantage of net-metering is that it keeps owner-installer conversations simple. Eliminating net-metering opens up a Pandora's box of questions. Are large solar arrays at 100% carbon offset still valid economically? How large a battery is too much battery capacity before diminishing returns? How small a battery is not enough for grid independence? Are small systems which target peak use more cost-effective than traditionally larger systems? How do local utility rate structures impact design? What about grid export policy? All of these questions are too difficult for homeowners and even installers to answer on their own.

Compounding the issue is that the solar design software which the industry is reliant upon to sell projects is mostly incapable of answering these questions. The software furthest ahead rely upon painstakingly manual programming to appropriately model solar battery behavior custom to each site. The more "artificially intelligent" software is catching up, but will continue to be expensive and hard for even the designer to understand.

If solar installers are reliant upon industry software to sell solar, and the industry software is incapable of modeling new solar battery economics, then the solar industry is heading into a crisis of its own making. Solar battery systems are valuable – but the industry lacks the tools to describe that value to the homeowner. PVBatts seeks to do what PVWatts did for the industry long ago – make solar battery system design so easy and accessible that design conversations can move forward and projects can proceed.

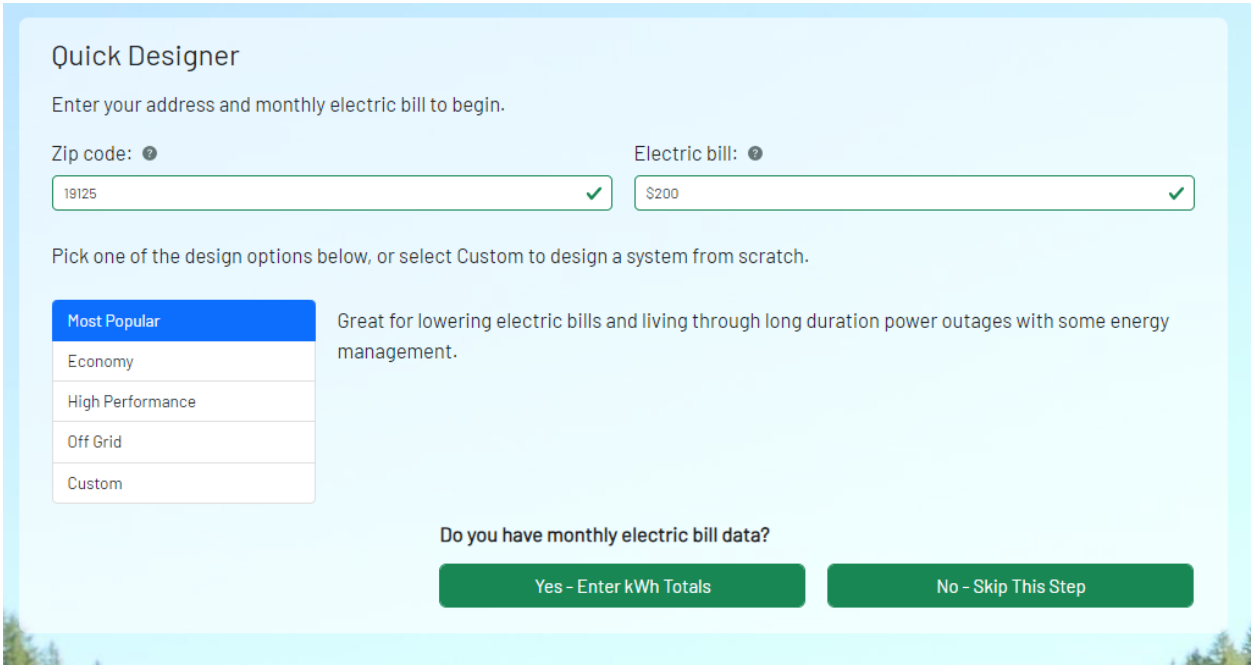
Solar batteries are great news for installers. The elimination of net-metering might shrink the solar array, but the project budget is maintained by the addition of a battery. That means more people can go forward with solar than ever before, because viable projects can now be made out of small rooftops. Solar contractors love solar because it is expensive and quick to install, which is why solar is a profitable trade. Solar batteries are even more expensive than solar and install even faster, so solar installers should embrace battery systems for new growth rather than simply view batteries as an add-on luxury!

Ultimately, PVBatts enables conversations between solar installers and homeowners about the right amount of solar and batteries to add to project site. Whether it's a small system to effectively eliminate peak pricing or a larger system to maximize grid independence, PVBatts crunches all the complicated math so that project stakeholders can quickly, easily, and accurately evaluate project goals during preliminary design process, before finishing the design in more advanced software. It offers a free, product agnostic version simple enough for homeowners to understand, as well as a paid advanced designer based on actual industry products. Our goal is to make installers and

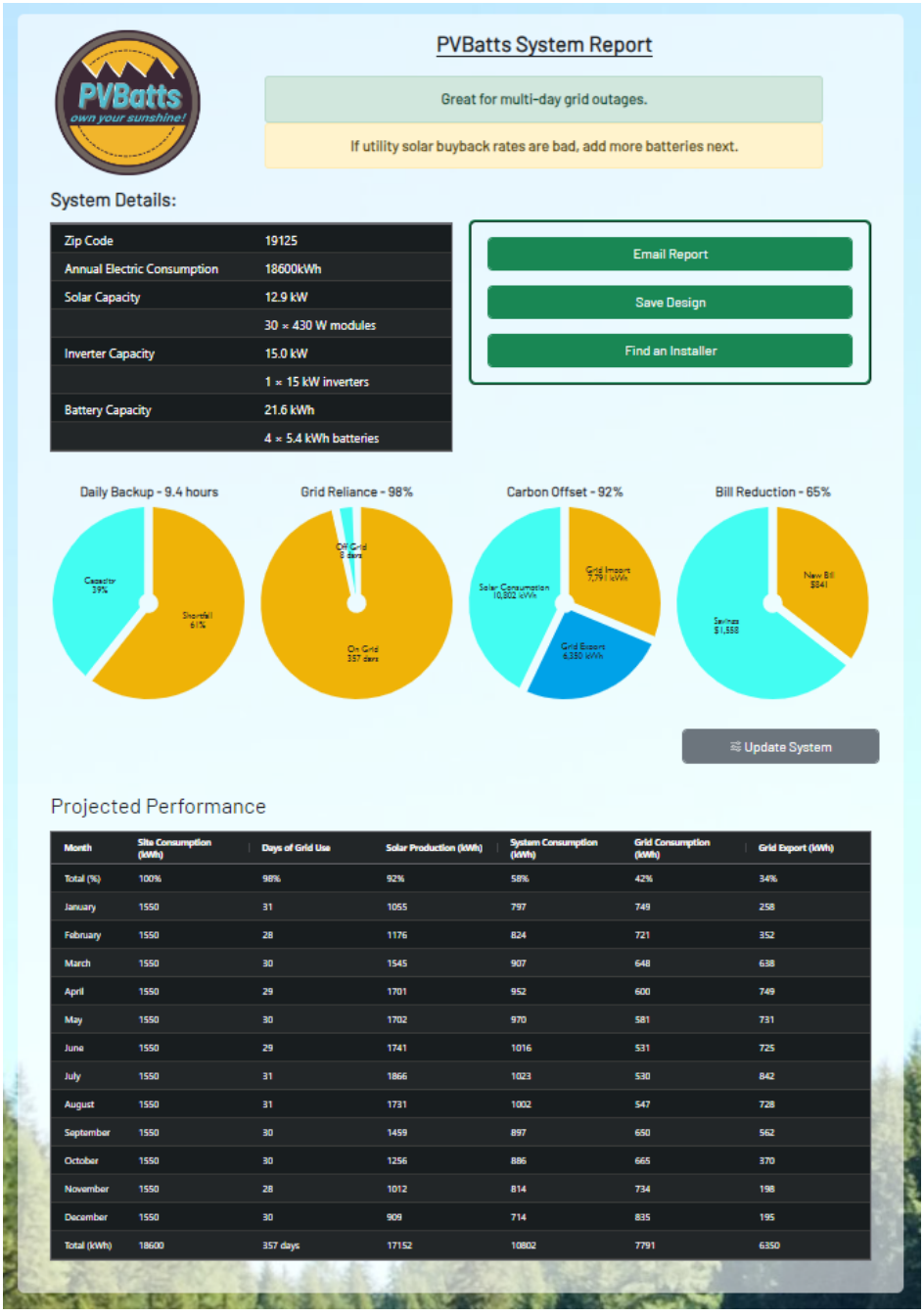
homeowners excited to proceed with solar battery projects, in a successful manner.

Response to Question 2:

PVBatts makes it quick and easy to design a solar project, based on location and electric bill. You can see for yourself at https://pvbatts.com, which is already live but in need of system expansion. In this example, a PVBatts model is simulated for Philadelphia, PA with a $200 electric bill.



This information is quickly converted into the PVBatts report, which provides guidance on the exact system design shown, as well as useful analytics about the user experience. This popular system models a 92% electricity offset (also known as a carbon offset or net-metering offset). The system stores 9 hours of daily home electricity. The home uses the grid almost every day, and roughly 30% of the solar production is exported to the grid. The electric bill is reduced by only 65% because the customer does not have access to net-metering.



PVBatts System Report

Great for multi-day grid outages.

If utility solar buyback rates are bad, add more batteries next.

System Details:

Zip Code	19125
Annual Electric Consumption	18600kWh
Solar Capacity	12.9 kW
	30 × 430 W modules
Inverter Capacity	15.0 kW
	1 × 15 kW inverters
Battery Capacity	21.6 kWh
	4 × 5.4 kWh batteries

Email Report

Save Design

Find an Installer

Daily Backup - 9.4 hours

Grid Reliance - 98%

Carbon Offset - 92%

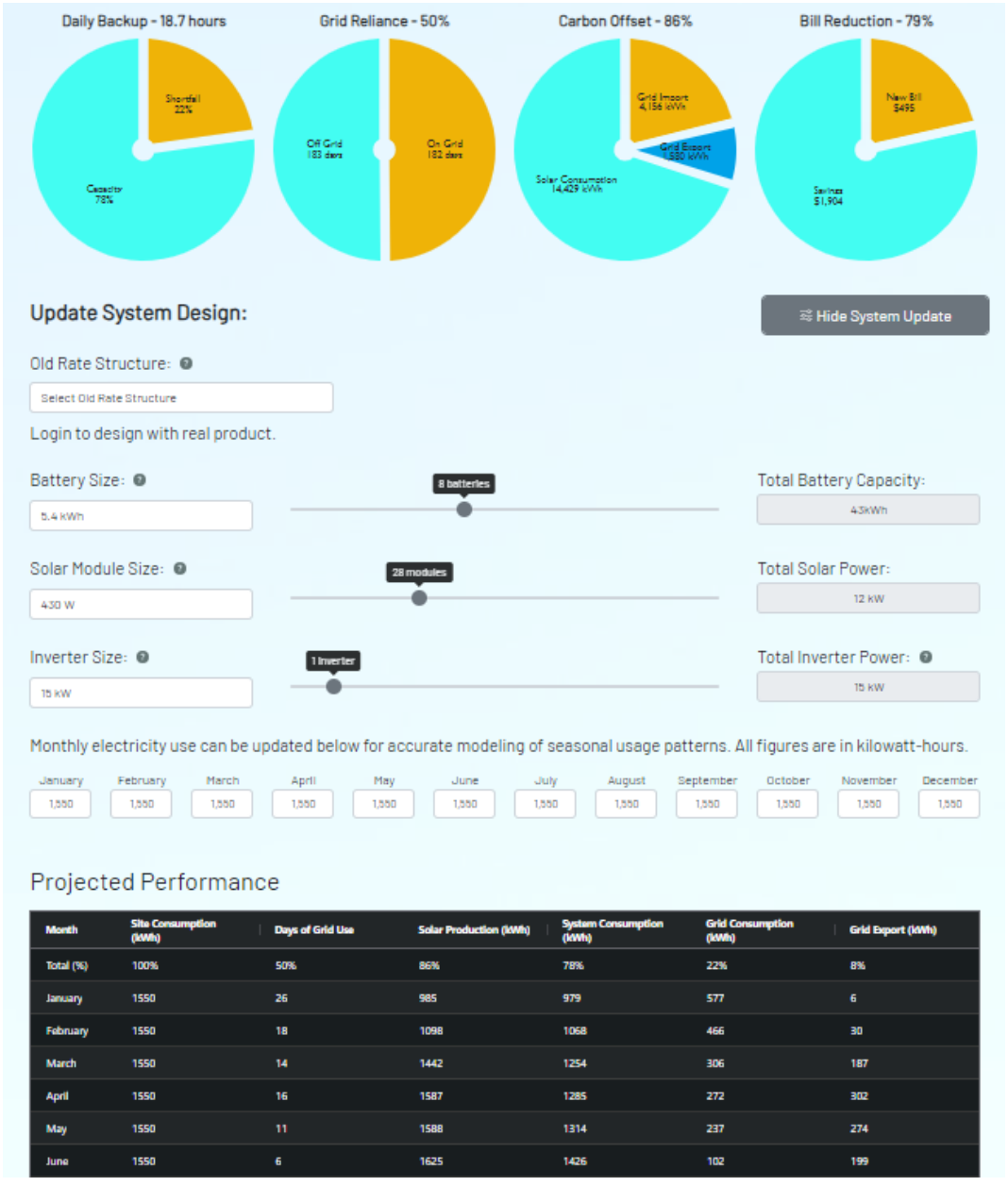
Bill Reduction - 65%

Update System

Projected Performance

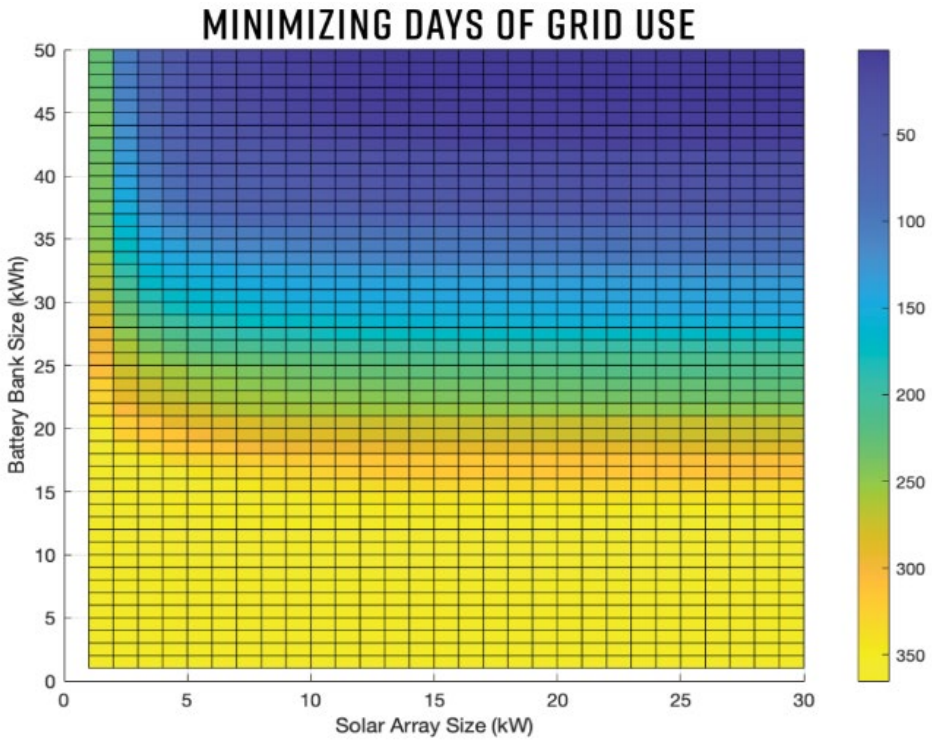
Month	Site Consumption (kWh)	Days of Grid Use	Solar Production (kWh)	System Consumption (kWh)	Grid Consumption (kWh)	Grid Export (kWh)
Total (%)	100%	98%	92%	58%	42%	34%
January	1550	31	1055	797	749	258
February	1550	28	1176	824	721	352
March	1550	30	1545	907	648	638
April	1550	29	1701	952	600	749
May	1550	30	1702	970	581	731
June	1550	29	1741	1016	531	725
July	1550	31	1866	1023	530	842
August	1550	31	1731	1002	547	728
September	1550	30	1459	897	650	562
October	1550	30	1256	886	665	370
November	1550	28	1012	814	734	198
December	1550	30	909	714	835	195
Total (kWh)	18600	357 days	17152	10802	7791	6350

After adjusting the system, the solar array size is slightly reduce to 28 panels, but the battery bank size is doubled from 4 to 8 batteries. The bill is reduced by 79%, because solar exports have decreased. Additionally, the home runs offgrid for half the year, using the grid almost every day in the winter and running the home mostly offgrid in the summer. This is a more appealing system configuration for a homeowner whose primary project goal is grid independence, even if the project is slightly more expensive. By wiggling around the battery, solar, and inverter sliders, the system designer can find the right configuration to minimize solar export, achieve the ideal bill reduction, or maximize grid independence.



PVBatts was created to solve complicated problems with a simple user interface. Behind the scenes, monthly electric bills are converted into hourly interval data. Rate structures (to be built before the Set! Demo), production, and consumption modeling are applied to each hourly interval of the year, resulting in customer-friendly data which is not readily available in any other industry software. For example, PVBatts counts the number of days per month that the site uses grid to power for home for some portion of the day, as a metric of grid independence. This helps customers understand that small batteries which target time-of-use rates still leave the home reliant on grid power on a daily basis. Whereas slightly larger battery banks deliver significant grid independence. Without such information, it is difficult for installers to sell larger battery banks.

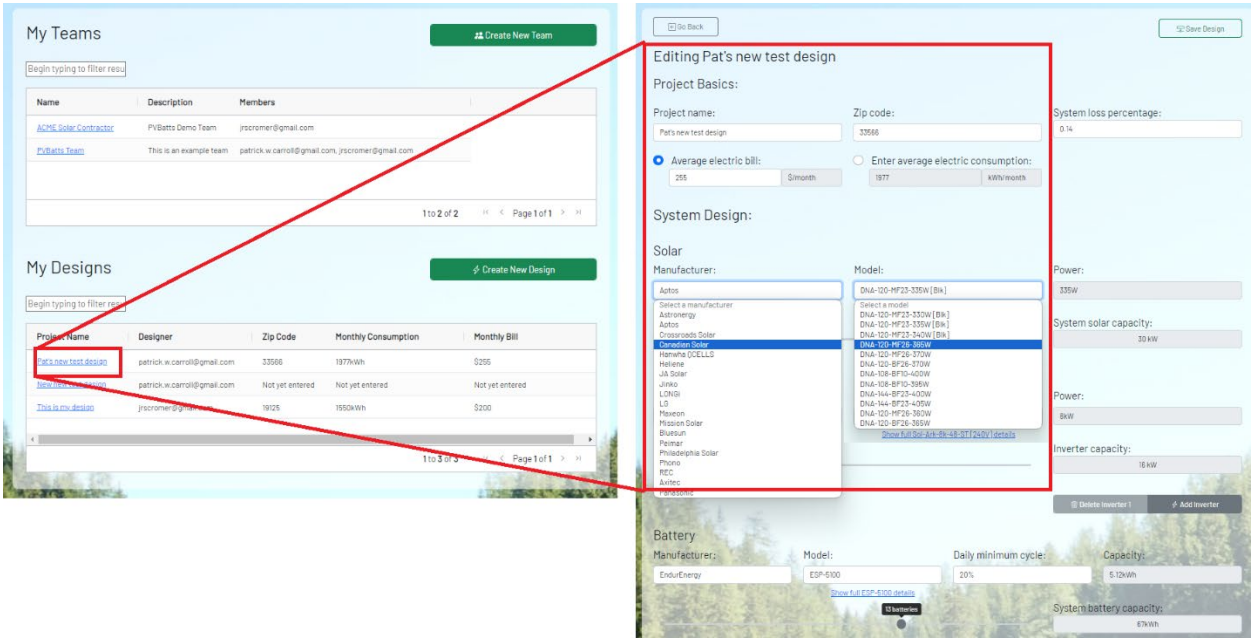
There is a tipping point where resdential energy storage system goes from relying upon the grid every day to being off-grid most days. The sun comes up most days of the year, and so batteries do not need to store an entire day's worth of energy to take the home offgrid for multiple days in a row. But identifying that right amount of batteries is difficult, because every project site is different to some degree.



The average home today only has 10 to 15 kwh of storage, whereas for most homes 20 to 25 kwh of storage would take that home offgrid for over half the year. Knowing these numbers increases customer satisfaction in solar battery ownership, especially those which go into the project with whole home backup power in mind.

PVBatts is intends to be a lightweight tool for homeowners and installers to discuss project starting point. There is a free, product agnostic version that emails system reports, and we intend to implement certified installer referrals register for live training classes. By remaining a lightweight tool, PVBatts can provide an education mission to the public.

PVBatts also has a logged in “Advanced Designer” version where companies can work together as teams. This enables a wide variety of advanced features including a real product database, which can result in feeding projects started in the software to other more advanced softwares later, and bring into alignment system details which are otherwise difficult to find from manufacturers.



Response to Question 3:

PVBatts consists of two founders. John Cromer is a former Product Director of Fortress Power and current Senior Technical Manager for Sol-Ark, both solar battery manufacturers. Prior to working in manufacturing, Mr. Cromer worked as a NABCEP-certified solar contractor and educator for over 12 years. Patrick Carroll is a computer programmer, with experience developing enterprise grade software portals in a variety of programming and low-code applications, including government and corporate websites. He currently works as a data architect consultant in the renewable industry. Both met as engineering students in college at the University of Pennsylvania from 2002-2006 and have maintained a close friendship in Philadelphia. Mr. Cromer manages the product features and Mr. Carroll provides all of the coding services.

PVBatts represents a part time effort to create industry tools needed by installers. Winning the American Solar Prize would enable a full time programming commitment by Patrick Carroll to build out features necessary to obtain industry partnerships, such as building out a export rate database, updating the consumption algorithm to accommodate the most popular battery incentive export structures, as well as a documented API for 3rd party integrations. It would also fund a full time customer success position such that PVBatts can implement its homeowner referral and education goals.

Until such time, PVBatts remains an active but grass roots effort. There are some ambitious roadmap goals, such as integration with industry software and solar company CRM systems to establish a standard industry API through which product and project information can be shared. Our vision is to remain a starting point for projects, whose project information can then be sent elsewhere, to whichever industry software the user wants to send it to. If successful, PVBatts will become a large software operation with outlets into industry data analytics and virtual power plant controls. It can grow into a large, distributed company of remote workers throughout the USA if it fulfills its vision. This includes not only programmers, but also customer success managers and administrative positions which can be entry level positions for those seeking career transitions into renewables. Companies such as Aurora Solar, PVSyst, Enact, and others can employ over 100 individuals. As PVBatts can provide services to homeowners, installers, solar software companies, and renewable manufacturers, it could easily become a company measured along that scale.

Since the American Solar Prize Round 6, PVBatts has implemented:

1) Real product database
2) User profiles, team management, and saved project designs
3) Improved data analytics
4) Adjustable monthly electric bill inputs
5) System email report generator
6) Utility rate database integration

Winning the Ready! contest would also provide funding to complete the economic engine. Our current model incorporates basic solar charging and discharging of the battery, as well as behind-the-meter rate structures. Ready round funding would help us to build out our export rate database, to incorporate pre-defined PPA contracts like California's NEM3, to simulate real time electricity pricing models like Texas' Virtual Power Plant market, and to estimate popular dispatchable on-demand utility battery incentive structures such as Massachusetts's Connected Solutions program. Lastly, PVBatts could incorporate demand management into its economically - driven consumption algorithm, so that customers with demand structures found in Arizona, Colorado, and Georgia could also gain access to accurate solar financial estimates.

Additionally, winning the Ready! Contest would elevate PVBatt's stature, making it easier to obtain industry partnerships. We want PVBatts to be a collaborative software, connecting manufacturers, distributors, and installers together into a collective product and project database. In doing so, we can provide added value down the road, such as accurate material pricing estimates, design and location based warranty compliance, and detailed project planning documentation. These items are not always accessible to installers in an obvious manner. Because PVBatts has a universal product database, it can become a universal product API. If we form enough industry partnership, we make it easy for 100% accurate system design and product information to be distributed across the industry, reducing design errors and improving project success.

Response to Question 4:

Budget: $25k – part time programming services + $25k – full time customer success manager

Specific:

- Goal 1: Add five utility export models to PVBatts software (NEM3 export, ConnectedSolutions style dispatchable incentives, Texas-style real time electricity pricing, traditional net-metering, no net-meteirng) to compliment utility rate database to improve accuracy of PVBatts economic model in a way that is more advanced than existing solutions.
- Goal 2: Acquire 100 paying installer customers within one year of launch for PVBatts subscription services (Advanced Designer and Project Referrals).
- Goal 3: Partner with at least two major renewable manufacturers and software companies within one year of launch for custom registration widgets.
- Goal 4: Become the dominant preliminary design tool in leading USA residential battery incentive markets within one year of launch.

Measurable:

- Goal 1: Measure the user-friendliness and accuracy of the software by conducting user surveys and interviews to determine how closely PVBatts simulations match up with post-project deliverability.
- Goal 2: Track the number of paying installers acquired on a monthly basis.
- Goal 3: Identify and contact manufacturer and software integration partners to co-develop software integration. Track the number of integrations secured.

- Goal 4: Research target battery incentive markets of California, Texas, and Northeast and develop a market entry plan for each incentive. Track progress towards market entry in those markets.

Achievable:

- Goal 1: The goal of developing and launching a more user-friendly and affordable solar battery design software solution is achievable with Mr. Carroll's renewable industry data architecture and programming expertise. There is a clear market demand for such a solution, and the company has the necessary expertise and programming resources to develop it.
- Goal 2: The goal of acquiring 100 paying customers within one year of launch is achievable due to Mr. Cromer's 15 year total experience in behind-the-meter renewable projects including working for two national manufacturers in this space. Installers will be targeted in primary solar battery markets across the USA with a marketing and sales strategy based on delivering detailed PVBatts reports on those regional incentives based on custom site designs.
- Goal 3: The goal of partnering with at least two major renewable manufacturers and software integration partners within one year of launch is achievable by utilizing Mr. Cromer's industry relationships and American Solar Prize prestige. Mr. Cromer already has relationships with multiple manufacturers and software companies who can benefit from this product, but needs funding for co-founder programmer Patrick Carroll to support the project technically full time as well as onboarding a customer success manager for account management.
- Goal 4: The goal of dominating the battery incentive market as a design tool within one year is achievable by utilizing public manufacturer lists of product-certified installers, commonly available on manufacturer websites, to make sure that their most preferred products are incorporated into the PVBatts product database.

Relevant:

- Goal 1: The goal of developing and launching a more user-friendly and affordable solar battery design software solution is relevant to the company's mission that solar battery design needs to be simple enough to be understood by homeowners in order to grow market interest. Providing this service to the public for free will help PVBatts achieve its other goals, such as acquiring new customers for advanced design tool and grow project referral revenue.

- Goal 2: The goal of acquiring 100 paying customers within one year of launch is relevant to the company's goal of generating revenue and achieving profitability. The typical installer is estimated to bring in $1000 of subscription revenue, and another $5000 in project referral revenue per year. This budget will more than secure the operations of PVBatts to be self-funding even as it pursues further investment rounds.
- Goal 3: The goal of partnering with at least two major renewable manufacturers and software integrations within one year of launch is relevant to the company's goal of increasing brand awareness and expanding its customer base. Leveraging the networks of others will substantially reduce PVBatts advertising needs.
- Goal 4: The goal of dominating battery incentive markets as a leading design software within one years of launch is relevant to the company's goal of achieving long-term growth and profitability. If PVBatts becomes standard in the most popular battery markets within the USA, it will grow into a national standard as the rest of the USA transitions away from net-metering and into solar battery design.

Time-bound:

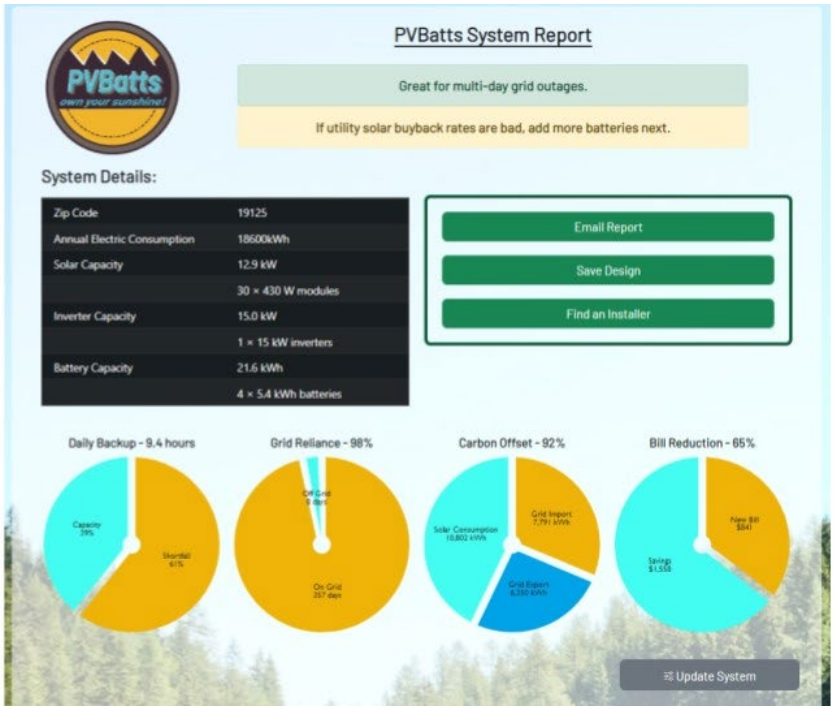
- Goal 1: Develop and launch a solar battery design software solution within two months. The basic PVBatts model is already launched and available at PVBatts.com. It would only take one month to update the model to include the various battery incentive structures discussed in this proposal if given full time attention by Mr. Carroll.
- Goal 2: Acquire 100 paying customers within one year of launch. This goal will take an entire year to accomplish as it also involves onboarding and training a customer success manager.
- Goal 3: Partner with at least two major renewable manufacturers within six months of launch. This goal can be easily achieved upon the completion of goal 1 utilizing Mr. Cromer’s industry contacts.
- Goal 4: Dominate the USA’s leading battery incentive markets as a standard design tool can be achieved by focusing marketing and training efforts onto these markets and promoting the completion of goal 1. It will take 12 months to achieve.

Supplementary Information

Four question narrative word count: _2500_____ total words

Technical Assistance Request (2 pages PDF, including images, Will Be Made Public)

Submission Summary Slide (a PowerPoint slide, will be made public)



Letters of Commitment or Support (optional)

Daryl DeJoy	Owner/NABCEP Certified PV	Island Energy Storage	Battery storage is becoming an essential component in the renewable energy. Proper design is crucial to enhancing our industry and I believe this type of design tool would do just that.
Robert Orona	General Superintendent	Bergelectric Corp. B	Being able to have access to the appropriate resources shouldn't be a cost issue if we want to

		Contractors & Engineers	have systems installed appropriately and code compliant.
Scott Hunt	Owner	Practical Preppers	I'm excited to use this application on a daily basis as part of my consultation service in the residential solar space.
Liam O'Brien	Owner	Kilawatt Consulting LLC	As a small business owner, there is nothing that excites me more than being able to use software built by some of the brightest minds in the US to help grow my solar+storage company's reach and expand our abilities, as the solar industry at large works to electrify and decarbonize the US grid.
Daniel Schippers	Sunbright Solar CEO / Owner	Sunbright Solar	His program was very informative, comprehensive, and well put together.
Timothy Olsen	President	Advanced Energy Systems LLC	Sorely needed.
Lotus	President	rmswi	PV Battt great idea!!!
Kenechukwu Obi	Director	Bitstream Engineering Solutions Ltd	Storage presents a huge opportunity for optimising PV systems and reducing carbon emissions. I strongly support John's current research that aims to develop a simplified and accessible battery sizing software.
Rebekah Carpenter	Owner	Fingerlakes Renewables Inc.	Having been in the solar industry as a designer and installer for more than 20 years, the need for a simple and accurate design and education tool for batteries is teetering on the edge of due and long overdue.
Dennis Beaver	owner	Beaver Solar	I have been looking for a battery design tool like this for years - thank you for putting forth the work required to produce this!
Brent Groce	Board Secretary	The Clean Energy Co-op	Battery sizing is a real challenge for organizations that are accustomed to grid-connected installations. A tool to make this task more easily accomplished would be a great help.
Emmett Miranker	Head of Business Development	Bodhi	Improving the ease of battery bank sizing and design will accelerate the adoption of residential energy storage.
Clayton Patrick Parker	Owner	Empower Off Grid	A long overdue tool for battery sizing.