

Solar and Battery Back-up-

BPVS since 1985 has fielded and serviced Solar PV systems with batteries sometimes called Solar + Storage or Hybrid PV systems. We have many sites with off grid PV systems. Our founder has lived off grid since 1980. We have many clients with PV systems that interact with the grid, a battery bank, a back-up generator, and their electric usage during a utility outage.

There is a great deal of hype in the marketplace now about Solar + Storage and there are incentive programs for adding batteries to utility interactive PV systems in Massachusetts. It is important for you to understand what you really want from battery back-up features of a solar electric system, what you really need and what is affordable.

The marketplace hype and the incentive programs in Massachusetts are for a select group of Solar + Storage products approved by the utilities which provide limited back up capacity during an outage but can be controlled (charged or discharged) through the internet by the utility to help meet grid demand requirements in late afternoon and evening hours. It is a way to shift solar availability away from daylight hours. The initial incentives for this type of system through the SMART or the Connected Solutions programs have proven insufficient to justify the expense for consumers. A new Clean Peak incentive is being developed for possible roll out in Fall of 2021.

The hype emphasizes the *value-added* feature of these Solar + Storage products, promising back up electricity for your home during an outage and an assurance from the utility that they would not discharge your battery bank if there is a risk of a storm and potential outages, and that during a prolonged outage your Solar PV system will re charge the battery bank.

We will continue to advise people to avoid this type of battery product and utility program unless the incentive is exponentially increased. For multiple technical reasons, both with the products and utility control, reliable power during an outage and durable service over time cannot be guaranteed or warranted.

Homeowners want continuous electric service during an outage for lights refrigeration, cooking, heating and cooling, water and sump and sewage pumps, entertainment equipment and more. Institutional and business owners have their own critical load profile. In some areas they will have heard about or experienced

utility power outages lasting days on end. They want the back-up system to work automatically and continuously. Traditionally that need has been met by a fossil fuel generator with an automatic transfer switch. Often budget or technical constraints will limit the size generator installed. There is considerable maintenance with fossil fuel generators. Most are not designed for continuous service and will need filter and oil changes and adjustments after as little as ten hours of service. Continuous duty or long operation service generators are much more expensive than portable units from Big Box stores or those often offered by generator dealers. As with Solar + Storage or any complex electrical device installation, National Electric Code compliance, a permit and inspection are required.

The lure of Solar + Storage functions on the level of environmental conscientiousness. Back-up power that is sustainable. Here too, let the buyer beware. To participate in the Massachusetts programs means you have ceded the environmental attributes for payment of the utility incentive. The manufacturer of the solar panels used, and the type of battery technology, may be so compromised that you likely are contributing to environmental degradation for resource extraction and environmental injustice to indigenous populations and factory workers. Lithium Ion (LI) based batteries are difficult to recycle safely and would be two to six times more expensive if recycling costs were properly added. Many of the brand name Solar & Storage products are really re-purposing spent electric vehicle batteries that are too expensive to recycle.

So, what does BPVS offer for Solar + Storage?

First, we carefully look at your situation and back up power needs. If you already own a PV system designed by BPVS, storage readiness is already built in so expanding with batteries does not mean a new solar array or re-wiring an existing array. Second, we feature Panasonic Solar modules, the highest quality, environmentally benign manufacturing techniques and recyclable. No slave labor involved. And we recommend lead acid AGM (absorbed glass mat) batteries from US companies. Not perfect but safer than LI - 100% recyclable and much less expensive.

Our Solar + Storage customers rely on their working and ready systems, many decades old. Costs range from \$2k for a 1 kWh (kilowatt hour) kit to over \$500k for a complex installation we monitor and maintain. Our average residential back up or off grid Solar + Storage system ranges in price from \$35k-\$ 45k. Adding

battery capacity to an existing array is replete with options with costs from \$5k on up.

Equipment takes up space so issues of proximity to your electrical panel or the need to build special structures can come into play. Even with AGM batteries adding storage is expensive so knowing your budget is important. Your decision and the cost are all about how much power you need and for how long.

The KiloVault Res-Q system we offer uses the safest Lithium based battery chemistry. A percent of our profits from their sale goes to Amnesty International, the most active organization working to remedy the plight of indigenous people in mineral extraction areas of Chile, Argentina and Bolivia and the Congo. The KiloVault, L I Iron Phosphate battery chemistry however does not use cobalt which affects miners in the Congo. This Res Q system is self-contained and the budget conscious household should consider it for small but essential electricity needs during an outage.

Our larger systems use Lead Acid- Absorbed Glass Mat (AGM) batteries made in the US which are completely recyclable and quite safe as well as maintenance free. They do not have the long lifecycle of Lithium Ion batteries but are also quite a bit less expensive. We believe that by the time your first set of AGM batteries wears out, one of the promising environmentally careful battery products in research & development will supplant Lithium Ion in lifecycle cost and reliability and safety.

Almost all our larger designs will involve a back- up fossil fuel generator because people want power no matter what the weather. A discharged battery bank needs sunny weather to recharge solely from Solar. January 2021 in some parts of the Berkshires is another example of instances over the years when no real sunshine occurs for 15 days in a row. The winter low sun period of the year is when the most prolonged grid outages occur. Keep in mind that the Solar + Storage products getting all the hype in our market and required to participate in the utility incentive SMART program were developed for the Southern and coastal California region where the sunshine is consistent. Oversizing a solar array to meet New England's worst case overcast conditions is very expensive.

The advantage of solar + storage + a fossil fuel generator is that a battery bank can be recharged by automatically starting the generator and automatically shutting it off when completed. This saves on emissions and fuel of course but also on maintenance and noise. Often this design can use a smaller generator than would

be called for without a Solar + Storage component. Some customers eschew the fossil fuel generator and simply conserve when battery capacity is diminished. If you want to go weeks on end with a limited fuel supply and average amounts of sunshine this type of design is perfect and the most popular choice of our customers. Remote homeowners often go most of the year not using their small fossil fuel generator at all. Between Halloween and Ground Hogs Day they'll run the generator a few hours each week during stretches of cloudy weather.

Often prospects tell us they want a wind generator instead of a fossil fuel generator for those no sun periods. Unfortunately, the wind is intermittent too and small-scale wind turbines mean lots of maintenance. One of our installations with micro-hydro auxiliary generation still needs a fossil fuel generator to assure reliability.

Solar and Storage has other uses and we also offer designs for dedicated load systems. If the load is charging an electric vehicle (EV) intermittently at a remote site during the day then very little on site battery storage is needed. The EV is the battery bank. Remote Instrumentation and small water pumps are other examples where small battery banks can be effective.

In Summary- please beware of the hype about solar and storage and back-up power supply from batteries. If an offer sounds too good to be true that is because there are hidden costs or failings. That goes for the utility sanctioned program in Massachusetts too. The interplay of batteries with solar and the grid and your loads requires a deeper technical understanding than most solar sales people possess.

Count on straight answers from BPVS.