We listened. Solar energy storage the way you want it.

Solar batteries aren't just for backup anymore. As utilities and localities eliminate or cap net-metering, batteries need to store and return power every day, not just when the grid goes down.

Elecyr's advanced energy storage provides a better answer. We've selected the best available battery technology for residential applications: Lithium iron phosphate (LFP) coupled with graphene nanotechnology. These batteries are safe, light and can be discharged up to 95% every day for 25 years. Until now, the best deep cycle storage has been lead-acid wet cells such as the premium two to six volt Rolls brand batteries. But even the best of these wet cell batteries will last two years under ideal conditions.

At a cost of 8¢ per kWh over the lifetime of the battery versus over 55¢ for the best lead-acid, Elecyr energy storage will pay for itself before the second time you replace a lead-acid setup. Like a new roof or improved insulation, it's an investment you can include in the mortgage.

Our simplest product is our 7.2kWh 8D battery. It includes charge control, remote voltage and current monitoring, isolated charging and discharging, and protection against short circuit and over-current. If you already have an energy storage system, the Elecyr 8D is the easiest way to upgrade. They are one-quarter the weight of their lead-acid counterparts and last ten to fifteen times longer. Two of these batteries, totaling 15kWh, will power an average home and work with most existing solar installations equipped for battery backup.

Elecyr also offers a complete energy storage solution called the PowerStack. Modular design means you pay for exactly what you need with no compromise. It also means you're free to expand and upgrade component by component over the years.

The PowerStack starts with a steel shelving frame on wheels. This frame comes in two models with room for either four or eight shelves. The shelves serve as as mounting hardware for our 3.7kWh batteries and inverters, which makes it simple for you to install yourself. The PowerStack charges directly from solar panels

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using MC4 cables, from a regular wall outlet, or from a 380 volt DC microgrid. With an assembly that's as simple as tightening a few bolts and connecting color-coded wires, you won't need to hire a professional electrician to install it. In fact, if you only need to power certain appliances, simply plug them directly into your PowerStack and enjoy your battery power.

For more complicated systems that require a connection to your home's electric panels, you will need a professional electrician. But complicated systems are where the PowerStack's modular design excels. Different stacks of inverters, batteries or a mixture of the two can be linked together to build a distributed energy system designed for your specific needs. Elecyr provides busses at 48, 380 or 760 VDC that are compatible with high voltage third party components including chargers, inverters, and VFD drives.

The PowerStack can also connect to the Internet so you can monitor your system from any laptop or smart phone. All systems include a ten-year warranty, which can be extended to 25 years when the system is monitored by Elecyr. With a monitoring plan, we record a history for every cell and component to predict problems before they occur.

Ready for the environment. Ready for the future.

Whether in the arctic, the desert, or on the water, Elecyr's batteries are ready for maintenance-free operation in the toughest environments. For the most demanding applications, ask us about our Lithium Titanate (LTO+) batteries that last for 30,000 cycles of daily discharge to 95%. These batteries operate in the most severe conditions at temperatures from -40 to +55°C, and have a shelf life exceeding ten years. While these batteries are more expensive than our LFP chemistry, over their lifetime they still deliver power at 8¢ per kWh.

AC power for real world applications

Elecyr energy storage will work with most AC inverters but Elecyr offers pre-packaged shelf-mount inverters for use with the PowerStack. These inverters include integrated solar charge controllers and a backup transfer switch and, although they operate at 48 volts, they can also be connected using an optional 12kW microgrid bridge to create a 380 volt system.

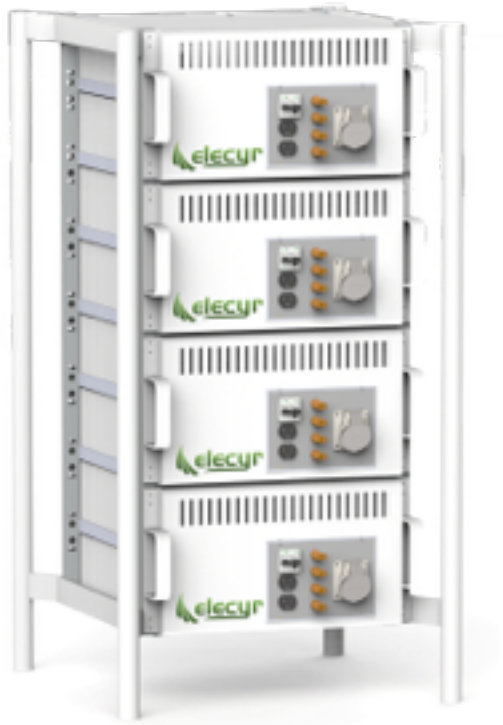
With Elecyr's cloud-based monitoring systems, multiple inverters may be configured for load-shedding to protect critical loads in an outage or reduce loads when power is most expensive. Although the PowerStack connects directly to a solar array with MC4 connectors, you're not limited to just solar power. You can charge from the grid when power is cheap or charge from a generator to maximize its efficiency. If you take part in a net-metering program, you'll still have that option with Elecyr.

Compared to large industrial inverters, Elecyr's inverters operate at high conversion efficiency — up to 98%. Elecyr's systems are optimized to preserve collected solar power by sending DC power directly from the panels to the batteries. Elecyr's batteries, in turn, have charging efficiencies much higher than lead-acid batteries or other chemistries. In conventional net-metered installations, the power losses of conversion from DC to AC and back to DC again combined with the poor efficiency of lead-acid batteries squanders nearly half the solar power. When roof space is limited, Elecyr's increased efficiency makes Net Zero Energy viable. For larger installations with individual loads between 17kW and 500kW, industrial 480 VAC inverters can be used with Elecyr's 380 VDC battery stacks.

Our inverters come in two models, the E-3000 and the E-4400. The E-3000 is our smallest and most efficient model and supplies 3kW of power, while the E-4400 supplies 4.4kW of power and can be stacked in parallel up to 16kW. For power demands greater than 16kW, several inverter stacks can be linked to form a 380 VDC microgrid.

Distributed storage for greater reliability

When you supply your own electricity, there's no reason to put all your eggs in one basket. It's smart to distribute energy storage and inverter power across several PowerStacks attached to multiple sub-panels.



This allows you to delegate certain loads to certain inverters which will maximize efficiency and protect critical loads. Critical loads are appliances that absolutely need uninterrupted power. Examples of critical loads might include heating, refrigeration, hardwired lighting or security systems. If you attach critical loads to a separate inverter, they're protected in the event of dwindling battery reserves. Distributed energy storage also works in buildings with multiple housing units. This way, everyone is allocated their fair share of energy for optional use while the entire building can always count on having enough energy for heating or cooling.

Building blocks

Use the rest of this packet to familiarize yourself with the way Elecyr's modular design can serve custom needs. On the following pages, you'll find specifications and prices for all our models as well as a guide to designing your own energy storage system with Elecyr components. You'll also find diagrams of example configurations to help you understand how these components fit together.

LFP BATTERY SPECIFICATIONS	8D 288A 24/48V 7.4 kWh	Single Shelf 72A 48V 3.7kWh
Dimensions	485x280x300 (19.7”x11.0”x11.7”)	586x486x135 (23.1”x19.1”x5.3”)
Weight	62 kg (138 lb)	30 kg (68 lb)
Normal capacity	288.0 Ah @ 1/3C3A(96A); 7.2kWh	72.0 Ah @ 1/3C3A(96A); 3.7kWh
Lifetime capacity	64,800 kWh; over 25 years with 80% daily discharge	32,400 kWh; 25 years with 80% daily discharge
Nominal voltage	25.6V/51.2V	51.2V
Charging cut-off voltage	29.2V/58.4	58.4V
Discharging cut-off voltage	20.8V/41.6V	41.6V
Standard charging current	1/3C_3A(48A for 48V, 96A for 24V)	1/3C_3A(24A)
Standard discharging current	1/3C_3A(48A for 48V, 96A for 24V)	1/3C_3A(24A)
Max continuous charging current	1.0C3A(144A for 48V, 288A for 24V)	1.0C_3A(72A), limited by charge controller
Max continuous discharging current	1.0C3A(144A for 48V, 288A for 24V)	1.0C_3A(72A), limited by charge controller
Maximum battery pack size	288Ah series, 1000V; 63 8D batteries series	72A, 1000V series; system limited parallel
Self discharge rate	< 0.1% per month	
Temperature range	Discharge -20 to +60°C; Charge 0 to +45°C; Storage -20 to +40°C	
Battery chemistry	$LiFePO_4$ (lithium iron phosphate) enhanced with graphene carbon nanotube anodes	$LiFePO_4$ (lithium iron phosphate) enhanced with graphene carbon nanotube anodes
Fire and explosion	Not flammable or explosive but internal organic material will burn if the battery or cell is incinerated. Class D fire extinguisher recommended for extinguishing combustion. Toxic gases (HF, PF6) will be formed if cells or battery are involved in a fire.	
Environmental impact	Does not contain toxic materials. When properly used or disposed there is no environmental hazard. It is advisable to consult with local authorities for disposal as regulations may vary dependent on location.	
Internal resistance	≤1.5mΩ(AC Impedance, 1 000 Hz)	
Bussing	Separate charge and discharge bus terminals, may be joined externally	
Battery management	Internal to battery enclosure, cell health is monitored and recorded over the life of battery	
Charge control	Solid state FET controller for charge and discharge current limiting; battery can be used with most appropriate charge sources. For charge controllers VRLA or AGM charge profile recommended. Electronic short circuit protection.	
Communications	RJ-11 multi-drop ModBus connection; JSON communication to Elecyr controller; API available for independent developers	
Warranty	36 month standard warranty in PSoC applications, 25 year Extended Warranty with monitoring	36 month standard warranty in PSoC applications, 25 year Extended Warranty with monitoring
MSRP	**$4590.00**	**$2250.00**

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48 VOLT SYSTEM SPECIFICATIONS		
Inverter	E-4400 (double shelf)	E-3000 (single shelf)
Nominal AC output voltage	120/240 VAC split phase (± 5%)	110/120, 220/240 VAC
Output frequency and accuracy	50/60 Hz ± 0.1%	50/60 Hz ± 0.1%
Total harmonic distortion	< 5%	< 3%
5 second surge (real watts) 4/8/16 kW	8500	6000
30 second surge (real watts) 4/8/16 kW	5200	4500
5 minute surge (real watts) 4/8/16 kW	4800	3450
30 minute surge (real watts) 4/8/16 kW	4500	3100
Continuous power output at 25°C	4400 VA (L-L)	3000 VA
Maximum continuous input current	144A	75A
Inverter efficiency	94%	96%
Transfer time	16 msecs	10 secs
No load (120 VAC output, typical)	25 watts/50 watts/100 watts	<10 watts
Continuous grid charging at 25°C	60/amps DC	6/amps DC
Grid charging efficiency	85%	92%
Power factor	> 0.95	> 0.95
Input current at rated output (AC amps)	17.5 AAC per leg at 120/240 VAC split phase	6A at 240 VAC; 12A at 240 VAC
Transfer relay capability	2/4/8 legs at 30A per leg	20A
AC stacking	1 to 4 for a maximum of 17.6 kW	NA
PV Charge Control		
Maximum PV open circuit voltage per string (non-microgrid)	125 vdc	57 vdc
Charging/load current at 25°C	40 amps DC	30A max
Maximum peak current	85 amps	30 amps
General, Physical, Environmental Specifications		
Operating temperature	-20°C to +60°C (-4°F to 140°F)	
Non-operating temperature	-40°C to +70°C (-40°F to 158°F)	
Operating humidity	0 to 95% RH non-condensing	
Vibration	10 ~ 500Hz, 3G 10min./1cycle, 60min. each along X, Y, Z axes	
Maximum operating altitude	15,000’ (4570m)	
Inverter and chargers UL/ETL listed to UL 1741 and to CSA 22.2 No. 107.1-95 standards, CE compliant; EMC emission compliance to FCC class A, EN55022 class A, 72/ 245/ CEE, 95/ 54/ CE, E-Mark; EMC immunity EN61000-4-2,3,4,5,6,8,11		
Input connections	(6) Anderson Blue SB-50 120A 48V; (2) Anderson Blue SB-175 280A 48V	
Output connections	(2) NEMA 5-15 15A 120 VAC; NEMA L5-30 (NEMA L15-30 for E4400); (2) Modbus	
Weight	24.9 kg (54.9 lbs)	15.5 kg (34.1 lbs)
Dimension	586x486x270 (23.1”x19.1”x10.6”)	586x486x135 (23.1”x19.1”x5.3”)
Warranty	36 month standard warranty	3 year standard warranty
MSRP	**$2890.00**	**$1750.00**

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48/380/760 VOLT SYSTEM COMPONENTS	MSRP
Frame for battery shelves or inverters, weight 32 lb., capacity 380b.	
Two side stands for 4 inverter or battery modules, weight 32 lb., capacity 390b, white powder coat. Assembled size 27”x27”x27”	$160
Two side stands for 8 inverter or battery modules, weight 61 lb., capacity 810 lb., white powder coat. Assembled size 27”x27”x54”	$290
Heavy duty caster set	$100
48 VDC bus connect and communications control	
(4) 100A Anderson bus connections (blue, 2 awg), (2) modbus, Ethernet,	$400
380 VDC bus connect and communications control	
(7) 100A 48V Anderson bus connections (blue, 6 awg), (2) modbus, (1) Ethernet, (2) 100A 380V bus connections (yellow, 4 awg), 380V charge bus orange Anderson SB-50, 380V discharge bus Anderson SB-50 (yellow, 6 awg),	$600
12 kW microgrid bridge	
The microgrid bridge links 48 volt batteries and Elecyr inverters to a 380 (260-420 VDC) microgrid consisting of DC boost converters and 380 volt shared energy storage. (4) 100A 48 VDC blue Anderson SB-50 bus connections, (1) 100A 380 VDC orange Anderson SB-50 charge connection	$1400
Cables	
.7m 48VDC battery cable, 120A, 8/2 awg, green Anderson SB-50 (battery side), blue Anderson SB-50 (inverter/bus side)	$60
1.2m 48VDC battery cable, 120A, 8/2 awg, green Anderson SB-50 (battery side), blue Anderson SB-50 (inverter/bus side)	$85
1.5m 380VDC bus cable pair, 120A, 8/2 awg, orange Anderson SB-50 (charge cable), yellow Anderson SB-50 (idischarge cable)	$190
1.0m 48VDC bus bridging cable, 280A, 2/2 awg, blue Anderson SB-175 both ends	$175
Modbus cable set (2) 1.2m RJ11 modbus cable, (6) 0.2m RJ11 modbus cables	$29

SOLAR PANELS AND DC/DC BOOSTERS	
FOR 380 VDC SYSTEMS	
EIQ Energy VBoost DC-DC converters provide for solar panels to be combined into a parallel DC bus operating at a nominal 380 volt (optionally760 volt). These strings of up to 11.4kW can be directly connected on a common DC busway up to 500 kW from Universal Electric. Elecyr 380 volt battery stacks can be connected directly to the same bus without combiners or additional wiring. The combination of EIQ Energy, Universal Electric and Elecyr dramatically simplifies the design and installation of high power solar installations.	
FOR 48 VOLT ELECYR 4 KW TO 16KW INVERTERS	
Each ELECYR 4400 watt inverters can directly accept a series string of solar panels up to 40A at 125 VDC. The battery stack is charged directly from the panel array charge controller at 96-98% efficiency. Up to four inverters can be combined to provide up to 17.4 kW of AC output.	
FOR 48 VOLT ELECYR 3 KW INVERTERS	
Each ELECYR 3000 watt inverter can directly accept a series string of solar panels up to 30A at 57 VDC. The battery stack is charged directly from the inverter’s internal charger at 98% efficiency.	

DETERMINE THE LARGEST SINGLE LOADS

A load is the amount of power in kilowatts (kW) needed at one time. The largest load for a single appliance sets the minimum wattage for the inverters, solar array, and energy storage. Appliances should have a label describing their power requirements, but this information is also available in manuals or manufacturer websites. Most normal household loads can be supplied by our efficient 3kW E-3000 inverters but, for larger loads, our 4kW E-4400 inverters can be stacked in parallel up to 16 kW. If you have single loads greater than 16kW or loads that require three phase power, Elecyr's buses support third party commercial inverters and/or drives.

DETERMINE THE DAILY PEAK DEMAND IN KILOWATTS

Another factor that affects the necessary inverter power is peak demand. This is the power you'll need when you have many appliances on simultaneously, such as when you are running around in the morning getting ready for work. Once you take note of the power demands of all individual loads, it's easy to keep track of which appliances you use at the same time. Their collective power demand in kilowatts is your peak which can be many times the average demand. Load shedding or selective use of high powered appliances can reduce the peak demand, but inverter and battery size needs to be sufficient to cover any simultaneous loads. Remember, loads can be split up across multiple panels and inverters so you don't necessarily have to buy a commercial inverter if your peak demand is over 16kW.

DETERMINE THE AVERAGE DEMAND IN KILOWATT-HOURS

Your electric bill contains a monthly average, but we size our system based on daily demand. You might not use the same amount of energy day to day, so do yourself a favor and try to estimate your highest daily usage. You probably use more power on Sunday when you're doing laundry than Monday when you're at work. Peak loads can use two to three times the amount of battery power than the average, so Elecyr recommends buying storage to take you through those peak times or periods of stormy weather. This way, you don't have to make sacrifices to your lifestyle. Remember, no rechargeable battery in the world can discharge 100%. We recommend you allow for an extra 20% of headroom when determining your storage needs.

CHECK YOUR SOLAR ARRAY KILOWATT CAPACITY

The solar array should be sized for the total daily power needs in kWh divided by the number of "solar hours" for the location. In most places this will be three to five hours of sun power, but it varies depending on the season and your latitude. In much of North America, you'd need 30 kWh per day which translates to an array of about 10 kW. The battery system should be sized for the daily load requirements and the total inverter power must be at least the size of the solar array. There's no need to figure out how much energy you use during the day versus night because our systems funnel all energy through the batteries first before delivering energy to your home. Our calculator at http://elecyr.com/solar-calculator can help determine the demands of typical homes, but you may benefit from a professional energy audit for more exact data.

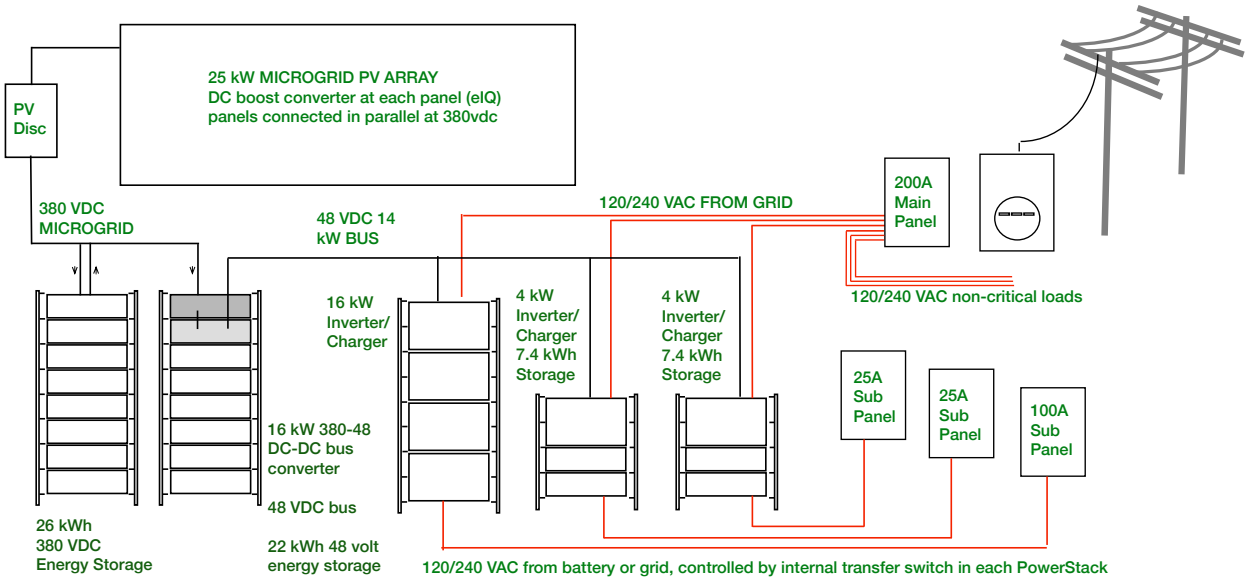
DETERMINE YOUR DISTRIBUTION STRATEGY

After you spend the time with steps 1-4, your PowerStack configuration will start to take shape on its own. One or two PowerStacks can power small homes with few loads. For larger installations with total loads higher than our inverters can handle, you can replicate a small system across multiple sub-panels to distribute the load. Once you understand how your loads are distributed, simply add battery storage accordingly, count up the number of shelves you require, select the appropriate frames, and choose the voltage of your bus.

If the total power requirement is less than 15 kWh per day, the best choice is a low voltage (48V) system with panels directly connected to one or multiple inverters. At 20 kWh per day or more, a parallel DC array using our 12kW microgrid bridge is more economical. For a cluster of buildings, a 380 volt microgrid provides the economy of a shared solar panels and energy storage with the convenience of small, efficient inverters. To better understand how these components can be combined to form unique configurations, take a look at the following examples.

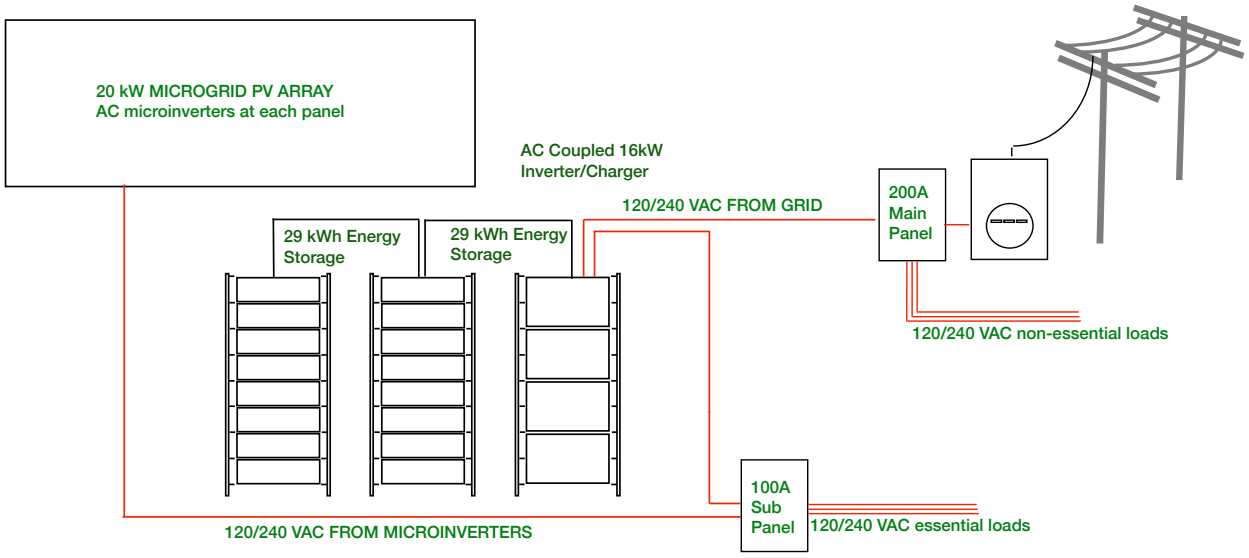
Example: DC coupled (grid hybrid) system.

The solar array is an elQ 380 vdc parallel string feeding a 380 VDC bus. A 380 volt energy storage acts as a buffer so that the 48 volt bus can be fed at lower current. Non-critical loads (which may be interrupted in a grid outage) are powered directly from the main AC panel. Critical loads are powered from inverters on the 48 volt PowerStack(s). An Elecyr Power controller determines when collected power is used and selects either inverter or pass-through (from grid) on each of the PowerStacks.



Example: AC coupled system with AC microinverters

The total power of the microinverters must not exceed 90% of the capacity of the PowerStack. The total energy storage should be sized for the amount of energy that it is desired to store, usually one or more day's requirements. Multiple AC coupled systems may be connected to the Main Panel from the bidirectional utility meter. Non-essential loads, loads that can be interrupted without harm in a grid outage, may be connected directly to the Main Panel. This type of system is best suited for locations with net metering and particularly locations with feed-in tariffs.



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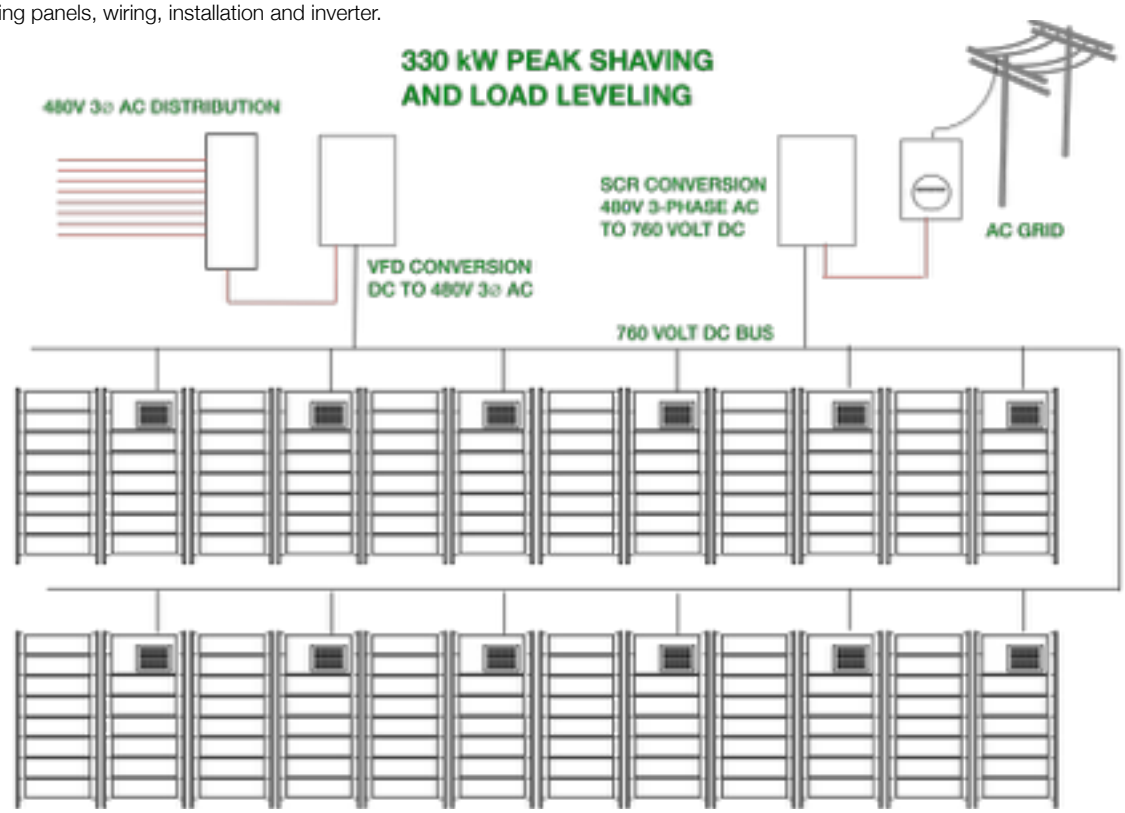
Example: Peak Shaving and Load Shedding

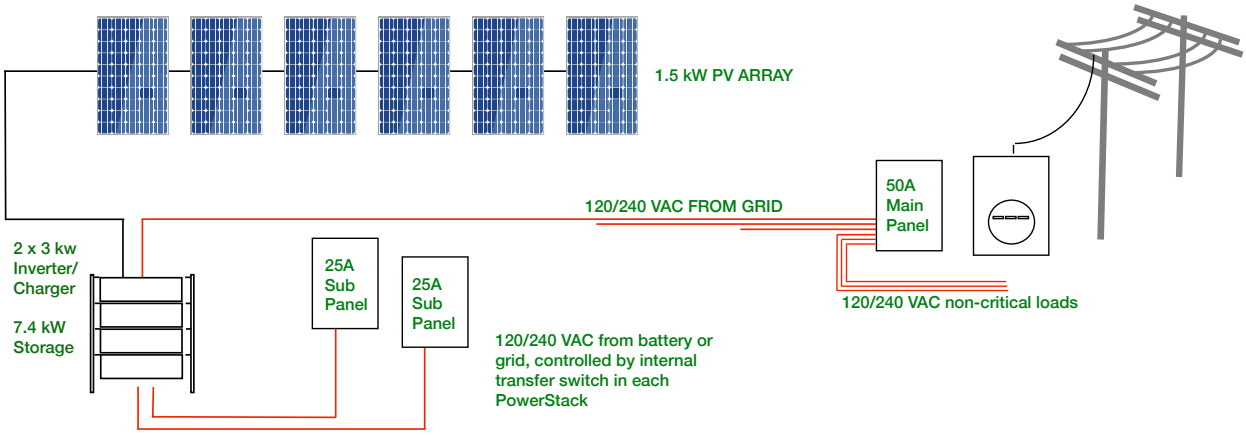
Elecyr's energy storage modules are used for storing renewable or grid electric power for use at a time other than when it's produced. Even when renewable power isn't available, Elecyr optimizes fossil-fueled generators and grid power to be run periodically at peak efficiency. This alone can provide up to 50% savings on energy costs.

Elecyr high voltage energy storage is designed to work hand-in-hand with Variable Frequency Drives (VFD) to produce three-phase AC output at 208 or 480 Volts. A VFD with direct DC link and sinusoidal output filtering provides output power at much lower cost and greater efficiency, with lower heat and weight than traditional inverters. Highly efficient and cost effective grid charging is provided by AC/DC converters controlled by Elecyr's Battery Management System. For large installations, Elecyr Microgrid Energy Storage Modules at 380 Volts are directly bus compatible with parallel DC solar solutions from eIQ Energy, with a typical array cost of $1.50 per watt including panels, wiring, installation and inverter.



Example: Tiny house or RV

A tiny house or RV may only need one or two Elecyr 8D batteries to provide all the power needed. In the following example, eight solar panels collect 8kWh per day. This can handle a peak load of 6kW and momentary load of 12kW.



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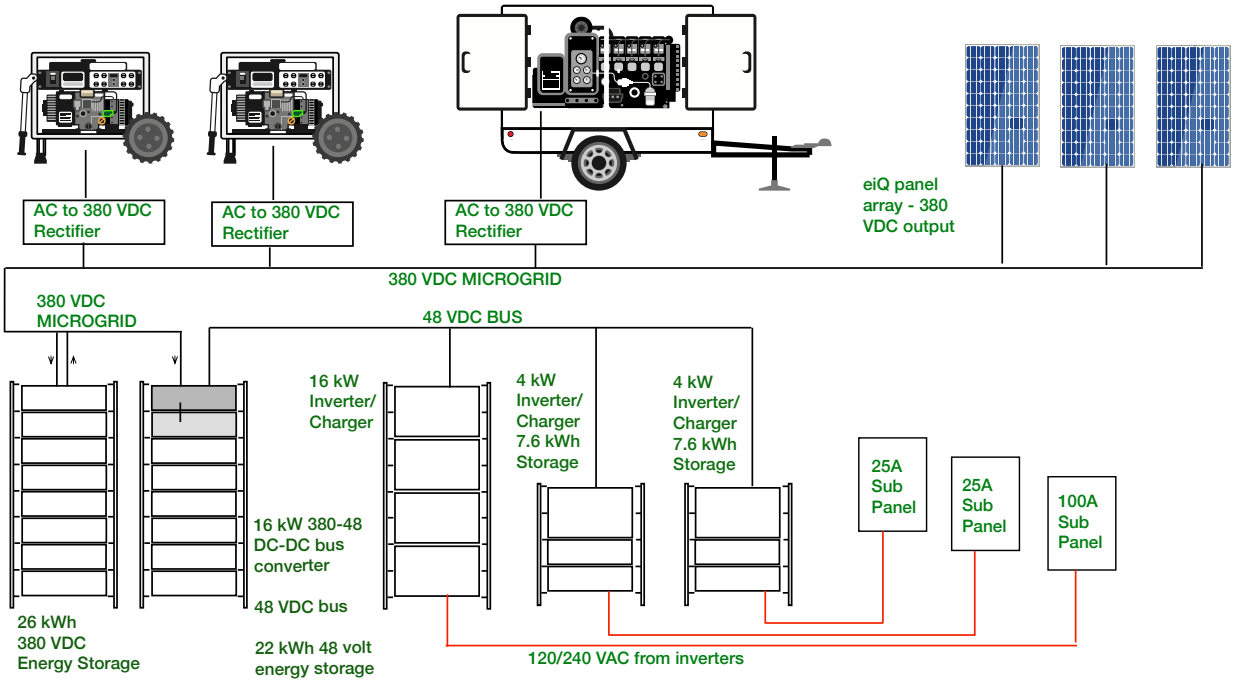
Example: Generator Balancing

Generators are most fuel efficient when operated at high capacity. Coupling generators with energy storage can double fuel economy by only operating the most efficient generator for the demand and then only when this can be done at peak output.



Example: Cluster housing with centralized solar array

A centralized high voltage DC solar array operating at 380 or 760 volts can minimize solar wiring and provide 98% solar collection. Each cluster home in the following diagram operates its own net zero power fed by a centralized solar array. With this type of system, each local power system can have independent back from the grid.