Enphase Storage System Review

Overall Rating as Tested

Equipment Cost	★★★★
Installation Ease	★★★★★
Customer Friendliness	★★★★★
Backup power	n/a

About this Review

Barry Cinnamon and his team at Cinnamon Solar and Spice Solar have scheduled a series of hands-on reviews of commercially available residential battery storage systems. Reviews are based on the installation and usage of each system using commercially available products and software, provided by manufacturers. The intent is to provide useful real-world experiences to installers, home owners and manufacturers as Behind the Meter (BTM) battery storage systems become more popular. To access more information about battery storage system terminology, our review processes, and ongoing review updates, go to www.spicesolar.com/resourses/storage.

Enphase AC Battery Overview

The Enphase Storage System is a modular AC coupled battery storage system designed for residential customers with and without grid-tied solar power systems. Each modular battery is comprised of a 1.2 kwh lithium iron phosphate battery and 280 watt inverter in a 55 pound indoor-rated wall mounted enclosure.

The Enphase Storage System is ideal for customers who want to store locally generated solar energy or inexpensive grid energy so that this energy can be consumed during peak electric periods, thereby reducing electricity energy charges. Key benefits of the Enphase system are that the equipment is relatively inexpensive and easy to install. Since the system is AC coupled it does not require a PV system to operate, and is compatible with the entire installed base of grid-tie PV systems. Note that the Enphase AC Storage System does not provide backup power.

The simplicity and modular nature of the Enphase Storage System make it one of the most straightforward systems to design (with the Enphase AC Battery Sizing Tool), install (with the Enphase Installer Toolkit phone app), operate (with the Enlighten web portal) and maintain. Enphase is an established solar equipment supplier with a reputation for delivering good product and service quality.

Applications Supported

- ✓ Optimized self-consumption of solar generation
- ✓ Time of use bill management (electricity usage time-shifting)
- ✓ Power export limiting (requires S or IQ series micro inverters, not tested)
- × Demand charge reduction (peak demand shaving)
- × Backup power

Equipment Installed and Tested:

Product	Part Number	Cost
Enphase Battery	B280-1200-LL-I-US00-RF0	$2,000
Wall Mount Bracket	BWM-16IN-B	$80
Envoy-S Metered	ENV-S-AM1-120	$600
Consumption Monitoring	CT-200-SPLIT	$20
Enphase Enlighten Manager (website)		
Enphase Installer's CT Toolkit (tested on iOS)		
Option: Enphase Energy: Envoy S Metered AC Combiner box	XAM1-120 M	$741
Option: Enphase Energy: Envoy S Cell Modem (1)	CELLMODEM-01	$360

(1) Customers who have an existing Enphase microinverter system with an Envoy S Metered gateway can use their existing gateway.

Installation Labor Cost

	Time Estimate (hours)	Cost @$80/hr (2)
Design	1	$80
Installation	6	$480
Configuration	2	$160
Totals	**9**	**$720**

(2) Not including sales and permitting

Documentation, Training and Support

Enphase gets excellent grades when it comes to the design of the Enphase Storage System. The modular nature of the system is inherently simple. Documentation for the Enphase Storage System is straightforward and comprehensive. Enphase provides regular regional training and webinars for their system. Their North American customer support team is available at (877) 797-4743 on M-F from 6am-5pm PST.

Shipping and Transportation

Large battery storage systems have special shipping requirements. The Enphase AC Battery is UN 38.3 certified for shipping worldwide. Most common carriers can meet these requirements, including Fedex and UPS. Since the system is modular it can be hand-carried to the installation site.

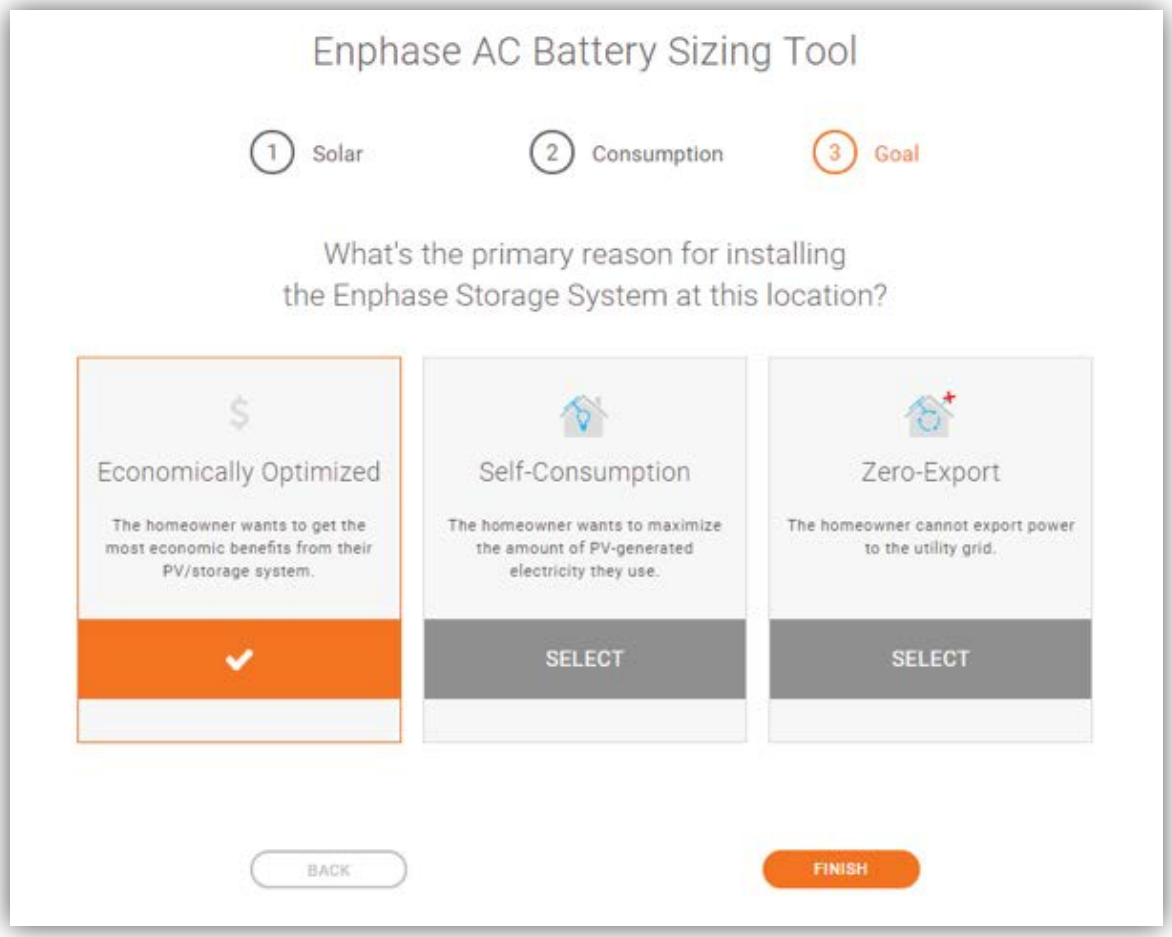
Installation Details

Test Site Conditions:

- Commercial building with 3 phase 208 service
- 5 Enphase microinverters (mix of M-215 and M-250)

- 5 microinverters from other manufacturers

To size the system for the correct number of AC Batteries, Enphase provides an AC Battery Sizing Tool. Information describing the home's energy use profile and energy costs (including applicable Time of Use profiles) is correlated with PV system output to recommend the optimal number of AC Batteries.



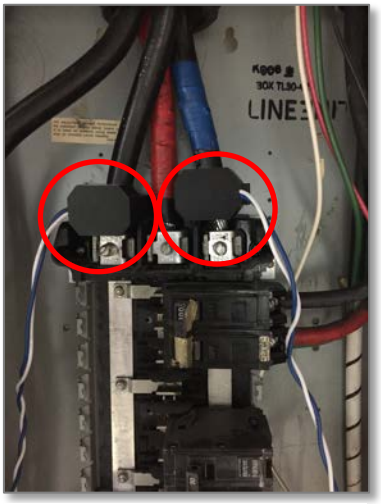
Enphase AC Battery Sizing Tool

Additional electrical components included a single 20-amp dual pole breaker, wiring, conduit and Ethernet wiring. For systems installed outdoors in conjunction with Enphase microinverters, a good option is the Enphase Combiner Box that accommodates the Envoy-S Metered gateway. Cellular monitoring is also helpful to minimize internet connectivity issues.

Since there is only one key piece of electrical equipment to install, permitting is much simpler than DC coupled systems or systems that incorporate backup power. A single AC Battery was installed near the subpanel in which several different micro inverters were installed. Note that the AC Battery mounts with a wall bracket that is similar to many string inverters.

Enphase AC Battery Installed Near Subpanel

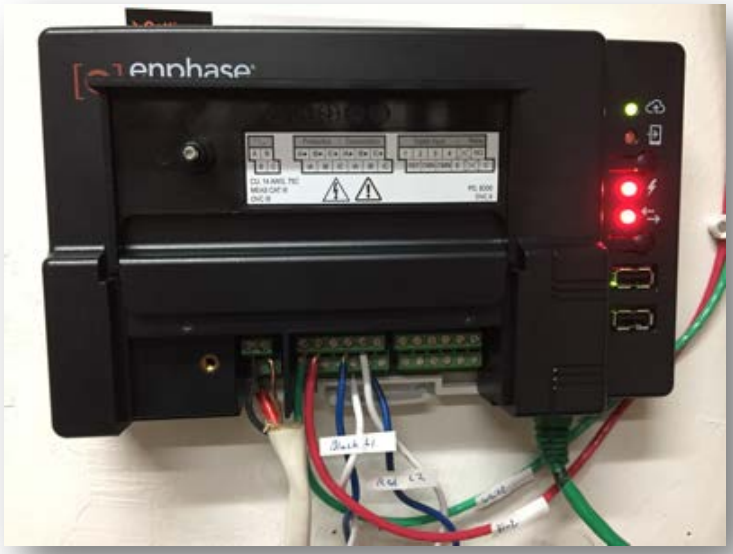
Two Consumption Metering current transducers (CTs) were installed on two of the three incoming AC power legs L1 and L2 so that net building energy usage could be monitored. Because there was limited space for these CTs, one of them was installed in the opposite direction. Since the current flow from this CT would therefore be negative, the leads were reversed when attached to the Envoy-S Metered gateway. One Production Metering CT is also installed on L1 from the microinverter (or other inverter) supply leg so that solar power generation can be monitored. Since this subpanel was about 25 feet away from the main panel (where the Envoy-S was installed), the leads from the Production CT were extended.



Two Consumption Metering Current Transducers

One Production Metering Current Transducer

Mounting and wiring the Envoy-S gateway was straightforward once the proper L1 wires were identified, and the leads from the Production CT were extended.

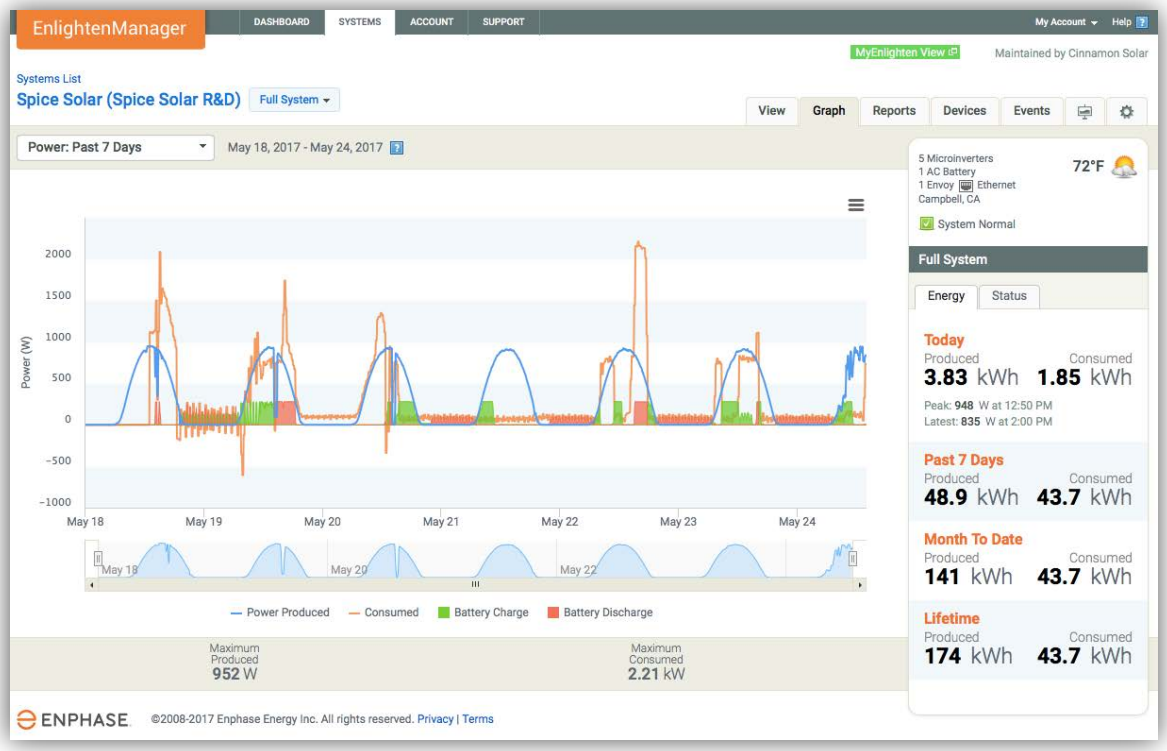


Envoy-S Gateway

The Enphase Installer Toolkit was used to configure the system. Initial configuration was completed using a cell phone wifi connection to the Envoy-S gateway. The error message indicating that the power product meter is not properly configured is a result of the installation on a 208 volt commercial system (instead of a 240 volt residential system).

Enphase Installer's CT Toolkit

Once the system was initially configured the Enlighten Manager web portal was used to complete the configuration of the system. Parameters of the A1-TOU electric rate at the site had to be entered into Enlighten so that charging and discharging would occur at optimal times. The picture below shows the operation of the system over a one week period. A similar view is also available on the Enlighten phone app.



Enlighten Manager Web Portal

Operation and Maintenance

Once the system was installed and configured, operation is completely automatic. Note that it will be necessary for the customer (or installer) to update electric rates as they change.

Conclusion

Enphase has a comparatively good track record for releasing stable, well-engineered and documented products. We expect that the Enphase Storage System will be one of the more reliable and user-friendly battery storage systems on the market. Since the complete system's initial price point is relatively low and it works with all existing grid tied PV systems, the Enphase AC Battery is an excellent entry level battery storage option.

Specifications

Inverter

Output Power:	270 VA
Nominal Voltage:	240 VAC
Nominal Frequency:	60 Hz
Nominal Output Current:	1.3 A
Power Factor:	1.0 (adjustable 0.7 leading, 0.7 lagging)
Weighted Inverter Efficiency:	97%

Battery

Capacity:	1.2 kwh
Chemistry:	Lithium Iron Phosphate
Nominal Voltage:	25.6 VDC
Depth of Discharge:	100%
Round Trip Cell Efficiency:	96%

Mechanical Data

Dimensions:	15.4” (W) by 12.8” (H) by 8.7” (D)
Weight:	55 lbs
Installation:	Wall mounted in indoor space
Enclosure:	NEMA 2
Cooling:	Natural convection (no fans)

Features and Compliance

Compatability:	Non-solar and grid-tied PV systems using Enphase Envoy S
Communications:	Power line carrier (PLC), TCP/IP through Envoy S
Monitoring:	Enlighten Manager and MyEnlighten Monitoring
Compliance:	UL 9540, UL 991, UL 1642, UL 1741, UL 1973; UN 38.3

Warranty

Battery Capacity:	>80% capacity, up to 10 years or 7300 cycles