



Fortress Power

Energy Storage Systems

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Managing Director at Fortress Power



TOPICS

Growth Opportunity

Fortress Lithium Battery

Hybrid Inverters Options

How to Sell Fortress Energy Storage

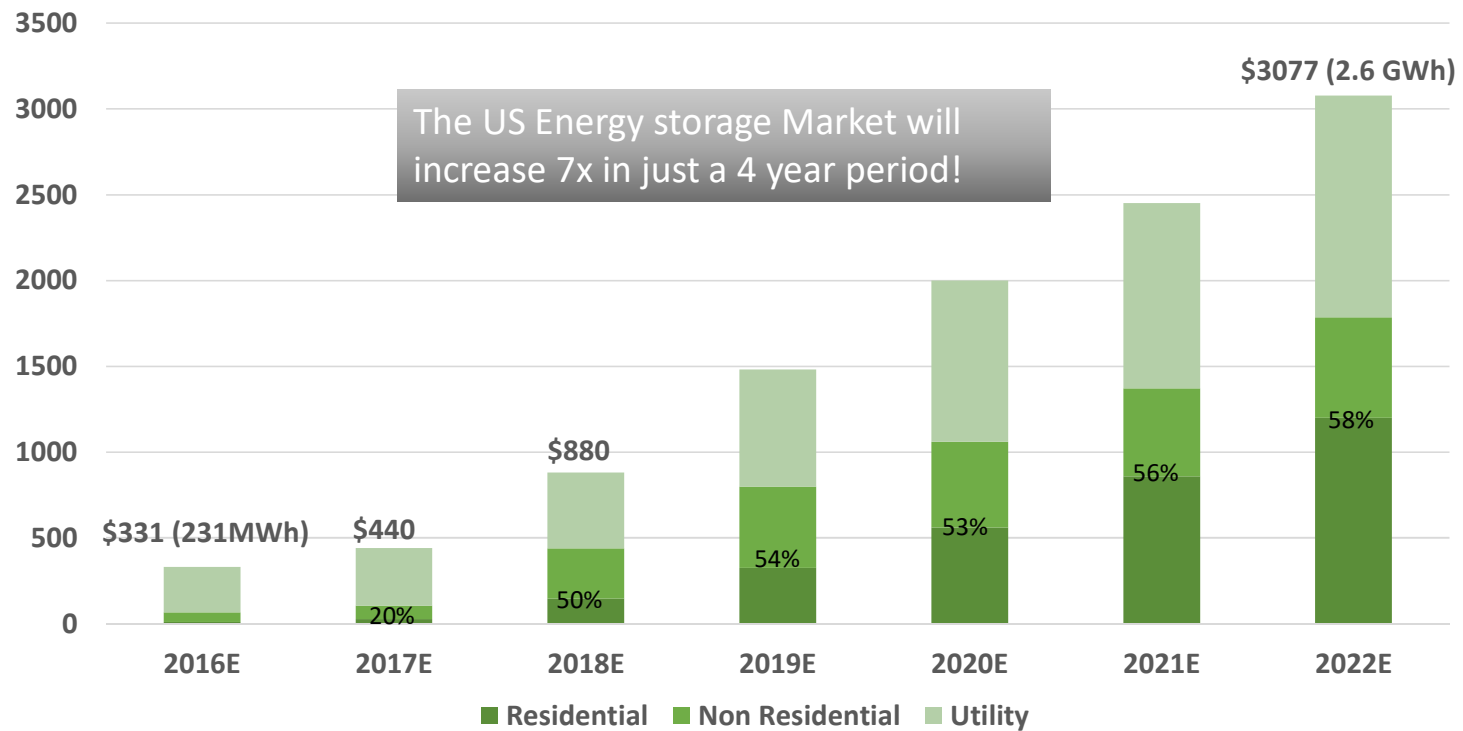
Fortress Energy Storage Sizing Tool

GROWTH OPPORTUNITY

Growth Opportunity

MARKET OPPORTUNITIES

U.S Annual Energy Storage Market Size, 2016-2022E (Million \$)



Source: GTM Research

SELLING ENERGY STORAGE

- ❑ 74% of homeowners are interested in home energy storage
- ❑ Only 14% of homeowners received quotes for Solar+Storage;
This is due to:
 - Expensive equipment
 - Complicated installation
 - Lack of proper trainings
- ❑ 50% of those receiving quotes convert into buyers

Source: Energysage Report

FORTRESS LITHIUM BATTERY

Fortress Lithium Battery

COMPANY INTRODUCTION

We are a world-leading battery manufacturer that brings high power density automotive Lithium Ferro Phosphate batteries to the energy sector.



U.S Headquarters
Southampton, PA



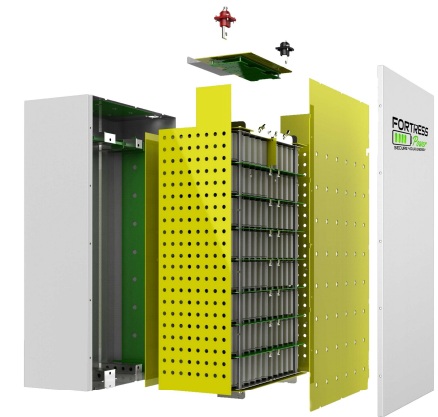
Manufacturing Facility
(since 2008)

LITHIUM FERRO PHOSPHATE TECHNOLOGY

We Use The Safest Lithium Technology – Lithium Ferro Phosphate

	FORTRESS	Other Lithium Ion (e.g. Tesla, LG Chem)
Chemistry	Lithium Ferro Phosphate (LFP)	Nickel- Manganese -Cobalt (NMC)
Safety	✓	X
Eco-friendly	✓	X
Operating Temperature	-4 – 140 °F	14 – 113 °F
Life Cycles	6000	< 3000
Peak Power Output	10 KW	7 KW
Rate of Capacity Loss	LFP < NMC	

Search LFP vs. NMC nail test videos on YouTube



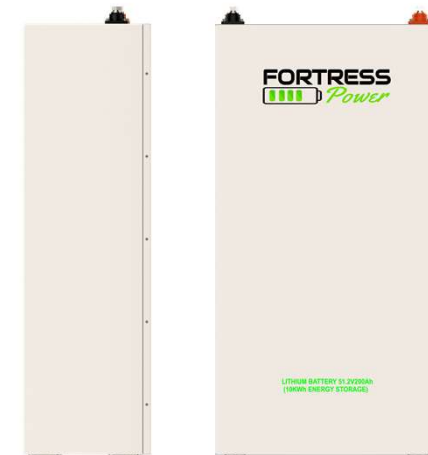
Fortress LFP Battery

FORTRESS BATTERY SPECIFICATION

SAFE • COMPACT • SLICK • AFFORDABLE

Size	LFP- 10	LFP- 15
Total Energy (kWh)	10.24	15.36
Capacity [Ah]	200	300
Max. Charge Current (Continuous) [A]	100	100
Max. Discharge Current (Continuous) [A]	200	200
Max. Pulse Current (for 10 sec) [A]	200	200
Voltage [V]	48 (51.2)	48 (51.2)
Dimension [H xW x D, inch]	33 x 16.4 x 9.4	33 x 16.6 x 13.4
Weight [lbs]	286	429
Depth of Discharge	100%	
Warranty	10 years	
Life Cycles	90% @ 3000; 80% @ 6000	
Stack-ability	2 batteries in parallel to 1 inverter	

Fortress LFP-10 Lithium Battery



NEW GENERATION-EVAULT LFP-15

More Benefits:

- **High visibility:** LCD Display showing State of Charge; Voltage; Temperature, and No. of cycles
- **More Power:** 8 batteries in parallel to 1 inverter
- **60% Increase on Discharge Power:** 160 A
- **95% Increase on Surge Power:** 390A for 5 Sec
- **More efficient battery cell** -> 11% less weight

First Shipments arrive in late December, ready to take pre-order!

New: Fortress eVault LFP-15 Battery



HYBRID INVERTER OPTIONS

Hybrid Inverter Options

COMPATIBLE INVERTERS

FORTRESS BATTERIES CAN BE PAIRED WITH MOST 48V CHARGERS AND HYBRID INVERTERS!

Brand	Inverter/Charger Mode	Configuration
Schneider	Conext XW MPPT charge controller; Conext XW+ series; Conext SW;	AC or DC coupled
Outback	FLEX max charge controller (48V), FLEXpower series (48V); Radian series (48V); FXR(A) and FXR (E) series (48V); GVFX and GVFX series (48V);	DC coupled
Darfon	H5001, HB51	AC or DC coupled
Sol-Ark	8 KW Inverter	DC coupled
Magnum	MS 4448PAE; MS 4048-20B	DC coupled
SMA	SUNNY ISLAND 4548-US/6048-US	AC coupled

SCHNEIDER XW+ IN DC COUPLED CONFIGURATION

The Most Durable Hybrid Inverter Worldwide with over 10 years in operation



SCHNEIDER XW+ IN AC COUPLED APPLICATION

	Technical Specification	
Inverter AC output	5.5 KW	6.8 KW
Surge power at backup	7/9.5 kW (30 min/60 sec)	8.5/12 kW (30 min/60 sec)
Transfer Switch	60 A auto-transfer relay at 8ms	
Compatible PV Inverters	AC-coupled to SolarEdge, Enphase, SMA, Fronius 10 kW+	
Requirement	<ul style="list-style-type: none"> ▪ PV Watts (or PV inverter size) \leq exceed XW+ system watts ▪ PV Watts/48V = __A should be \leq Battery Max Charging Current ** 	
Stack-ability	<ul style="list-style-type: none"> ▪ Max. 4 in 1-Ph (120/240V) ▪ Max. 9 in 3-Ph (208V): 3 units per phase 	
Limit	Not Rule 21 complaint	



13.6 kW/30 kWh ESS

****Example: 7.5 KW PV array /48V = 156 A**

DARFON H5001 HYBRID INVERTER



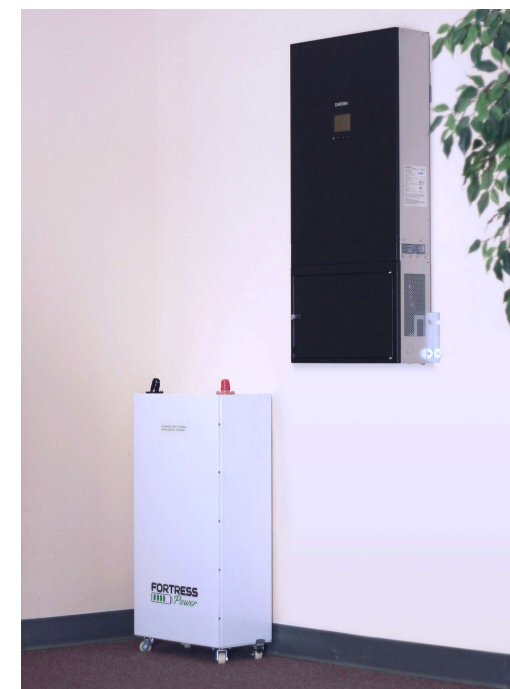
Key features:

- PV inverter, charger inverter, control, communication, distribution box, and auto-transfer, all in one unit
- Transfermerless
- Compact and Easy-to-Install
- DC Coupled Solution

DARFON H5001 HYBRID INVERTER

Technical Specification		
AC output to Critical Load		
	On Solar or Battery (Back-up)	With Grid Present
Output Power	5.5 KW	7 KW
Surge power	5.5/6.5/7.5 kW (40/20/5 Sec)	-/9.6/- kW (40/20/5 Sec)
AC output to Grid (Pass-through)		
Output Power	5 KW	
AC Output Voltage	120/240 V	
Transfer Switch	7kW auto-transfer relay at 20ms	
PV Array	Up-to 6.5 KW per inverter	
Stack-ability**	Max 3 in parallel	
Limit	Battery can't be charged by Generator	

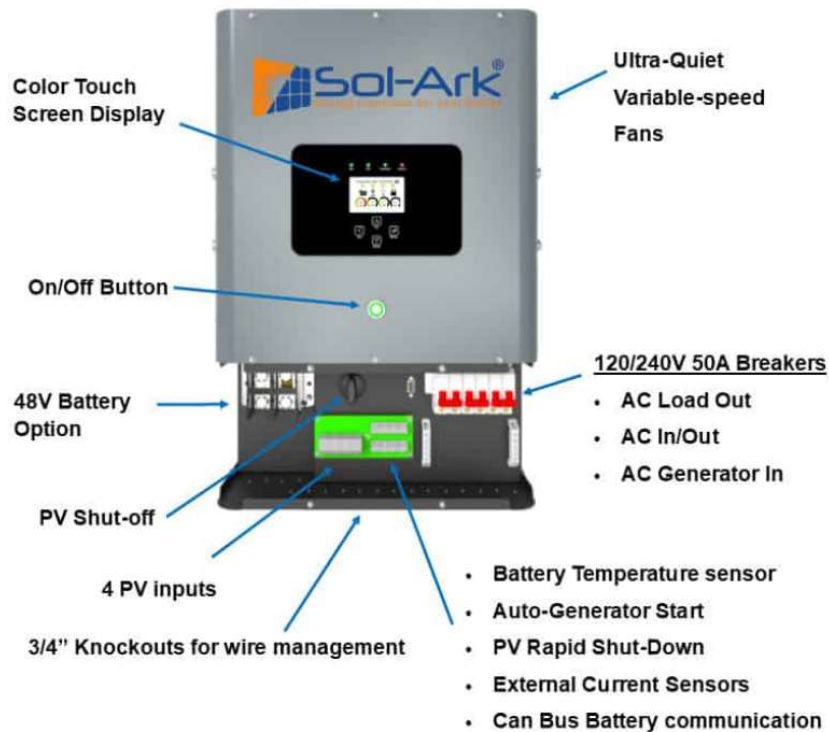
****Firmware to support stacking will be release in December!**



5 kW/10 kWh ESS



SOL-ARK 8 KW HYBRID INVERTER



Key features:

- PV inverter, charger inverter, control, communication, distribution box, and auto-transfer, all in one unit
- Transfermerless
- Extreme Compact & Easy Install
- DC-Coupled solution
- High surge Power: 20KW
- Only 7% roundtrip efficiency loss

SOL-ARK 8K HYBRID INVERTER

Technical Specification		
AC output to Critical Load		
	On Solar or Battery (Back-up)	With Grid Present
Output Power	8 KW	12 KW
Surge power	20 kW (5 Sec)	
AC output to Grid (Pass-through)		
Output Power	11 KW	
AC Output Voltage	120/240 V	
Transfer Switch	12 kW auto-transfer relay at 25ms	
PV Array	Up-to 11 KW	
Stack-ability	Not available	
Limit	Not Rule 21 complaint	



Sol-Ark 8 KW

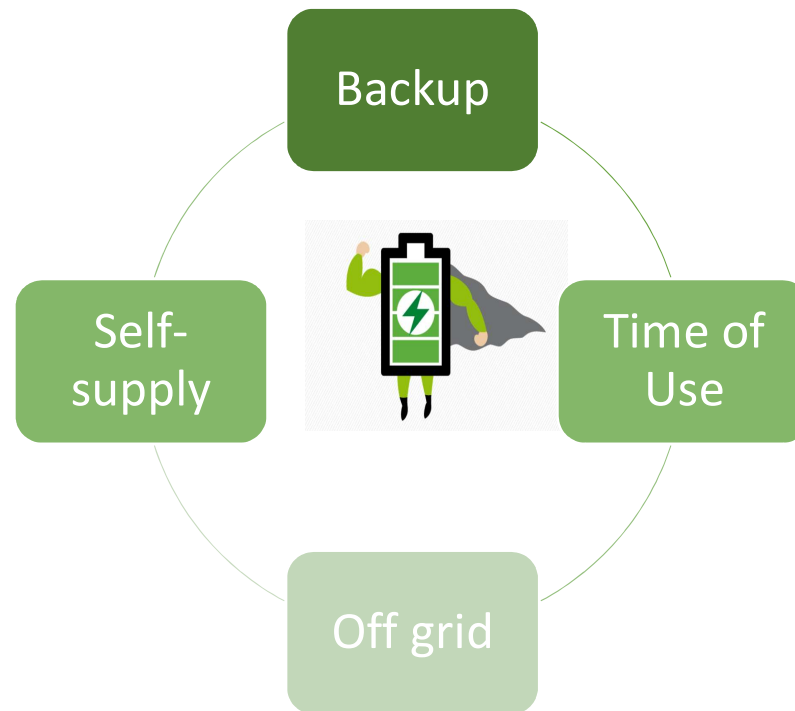
HOW TO SELL FORTRESS ENERGY STORAGE

How to Sell Fortress Energy Storage



APPLICATIONS

ALL IN ONE SOLUTION



BENEFITS OF ENERGY STORAGE



Back Up Your Facility

Power your facility when the grid is off



Maximize Your PV Production

Keep the solar panels running during the outages; store the excess solar power for later use.



Save Money on your Electric Bill

Charge the batteries at off-peak times, and discharge them during the peak periods



Tax and Incentives

30% ITC available if it's powered by solar; enjoy state and utilities rebates

BACKUP OPTIONS

	Fortress Lithium	Lead Acid	Generator
Applications	Backup power, time of use, self-use & off grid	Backup power	Backup power
Depth of discharge	100%	50%	N/A
Potential Harm	Safest technology	Risk of harmful gases	Environmental pollution
Life Cycles	6,000	500-1,000	N/A
Warranty	10 years	2 years	2 years
Fuel Cost	\$0	\$0	\$ 50-100/day
Maintenance	No	Every 6 months	Yes
Incentives	Yes	Yes	No

COST ANALYSIS

	Fortress Power + Darfon	Lead Acid	Generator (20 KW)
Total Installed Cost	\$12,500	\$13,600	\$10,000
30% ITC	\$3,750	\$4,080	N/A
Net Out-of-Pocket	\$8,750	\$ 9,520	\$10,000
Cost per Cycle	\$1.5 @ 6000 cycles	\$ 9,5 @ 1000 Cycles	N/A
Fuel Cost	\$0	\$0	\$ 50-100/day

- *Fortress system: 5kW H 5001 inverter + 10 kWh battery*
- *Lead Acid system: Outback GS 4048a + 20 kWh lead acid battery*
- *Total installed cost: the final sales price to home owners*

COMPARISON CHART

	Fortress Power Solutions	Tesla	Solaredge + LG Chem	Pika Energy	Sonnen
Configuration	Ac or DC coupling	AC coupling	DC coupling	DC coupling	AC coupling
Battery Chemistry	LFP	NMC	NMC	NMC	LFP
Battery Cycles	6,000	2,800	2,500	2,800	10,000
Price level	Low	Low	Low	High	High
Cost per Cycle	Lowest	High	High	Highest	Medium
Maintenance	Easy	Hard	Easy	Easy	Hard

•AC coupling requires an additional PV inverter and has at least 5% more power loss

COMPETITIVE ADVANTAGE

✓ SAFE

✓ COMPETITIVE PRICED

✓ LOWEST COST PER CYCLE



✓ ALL IN ONE SOLUTION

✓ MORE EFFICIENT

✓ EASY INSTALL/MAINTENANCE

FORTRESS
 *Power*
SECURE YOUR ENERGY

FORTRESS ENERGY STORAGE SIZING TOOL

FORTRESS ENERGY STORAGE SIZING TOOL

FORTRESS ENERGY STORAGE SIZING TOOL

How to size the Energy Storage System For Backup

1. Sizing PV array
2. Estimate average daily PV production
3. Selecting critical load circuits
4. Calculating daily usage of critical load panel
5. Selecting battery bank size

Available for our authorized Installer

PV ARRAY SIZING

String	Solar Module Specifications						Module String Specifications		
	Module Watts	Voc	Vmppt	Quantity	Temperature Coefficient of Voc %/°C	Record-low temperature °C	String Voc	String Vmppt	PV array size
String 1	310	40.3	32.9	10	-0.29	-20	455.6	329.0	3100
String 2	310	40.3	32.9	9	-0.29	-20	410.0	296.1	2790
Total Modules				19			Total PV System Size(Watts)		5890

Darfon H5000 Specifications		
String VOC	String VMPPT	PV System
120 - 460V	250 - 430 V	Up to 6.5 kW

2 independent MPPTs allow different module layout in each string.

ESTIMATE AVERAGE DAILY PV PRODUCTION

PV Production of A 5.89 KW PV Array in NJ

	Solar Radiation	Monthly AC Energy (kWh)	Avg. Energy Per Day (kWh)
January	3.07	480	15.5
February	4.06	566	20.2
March	4.75	729	23.5
April	5.64	785	26.2
May	5.99	847	27.3
June	6.12	819	27.3
July	6.26	850	27.4
August	5.89	792	25.5
September	5.39	727	24.2
October	4.05	590	19.0
November	3.11	457	15.2
December	2.72	423	13.6

SELECT CRITICAL LOAD CIRCUITS

	Category	Item	Quantity	Starting Watts	Running Watts	Hours/Day	Watthours/Day
1	Essential	Refrigerator/Freezer-Energy Star	1	1200	200	8	1600
2	Essential	LED Light Bulb-60 Watt Equivalent	6	48	48	6	1728
3	Essential	Incandescent Light Bulb-60 Watt	4	240	240	6	5760
4	Essential	Sump Pump-1/3 HP	1	1300	800	0	0
5	Essential	Water Well Pump-1/3 HP	1	1400	750	3	2250
6	Kitchen	Microwave Oven-650 Watts	1	1000	1000	0	0
7	Kitchen	Coffee Maker-4 cup	1	600	600	0	0
8	Personal Electronics	Cell Phone Charger	2	50	50	1	100
9	Personal Electronics	Computer-Laptop	1	250	250	2	500
10	Personal Electronics	TV-Flat Screen-46"	1	190	190	3	570
			Totals	6278	4128		12508
Inverter Type		Watthours/Day		Surge Power		Running Watts	
Darfon H5001		12508 Watts		222 Watts Available		872 Watts Available	

SELECT BATTERY BANK SIZE

Critical Load Consumption Report

Item	Watthours/Day
Refrigerator/Freezer-Energy Star	1600
LED Light Bulb-60 Watt Equivalent	1728
Incandescent Light Bulb-60 Watt	5760
Sump Pump-1/3 HP	0
Water Well Pump-1/3 HP	2250
Microwave Oven-650 Watts	0
Coffee Maker-4 cup	0
Cell Phone Charger	100
Computer-Laptop	500
TV-Flat Screen-46"	570
	12,508 Wh/Day

Select Battery Bank Size

Fortress Power Battery	LFP -15
System Size:	15,360 Wh
Battery Quantity	1
Depth of Discharge:	90%
Available Power:	<u>13,824 Wh</u>

WHAT TO EXPECT

Available power in Battery at 90% DoD	13,824 Wh	1.1 Days
Lowest average daily available PV Power:	13,600 Wh	
Highest average daily available PV Power:	27,400 Wh	

TIME-OF-USE APPLICATION

Provide us one of the following stats along with a monthly electric bill and we will run the financial return for you!



Monthly Electric Bills



Spreadsheet Interval Data



Green Button Data



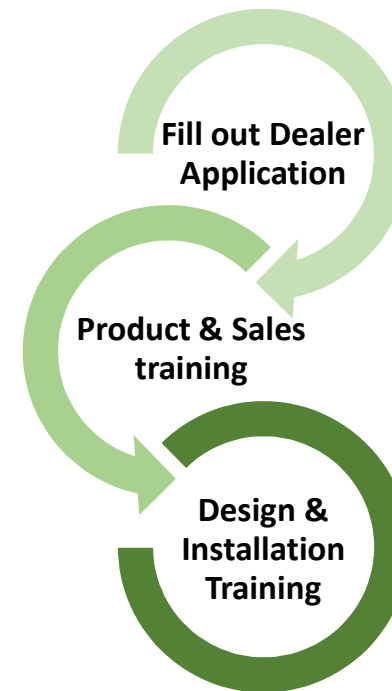
Import UtilityAPI Data

DEALER BENEFITS

Dealer Benefits



Becoming an Authorized Dealer



THANK YOU & CONTACT US

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