



# 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**

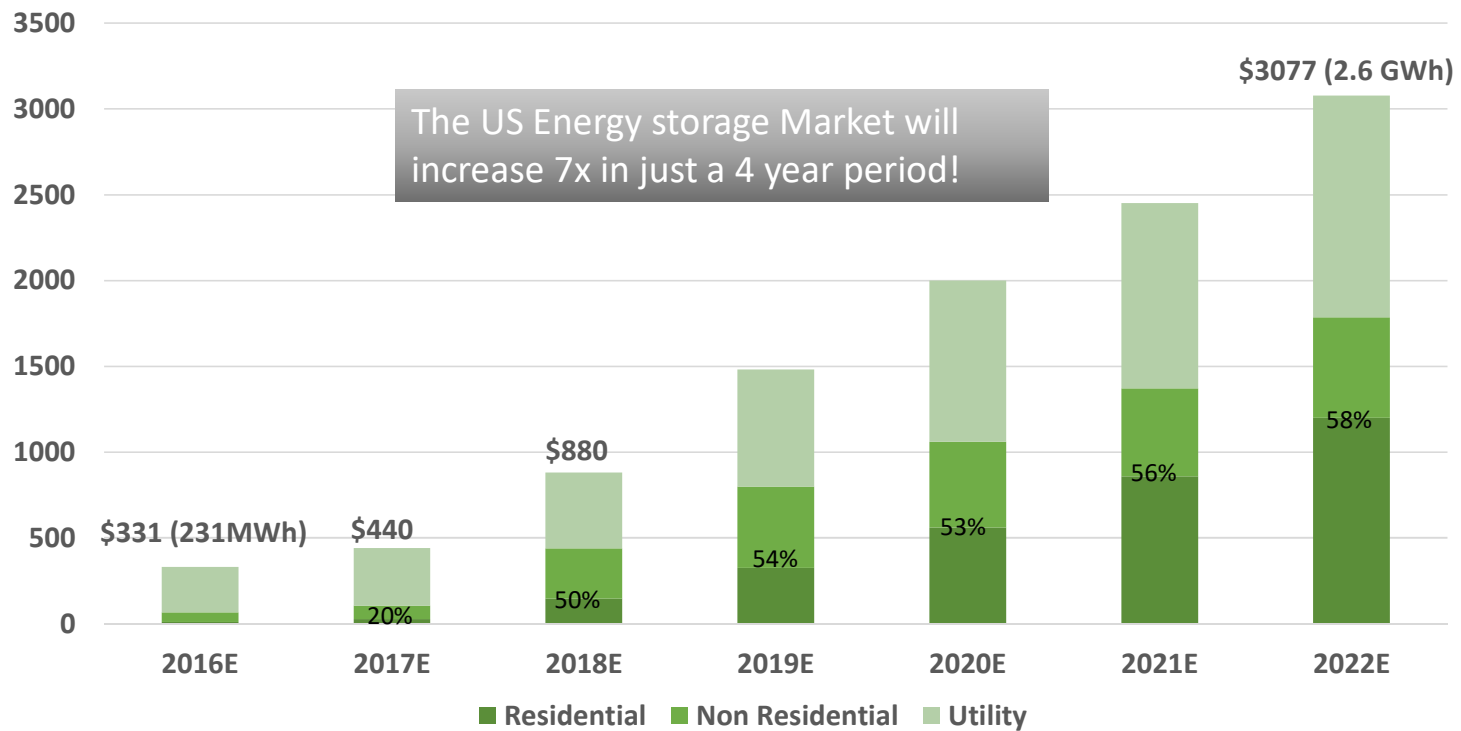
# GROWTH OPPORTUNITY

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



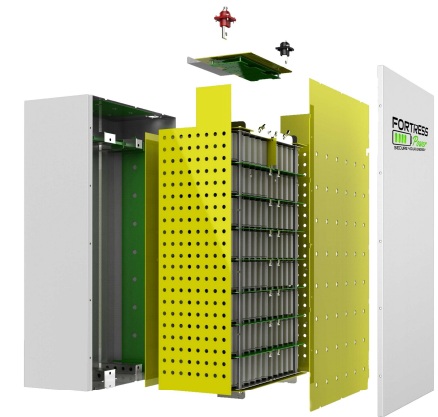
Manufacturing Facility  
(since 2008)

# 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); Radiance series (48V); FXR(A) and FXR (E) series (48V); GVFX and GVFX series (48V);	DC coupled
Darfon	H5001, HB 51	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"> <li>▪ PV Watts (or PV inverter size) <math>\leq</math> exceed XW+ system watts</li> <li>▪ PV Watts/48V = __A should be <math>\leq</math> Battery Max Charging Current **</li> </ul>	
Stack-ability	<ul style="list-style-type: none"> <li>▪ Max. 4 in 1-Ph (120/240V)</li> <li>▪ Max. 9 in 3-Ph (208V): 3 units per phase</li> </ul>	
Limit	Not Rule 21 complaint	



13.6 kW/30 kWh ESS

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

# DARFON H5001 HYBRID INVERTER



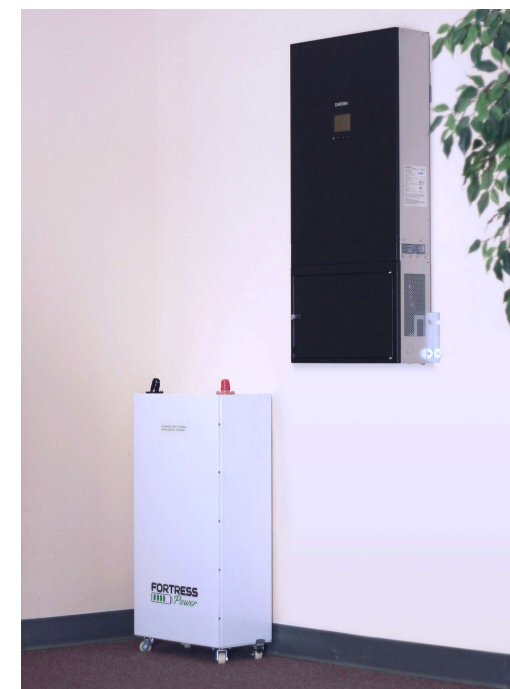
## Key features:

- 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	

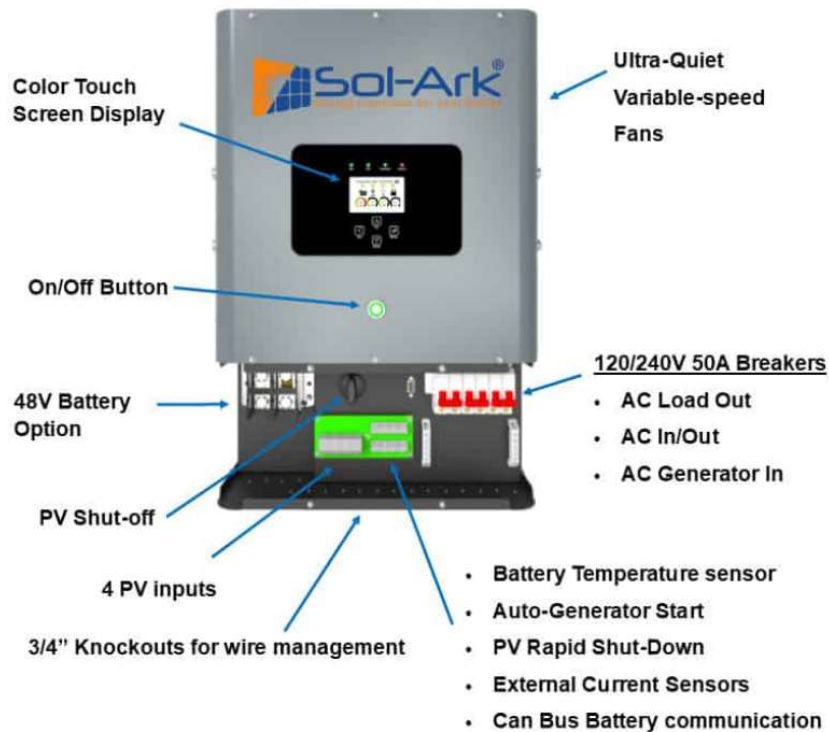
**\*\*Firmware to support stacking will be release in December!**



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		
<b>AC output to Critical Load</b>		
	On Solar or Battery (Back-up)	With Grid Present
Output Power	8 KW	12 KW
Surge power	20 kW (5 Sec)	
<b>AC output to Grid (Pass-through)</b>		
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

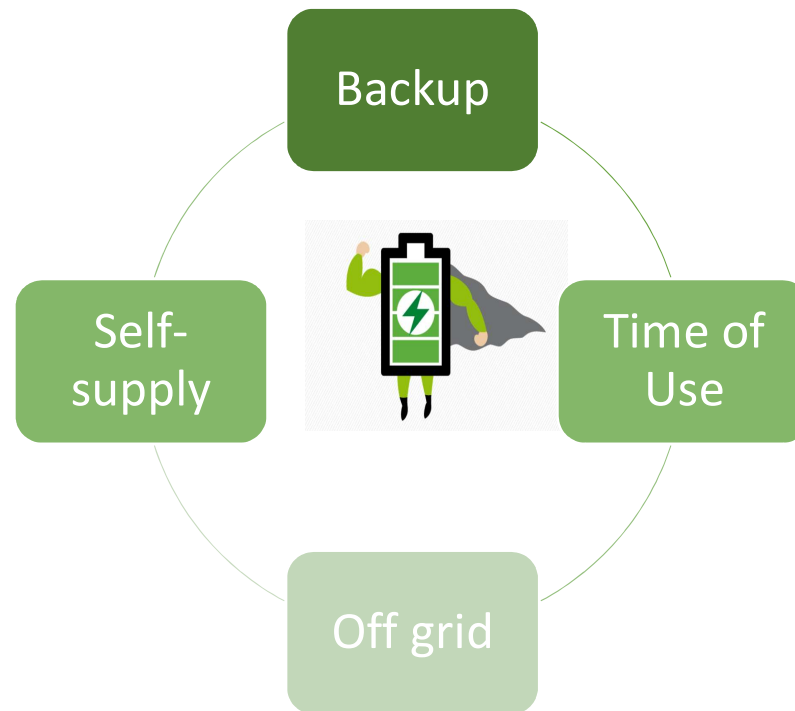
# HOW TO SELL FORTRESS ENERGY STORAGE

## 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

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



## COST ANALYSIS

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

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

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# 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
			<b>Totals</b>	<b>6278</b>	<b>4128</b>		<b>12508</b>
<b>Inverter Type</b>		<b>Watthours/Day</b>		<b>Surge Power</b>		<b>Running Watts</b>	
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
	<b>12,508 Wh/Day</b>

## Select Battery Bank Size

Fortress Power Battery	<b>LFP -15</b>
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	<b>13,824 Wh</b>	<b>1.1 Days</b>
Lowest average daily available PV Power:	<b>13,600 Wh</b>	
Highest average daily available PV Power:	<b>27,400 Wh</b>	

## 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



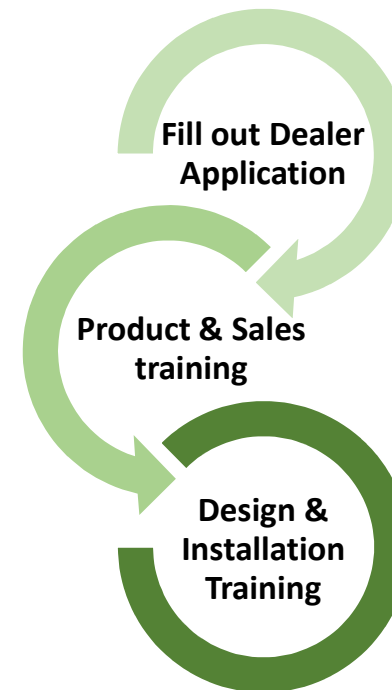
Import UtilityAPI Data

# DEALER BENEFITS

## Dealer Benefits



## Becoming an Authorized Dealer



## THANK YOU & CONTACT US

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