



# Fortress Power

Energy Storage Systems

Jing Yu

Managing Director at Fortress Power



## TOPICS

**Growth Opportunity**

**Fortress Lithium Battery**

**AC & DC Coupled Solutions**

**Integration Guide with Inverter/Charger**

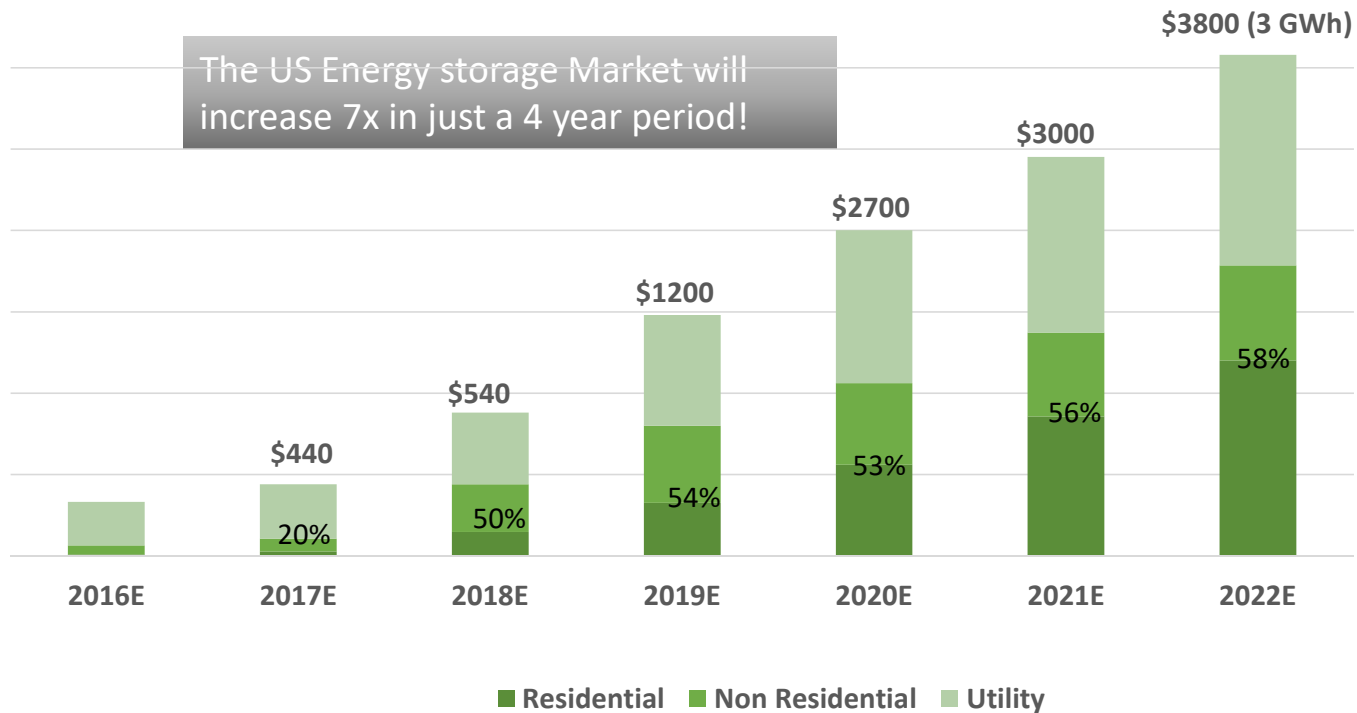
**Various Backup Options**

# GROWTH OPPORTUNITY

————— Growth Opportunity —————

# MARKET OPPORTUNITIES

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



Source: GTM Research

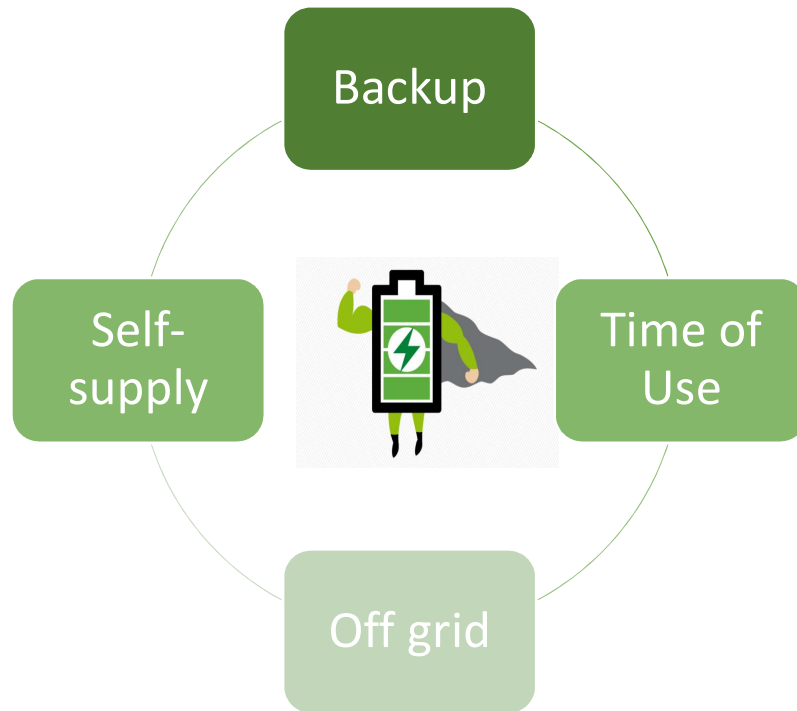
## WHY SELLING ENERGY STORAGE

- ❑ 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 ->> **Adding energy storage to your PV projects**

*Source: Energysage Report*

# ENERGY STORAGE BENEFITS

ALL IN ONE SOLUTION



## Back Up Your Facility

Power your facility when the grid is off ; Keep the solar panels running during the outages;



## Maximize Your PV Production

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



# FORTRESS LITHIUM BATTERY

Fortress Lithium Battery

## COMPANY INTRODUCTION



U.S Headquarters, Southampton, PA



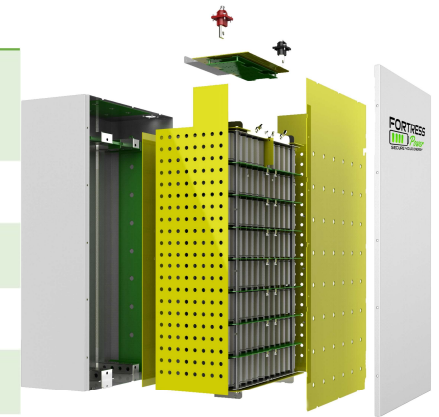
Manufacturing Facility (since 2008)

- Fortress brand is established in 2016
- The manufacturing facility is located in China (since 2008)
- Lithium Ferro Phosphate Technology
- Automotive manufacturing standard
- Installs throughout the North and South America

# LITHIUM FERRO PHOSPHATE TECHNOLOGY

We Use The Safest Lithium Technology – Lithium Ferro Phosphate

	<b>Fortress Power</b>	<b>Other Lithium Ion (e.g. Tesla, LG Chem)</b>
Chemistry	Lithium Ferro Phosphate (LFP)	Nickel- Magnesium -Cobalt (NMC)
Safety	✓	X
Eco-friendly	✓	X
Life Cycles	6000	< 3000
Operating Temperature	-4 – 140 °F	32 – 113 °F
Degradation Rate	LFP < NMC	



Fortress LFP Battery

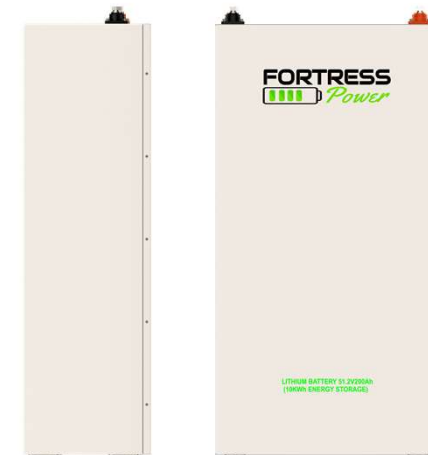
Search LFP vs. NMC nail test videos on YouTube

# 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]	100	100
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

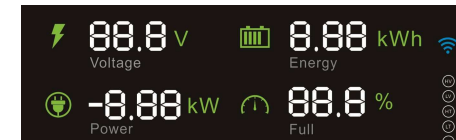


## NEW GENERATION-EVAULT LFP-15

### More Benefits:

- **High visibility:** LCD Display showing Voltage; Remaining capacity; AC output; State of Charge
- **More Power:** 8 batteries in parallel to 1 inverter (120 KWH)
- **35% Increase on Charge Current:** 135A
- **50% Increase on Discharge Power:** 150 A
- **20% Increase on Surge Power:** 12 KW for 10 Sec
- **More efficient battery cell** -> 11% less weight

*Available in next month!*



New: Fortress eVault LFP-15 Battery

## HYBRID INVERTER OPTIONS

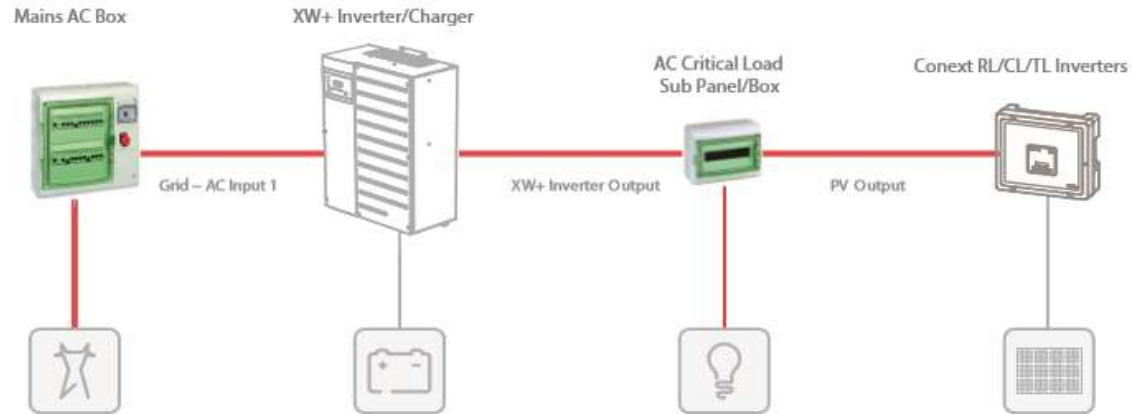
AC & DC Coupled Solutions

## 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;	<u>AC</u> or DC coupled
Outback	Skybox, FLEX max charge controller (48V), FLEXpower series (48V); Radian series (48V); FXR(A) and FXR (E) series (48V); GVFX and GVFX series (48V);	<u>DC coupled</u>
Sol-Ark	8 KW Inverter	<u>DC coupled</u>
Magnum	MS 4448PAE; MS 4048-20B	DC coupled
SMA	SUNNY ISLAND 4548-US/6048-US	AC coupled
Darfon	H5001	DC coupled

# SCHNEIDER XW+ IN AC & DC COUPLED CONFIGURATION



## Application for AC coupled solutions

- When retrofitting to existing PV systems
- For new installations that require module level rapid shutdown

Figure 1 AC-Coupled System Diagram

## Application for DC coupled solutions

- For new installation
- No additional PV inverter
- More efficient

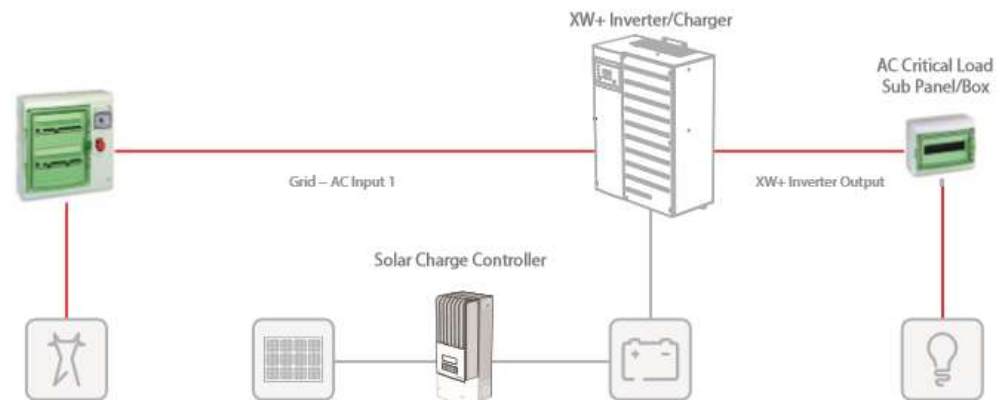


Figure 2 DC-Coupled System Diagram

# AC COUPLED SOLUTION: FORTRESS + SCHNEIDER

**Reliable • Affordable • Safe • Long-lasting**

	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)
Storage capacity	10 & 15 KWH per unit; scalable to 120 KWH	
Transfer Switch	Built-in 60 A auto-transfer relay at 8ms	
Compatible PV Inverters	AC-coupled to Enphase, AP systems, AC modules, Solaredge, 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>	
Rule 21	Compliant	

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



13.6 kW/30 kWh ESS

# COMPARISON CHART OF AC COUPLED SOLUTIONS

## Solutions for existing PV systems

	Fortress Power + Schneider	Tesla	Sonnen
<b>AC output</b>	5.5/6.8KW	5 KW	3-8 KW
<b>Surge Power</b>	9.5/12KW	7.5 KW	6-12 KW
<b>Battery capacity</b>	10 & 15 KWH per unit; scalable to 120 KWH	13,5 KWH	4-16 KWH
<b>Battery Chemistry</b>	LFP	NMC	LFP
<b>Battery Cycles</b>	6,000	2,800	10,000
<b>Price level</b>	Low	Low	Very High
<b>Cost per Cycle</b>	Low	High	High
<b>Maintenance</b>	Easy	Hard	Hard

## OUTBACK PREWIRED FLEX POWER RADIANT 4 & 8 KW (DC COUPLED)



### Key features:

- Factory tested, pre-wired and pre-configured
- Grid-interactive and stand-alone capability in one package
- GridZero technology optimizes the balance between stored and renewable energy sources
- Advanced Battery Charging (ABC) supports leading-edge battery technologies, including lithium-ion

# COMPARISON CHART OF DC COUPLED SOLUTIONS

## Solutions for new PV systems

	Fortress Power + Radian 8K	SolarEdge + LG Chem	Pika Energy
AC output/Grid-tie	8KW (scalable)	5 KW	7.6/11.4 KW
AC output/Back-up	8KW	5KW	8KW
Surge Power	12KW	7.5 KW	12/15 KW
Battery Chemistry	LFP	NMC	NMC
Battery Cycles	6,000	2,500	2,800
Price level	Medium	Lowest	Highest
Cost per Cycle	Lowest	High	Highest
Installation time	Least	Mid	Highest

## OUTBACK SKYBOX (DC COUPLED)



LISTED TO UL 1741 SA

### Key features:

- Clean balance-of-systems, all in one box
- Easy and fast to install
- Extensive quality and reliability testing
- Advanced Battery Charging (ABC) supports leading-edge battery technologies, including lithium-ion

## Outback FXR / VFXR Series

### Key features:

- Single-phase 120V or 230V sinewave output in 12V, 24V, or 48V versions
  - Programmable for seven different modes with generator assist
  - Modular, stackable design for up to 9 inverters in three-phase and 10 inverters in grid-tied
- \*Advanced Battery Charging (ABC) supports leading-edge battery technologies, including lithium-ion



OPTIMIZE WITH OPTICS RE

LISTED TO UL 1741 SA

# Flex Power Prewired VFXR & FXR Series



OPTIMIZE WITH OPTICS RE

LISTED TO UL 1741 SA



NOW AVAILABLE WITH FLEXMAX 100 CHARGE CONTROLLERS



NOW AVAILABLE WITH FLEXMAX 100 CHARGE CONTROLLERS



NOW AVAILABLE WITH FLEXMAX 100 CHARGE CONTROLLERS

**FORTRESS**  
 *Power*  
SECURE YOUR ENERGY

# SOL-ARK 8 KW HYBRID INVERTER (DC-COUPLED)



Sol-Ark 8 KW

\*\*available in stock!

## Key features:

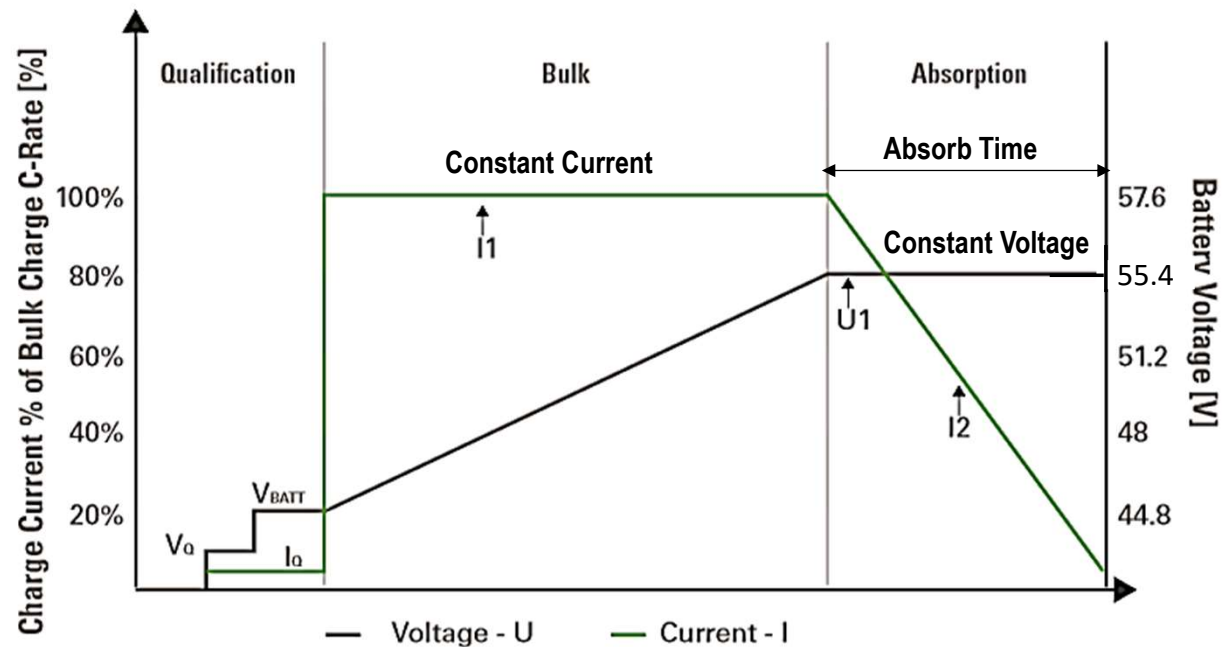
- inverter/charger inverter, control, communication, distribution box, and auto-transfer, all in one unit
- Transformer-less, Only 7% roundtrip efficiency loss
- Extremely Compact & Easy Install
- High surge Power: 20KW

Technical Specification		
AC output to Critical Load		
	On Solar or Battery (Back-up)	With Grid or Generator Present
Output Power	8 KW	12 KW
Surge power	20 kW (5 Sec)	
AC output to Grid (Pass-through)		
Output Power	12 KW	
AC Output Voltage	120/240 V	

# INTEGRATION GUIDE WITH INVERTER/CHARGER

## Integrate Guide with Inverter/Charger

# CHARGING STAGES



	Lithium Ferro Phosphate	Lead Acid
Absorb time	6 min	120min
Float Charge	N/A	✓

## INTEGRATION GUIDE-INVERTER/CHARGER SETTING

**Charger/Inverter configuration recommendation for best Performance:**

Schneider/SMA/Outback/Sol-Ark	3000 Cycles	6000 Cycles
Equalized Support	Off	Off
Capacity Limit	LFP-10:200 Ah / LFP-15:300 Ah	
Equalized Voltage	Off	Off
Recharge Voltage	47V	49V
Bulk Voltage	57.6V	55.4V
Absorb Voltage	57.6V	55.4V
Low Battery Cut Out Voltage	48.4V (48V)	50.7V (48V)
High Battery Cut Out Voltage	58V	56 V
Float Voltage	OFF/unless use as back up 54.4V	
Max Charge Current	100A per battery	50A per battery

*The Battery Parameter Setting Guides with Schneider and Outback Inverters/Chargers are available to download on [www.fortresspower.com/Resource](http://www.fortresspower.com/Resource)*

# INTEGRATION GUIDE-INVERTER/CHARGER SETTING

## Parameter Setting for Fortress LFP-10 & 15 battery with OutBack Inverter/Chargers

Inverter	80% DoD, 6000 cycles	90% DoD, 3000 cycles
Absorb Voltage and Time	55.4, 0.1 hour	57.6, 0.1 hour
Float Voltage and Time	54.4, Time = 0 = Disable	
Re-float Voltage	50 (Disabled, leave at default)	
Re-Bulk Voltage	50.6	
AC Input Mode	Grid Tied (default, adjust as needed)	
SellRE (Offset) Voltage	52 (default)	
AC Charger Limit in AC	12A@240V or 24A@120V per battery	23A@240V or 47A@120V per battery
Low Battery Cut-Out Voltage	50.7	48.4
Low Battery Cut-in Voltage	52	
Charge Controller		
Absorb Voltage and Time	56, 0.1 hour	58, 0.1 hour
Float Voltage	54.4	
Rebulk Voltage	50.6	
DC Current Limit	50 A per battery	100 A per battery
Absorb End Amps	0	
FLEXnet DC (FN-DC)		
FN-DC Battery Ah	LFP-10: 205/ LFP-15: 305 per battery	
FN-DC Charge Voltage	55.2	57.4
FN-DC Charged Return	LFP-10: 11A/ LFP-15: 16A	
FN-DC Battery Charge	98%	
FN-DC Relay Invert Logic	No	
FN-DC Relay Voltage	High = 53.4 ; Low = 48.4	
FN-DC Relay SOC High/Low	SOC High = 0% SOC Low = 0%	
FN-DC Relay Delay	High = 1, Low = 0	
MATE3/MATE3s		
FLEXnet DC Advanced	Low SOC Warning = 20%	
FLEXnet DC Advanced	Critical SOC Warning = 10%	

# VARIOUS BACKUP OPTIONS

## Various Backup Options

## 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

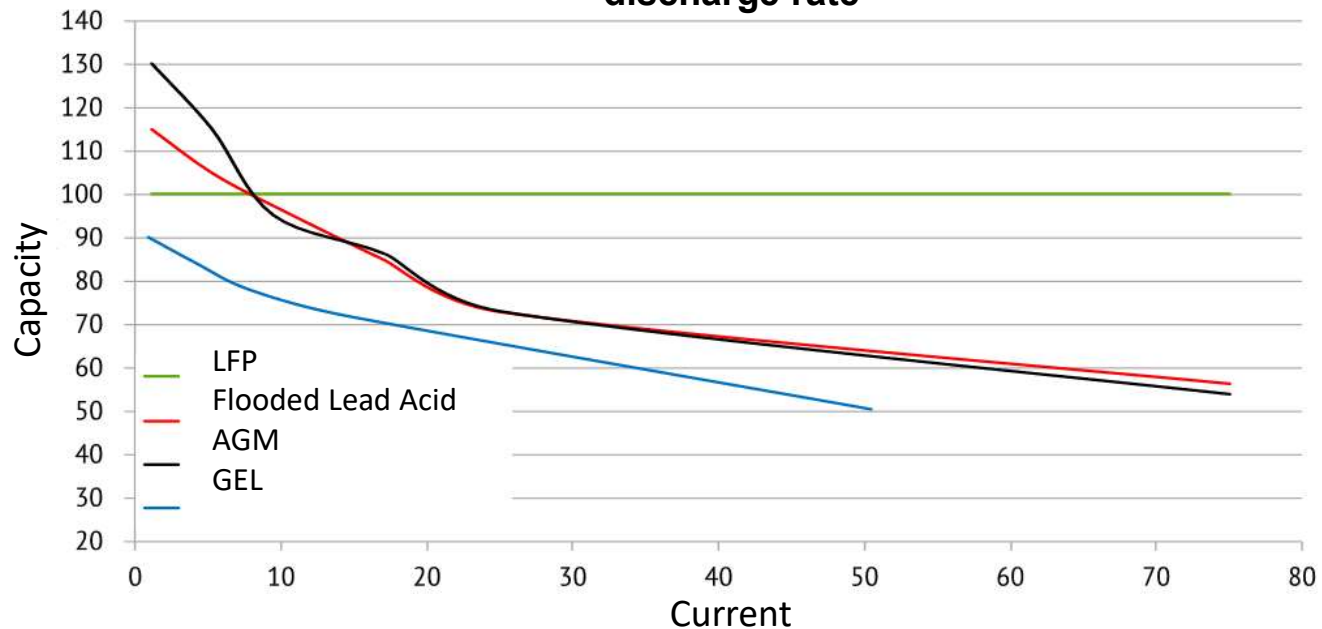
## COST ANALYSIS OF VARIOUS BACKUP OPTIONS

	<b>Fortress Power + Schneider</b>	<b>Lead Acid</b>	<b>Generator (20 KW)</b>
<b>Total Installed Cost</b>	\$13,800	\$13,600	\$10,000
<b>30% ITC</b>	\$4,140	\$4,080	N/A
<b>Net Out-of-Pocket</b>	<b>\$9,660</b>	<b>\$ 9,520</b>	<b>\$10,000</b>
<b>Cost per Cycle</b>	<b>\$1.6 @ 6000 cycles</b>	<b>\$ 9,5 @ 1000 Cycles</b>	N/A
<b>Fuel Cost</b>	\$0	\$0	\$ 50-100/day

- *Fortress system: Schneider XW+ 5848 + 10 kWh battery*
- *Lead Acid system: Outback GS 4048a + 20 kWh lead acid battery*
- *Total installed cost: the final sales price to home owners*

# PERFORMANCE COMPARISON

LFP vs Lead Acid at various discharge rate



## Further disadvantage of Lead Acid batteries:

- 3 times more space
- More cable cost and longer installation time

# COMPETITIVE ADVANTAGE

✓ SAFE

✓ COMPETITIVE PRICED

✓ LOWEST COST PER CYCLE



✓ ALL IN ONE SOLUTION

✓ MORE EFFICIENT

✓ EASY INSTALL/MAINTENANCE

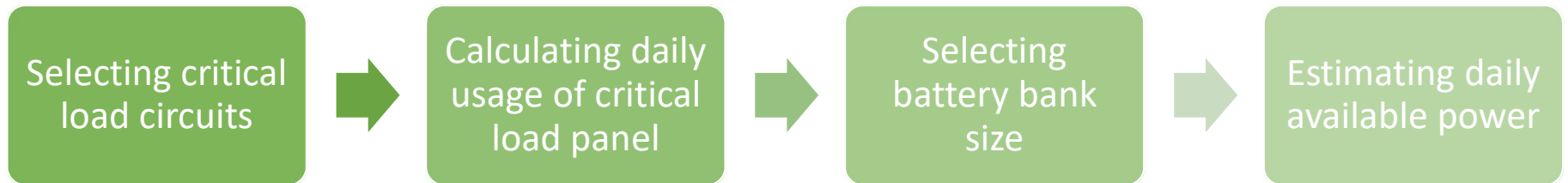
**FORTRESS**  
 *Power*  
SECURE YOUR ENERGY

# FORTRESS ENERGY STORAGE SIZING TOOL

# FORTRESS ENERGY STORAGE SIZING TOOL

# FORTRESS ENERGY STORAGE SIZING TOOL

How to size the Energy Storage System For Backup



*Available for our authorized Installer*

# 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	Incandescent Light Bulb-60 Watt	6	360	360	4	8640
3	Essential	Incandescent Light Bulb-60 Watt	4	240	240	4	3840
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	Electric Range-8" Element	1	2100	2100	1	2100
7	Kitchen	Microwave Oven-650 Watts	1	1000	1000	0.1	100
8	Personal Electronics	Cell Phone Charger	2	50	50	2	200
9	Personal Electronics	TV-Flat Screen-46"	1	190	190	4	760
10	Personal Electronics	Computer-Laptop	1	250	250	2	500
	<b>STANDBY POWER</b>	<b>Schneider XW+6848NA</b>	<b>1</b>	<b>8</b>	<b>8</b>	<b>24</b>	<b>192</b>
			<b>Totals</b>	<b>8098</b>	<b>5940</b>		<b>20182</b>
	<b>Inverter Type</b>	<b>Quantity**</b>	<b>Watthours/Day</b>	<b>Surge Power</b>		<b>Running Watts</b>	
	Schneider XW+6848NA	1	20182 Watts	3902	Watts Available	860	Watts Available

# SELECT BATTERY BANK SIZE

## Critical Load Consumption Report

Load Consumption Report	
Item	Watthours/Day
Refrigerator/Freezer-Energy Star	1600
Incandescent Light Bulb-60 Watt	8640
Incandescent Light Bulb-60 Watt	3840
Sump Pump-1/3 HP	0
Water Well Pump-1/3 HP	2250
Electric Range-8" Element	2100
Microwave Oven-650 Watts	100
Cell Phone Charger	200
TV-Flat Screen-46"	760
Computer-Laptop	500
Inverter Standby Power	192
<b>TOTAL</b>	<b><u>20182 Wh/Day</u></b>

## Select Battery Bank Size

Fortress Power Battery	<b>LFP -10</b>
System Size:	10,240 Wh
Battery Quantity	2
Depth of Discharge:	90%
Available Power:	<u>18,432 Wh</u>

# ESTIMATE AVERAGE DAILY PV PRODUCTION

## PV Production of A 8 KW PV Array in NC

	Solar Radiation	AC Energy	Energy Per Day (watthours)	Full charge on battery	avail. Energy after battery charged
January	3.8	751	<b>24,226</b>	(18,432)	<b>5,794</b>
February	4.28	746	<b>26,643</b>	(18,432)	<b>8,211</b>
March	5.23	986	<b>31,806</b>	(18,432)	<b>13,374</b>
April	5.91	1,039	<b>34,633</b>	(18,432)	<b>16,201</b>
May	6.32	1,132	<b>36,516</b>	(18,432)	<b>18,084</b>
June	6.74	1,106	<b>36,867</b>	(18,432)	<b>18,435</b>
July	6.36	1,090	<b>35,161</b>	(18,432)	<b>16,729</b>
August	5.78	1,004	<b>32,387</b>	(18,432)	<b>13,955</b>
September	5.19	886	<b>29,533</b>	(18,432)	<b>11,101</b>
October	5.08	926	<b>29,871</b>	(18,432)	<b>11,439</b>
November	4.14	749	<b>24,967</b>	(18,432)	<b>6,535</b>
December	3.38	646	<b>20,839</b>	(18,432)	<b>2,407</b>

<u>WHAT TO EXPECT</u>		
Available power in Battery at 90% DoD	18,432 Wh	0.9 Days
Lowest average daily available PV Power:	24,500 Wh	
Highest average daily available PV Power:	30,065 Wh	

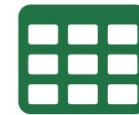


## TIME-OF-USE APPLICATION

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



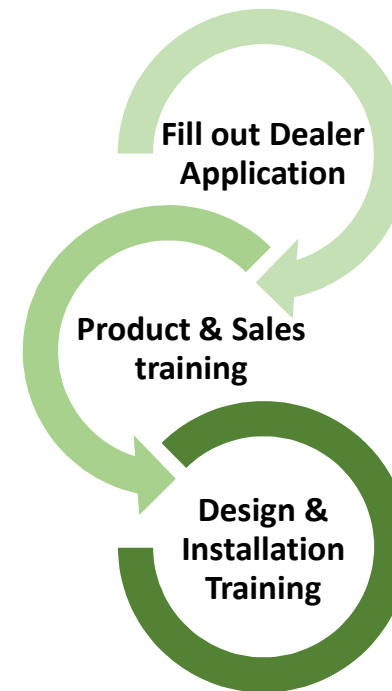
Import UtilityAPI Data

# DEALER BENEFITS

## Dealer Benefits



## Becoming an Authorized Dealer



## THANK YOU & CONTACT US

Alex Lepore

Sales & Marketing

[alexl@fortresspower.com](mailto:alexl@fortresspower.com)

(215) 353- 7733

[www.fortresspower.com](http://www.fortresspower.com)

Jing Yu

Managing Director

[jingy@fortresspower.com](mailto:jingy@fortresspower.com)

(877) 497- 6937

[www.fortresspower.com](http://www.fortresspower.com)

**See you at booth 605 during Solar Power Northeast in Boston on Feb 5&6 th.**

