New Approaches to Mini Grids

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Dakar, Senegal

OutBack POWER
member of The alpha Group™

1. Real World Applications
2. Safety Concerns
3. Stacking to Right Size Power
4. Energy Storage
5. Monitoring
6. Field Service ability
7. New Products

OutBack Power Technologies

- Premier developer of off-grid and grid hybrid power conversion systems for renewable & energy systems
- Member of the Alpha Group of Companies
- Based in Arlington, Washington USA since founding in in 2001
- International brand & product quality recognition

One of Five Systems installed in 2008 in N'Kau Lesotho Africa

Three 3.0 kW Inverter/Chargers - 9.0 kW Total 230/400 VAC Three Phase

Fishing Village Micro grid on Ndeda Island on Lake Victoria,

One 7kw Radian, 10 kw array , 600 ahr batteries, 100 happy customers!

Gloria's Drinks Factory Kpong, Ghana, Western Africa, 70 KW of Radians 96 x 1000AH 2volt OPZv cells, 100 employees

Gloria’s Drinks Factory, Cont.

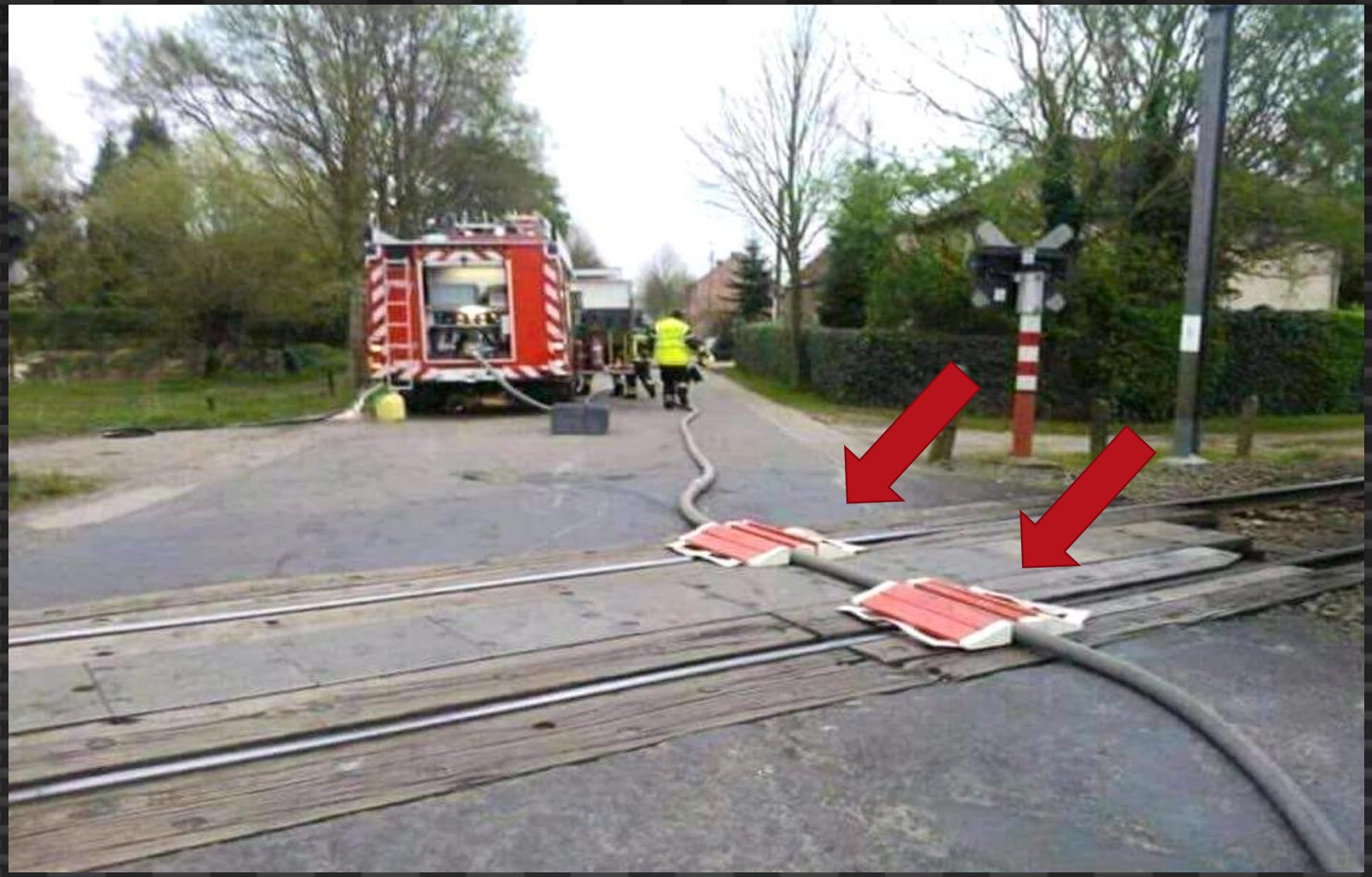
- ✓ 16 x FM80 charge controllers
- ✓ 95 KW Solar array
- ✓ 12Kms 6mm solar cable

Fully Integrated Solutions

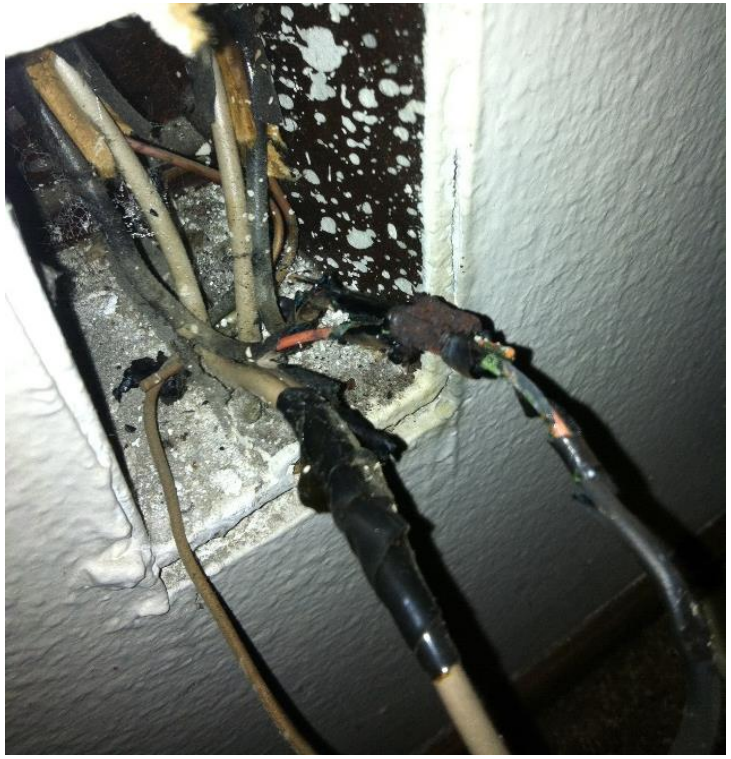
Real World Applications - Tea Plantation, India, Micro Grid

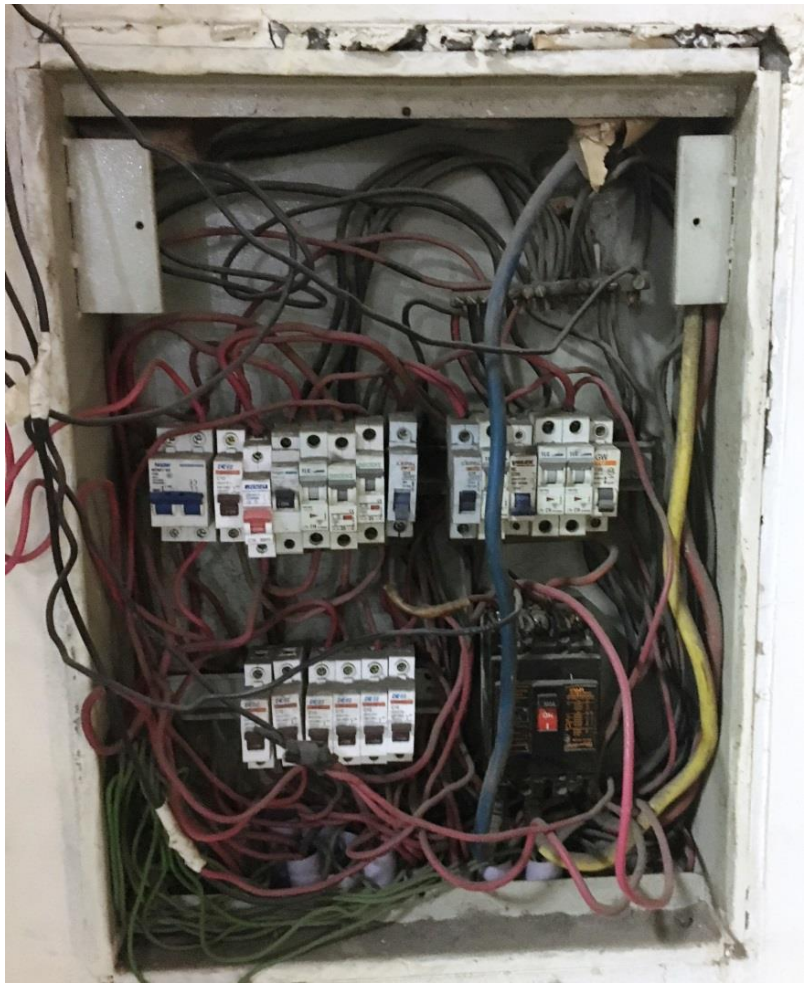
27 kW Inverters,
560 Amps of Charge Controllers

Safety Concerns



Proper wire management is so important

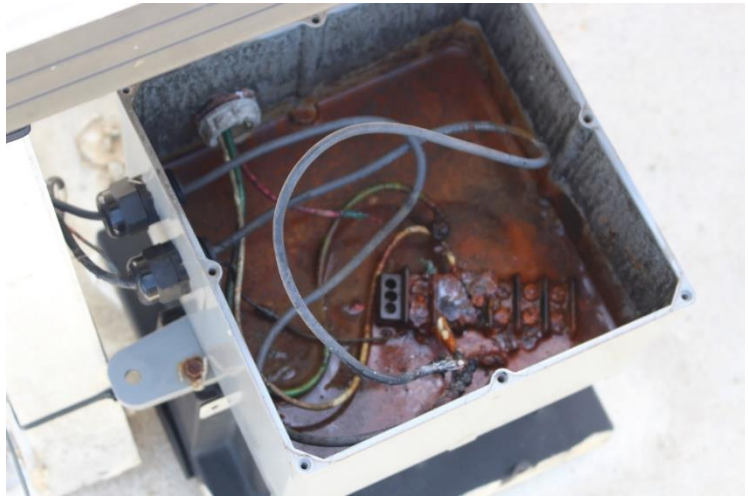




Take great care in your preparation or …

Did you take it all into account: Proper materials

Solar can create some Amazing heat when shorted



Water penetration into the box caused the combiner boxes to incinerate themselves

Wiring practices and ‘Looming’

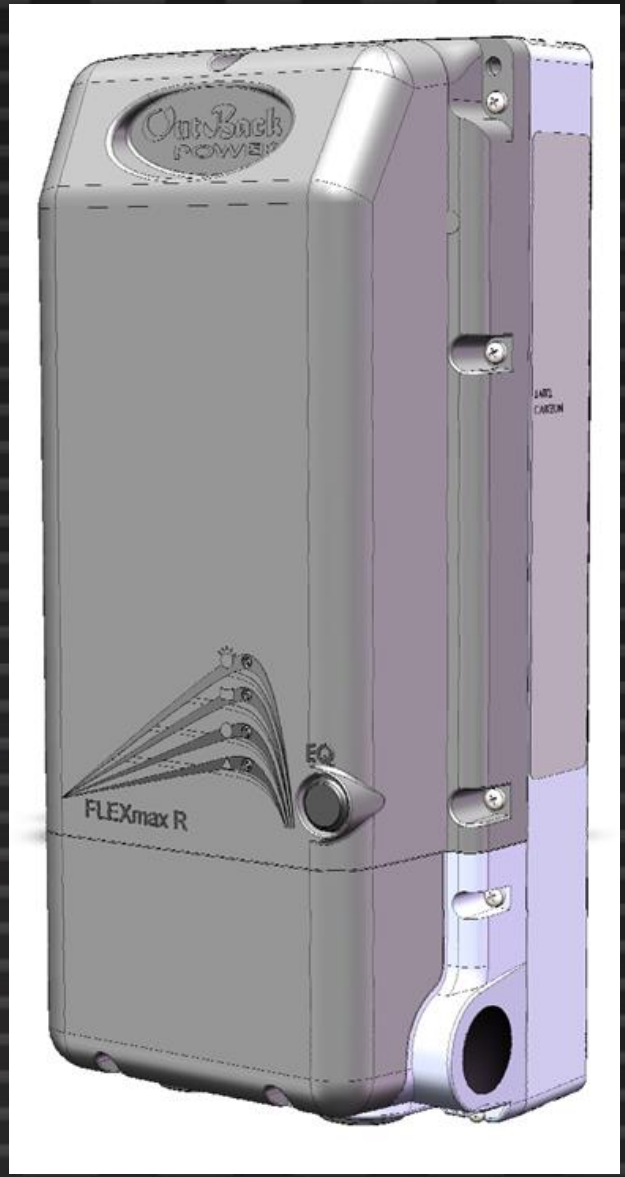
- Organized wiring practices
  - Trouble Shooting
  - Reduce Damage to wires
  - Labeling of conductors

Protection against the elements

https://youtu.be/VJa8SaINteg?t=254

OutBack FLEXmax 100

- IP54 sealed design for NEMA 3R rating
- Advanced thermal management with passive cooling
  - No Internal Fans
  - External Fan for 100A operation.
  - 300Vdc PV input
- Improved EMI signature
- Low tare loss of less than 1 Watt
- Advanced communications option using AXS Card Modbus interface



Energy Storage

EnergyCell PLC

Product Lineup

	OFF-GRID DEEP CYCLE REGULAR DEEP DISCHARGE	GRID-TIED SELF-CONSUMPTION FREQUENT PARTIAL DISCHARGE	GRID-TIED EMERGENCY BACKUP UPS HIGH RATE DISCHARGE
12V Front Terminal AGM Maintenance-Free	EnergyCell RE EnergyCell PLC 	EnergyCell NC EnergyCell PLC 	EnergyCell GH EnergyCell PLC 
12V Top Terminal AGM Maintenance-Free	EnergyCell RE 	EnergyCell NC 	
2V High Capacity AGM Maintenance-Free	EnergyCell RE & OPzV 	EnergyCell NC 	
6V Flooded Lead Acid Maintenance-Required	EnergyCell FLA 		
2V High Capacity Flooded Lead Acid Maintenance-Required	EnergyCell FLA 		

Competitive Analysis

Spec Comparison/Effective Cost Per kWh

	Best Value			Lowest cost		Lowest cost per Kwhr	
Brand	**OutBack**	**OutBack**	**North Star**	**Trojan**	**Full River**	**Simpliphi**	**LG Chem**
Model	200PLC	200NC	NSB 170FT Blue+	L16RE-A	DC210-12	PHI 3.4kWh	RESU10H
Technology	**VRLA Pure Lead Carbon**	**VRLA AGM Carbon**	**VRLA Pure Lead Carbon**	**FLA Carbon**	**VRLA AGM**	**Li-phosphate**	**Li-ion NMC**
Voltage	12V	12V	12V	6V	12V	48V	400V
20hr Rate	178	178	181	325	210	-	-
Cycles at 50% DoD	3,000	2,600	2,050	1,600	1,300	11,000	6,000
Operating Temp Range	-40˚ to 149˚F	-10˚ to 140˚F	-40˚ to 149˚F	-4˚ to 113˚F	-4˚ to 113˚F	-4˚ to 140˚F	14˚ to 113˚F
Terminal Type	T11	Threaded copper alloy insert	M8	LT	LT	-	-
Dimensions LxWxH (in)	22 x 4.92 x 12.6	22.01 x 4.95 x 12.6	22 x 4.9 x 12.6	11.67 x 6.95 x 17.56	20.87 x 8.23 x 8.58	13.5 x 8 x 14	8.94 x 17.8 x 19.2
Weight (lbs/kg)	130/59	131/60	132/60	115/52	133.38/60.5	75.5	214
Warranty	6 year full replacement	2 year full replacement	2 year full replacement	2 year full replacement	2 year full replacement	10 year full replacement	10 year full replacement
Shelf Life @ 25˚C	24 months	6 months	24 months	6 months	6 months	12 months	12 months
Qty batteries needed ~8-10 kWh 48V Bank	8	8	8	8	8	3	1
Avg Retail Price (excl. delivery/installation)	$4,586.32	$4,389.36	$4,011.60	$2,642.48	$4,525.36	$12,178.59	$6,425.71
Effective kWh Size (20hr Rate)	8.54	8.54	8.69	7.8	10.08	10.2	9.3
Total Effective kWh Delivered	25,620	22,204	17,814.5	12,480	13,104	112,200	55,800
Effective Cost Per kWh Delivered	**0.18**	0.20	0.23	0.21	0.35	0.11	0.12

The least expensive battery with similar Ahr capacities is typically the most costly per Kwhr delivered

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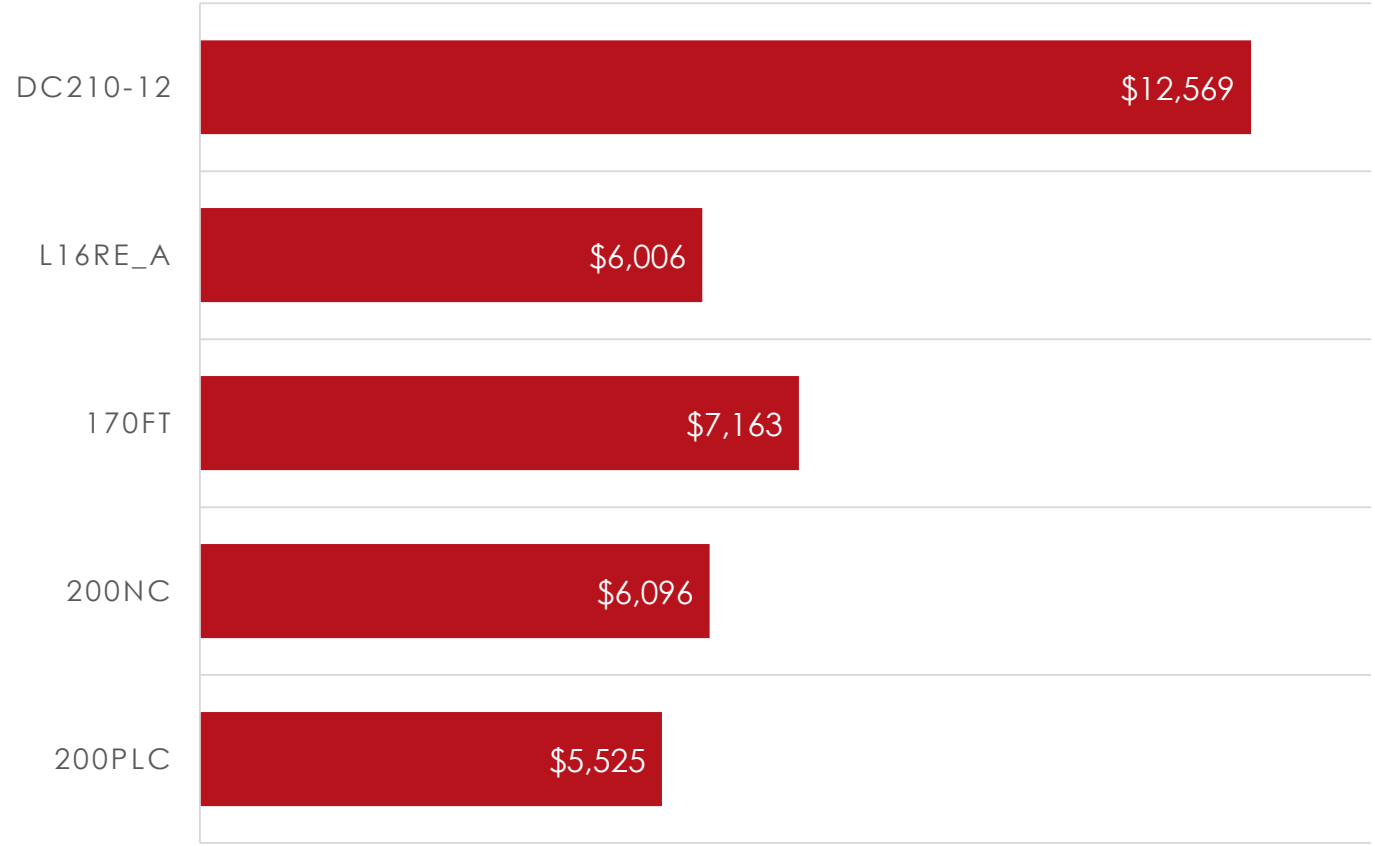
Competitive Analysis

10 YEAR COST OF OWNERSHIP – 10 KWH 48V BATTERY BANK



Brand	OutBack	OutBack	North Star	Trojan	Full River
Model	200PLC	200NC	NSB 170FT Blue+	L16RE-A	DC210-12
Effective Cost Per kWh Delivered	**0.18**	0.20	0.23	0.21	0.35
life in years w/ daily cycle @ 50%	**8.3**	7.2	5.6	4.4	3.6
10 year cost of ownership	**$5,525**	**$6,096**	**$7,163**	**$6,006**	**$12,569**

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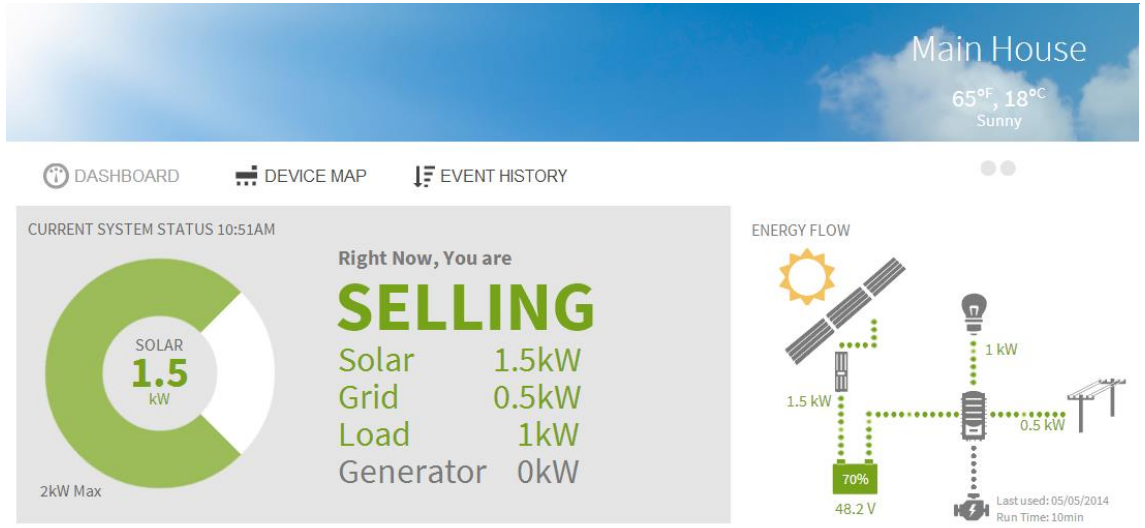
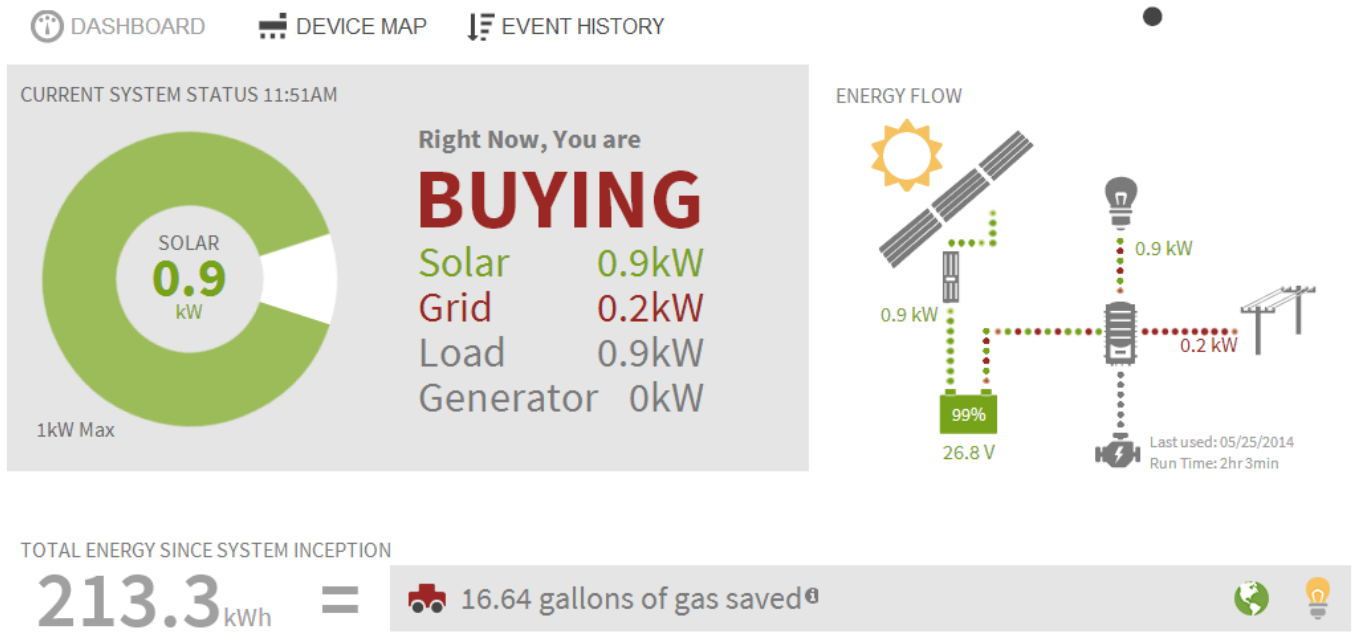
Real World Applications – 34 KW Radians & Simplify Li-ion Batteries

Monitoring and Serviceability

OutBack Product Overview

Optics





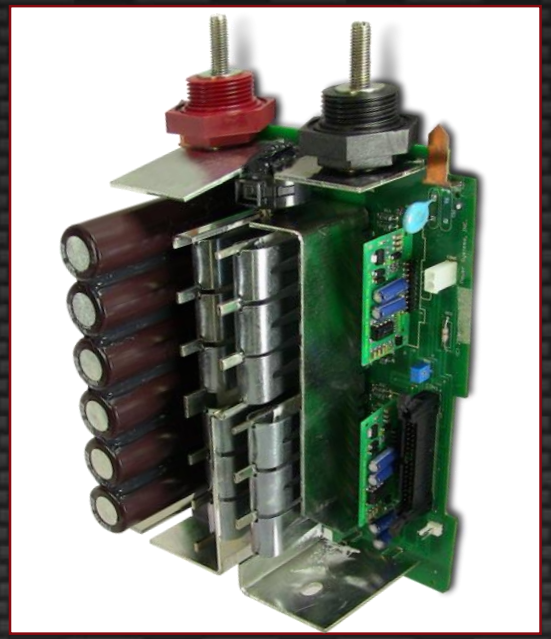
Service Ability

Keeping Spares for Projects

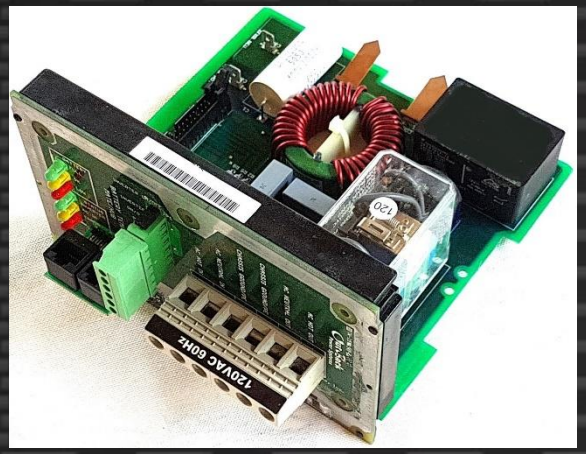
Improved Service

Turn around of less than an Hour

Online video for board replacements



1. FET Board
2. Control Board
3. AC Board



OutBack Product Overview

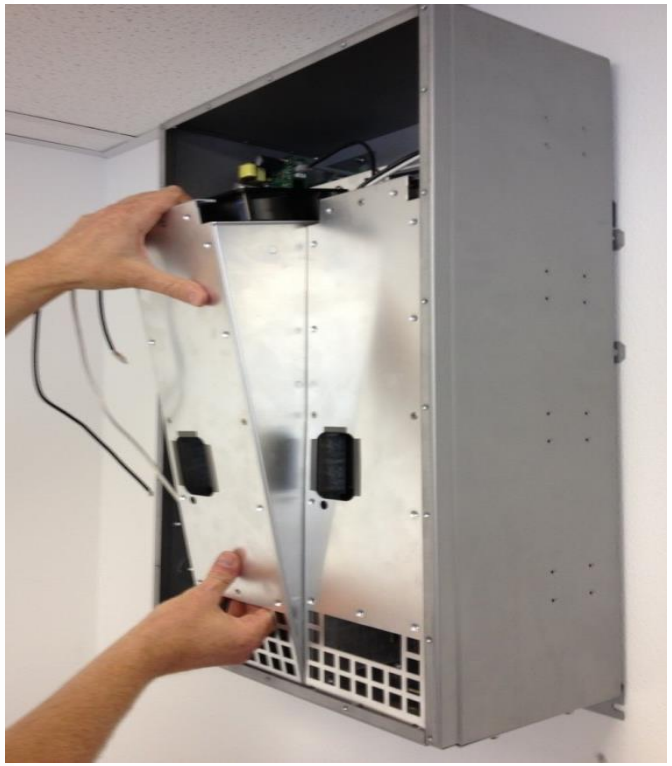
Radian Field Servicing

Two identical 3.5 kW power blocks

Separate control and AC board stack

Dual Power Module Benefits:

- Better efficiency in low power
- Low tare loss - 30 W
- Redundancy & Ease of Servicing
- Field Serviceable
- Field upgradeable firmware



New Products

Alino sizes 50hz 230 Vac

- 1.4KVA, 24 Volts, 40 amp MPPT
- 2.6KVA, 48 Volts, 40 amp MPPT
- 3.3KVA, 48 Volts, 40 amp MPPT
- AVR Ac Input Voltage 165 to 275 Vac = 230 Vac +/- 10%
- AC Battery Charger ~ 20 amps DC

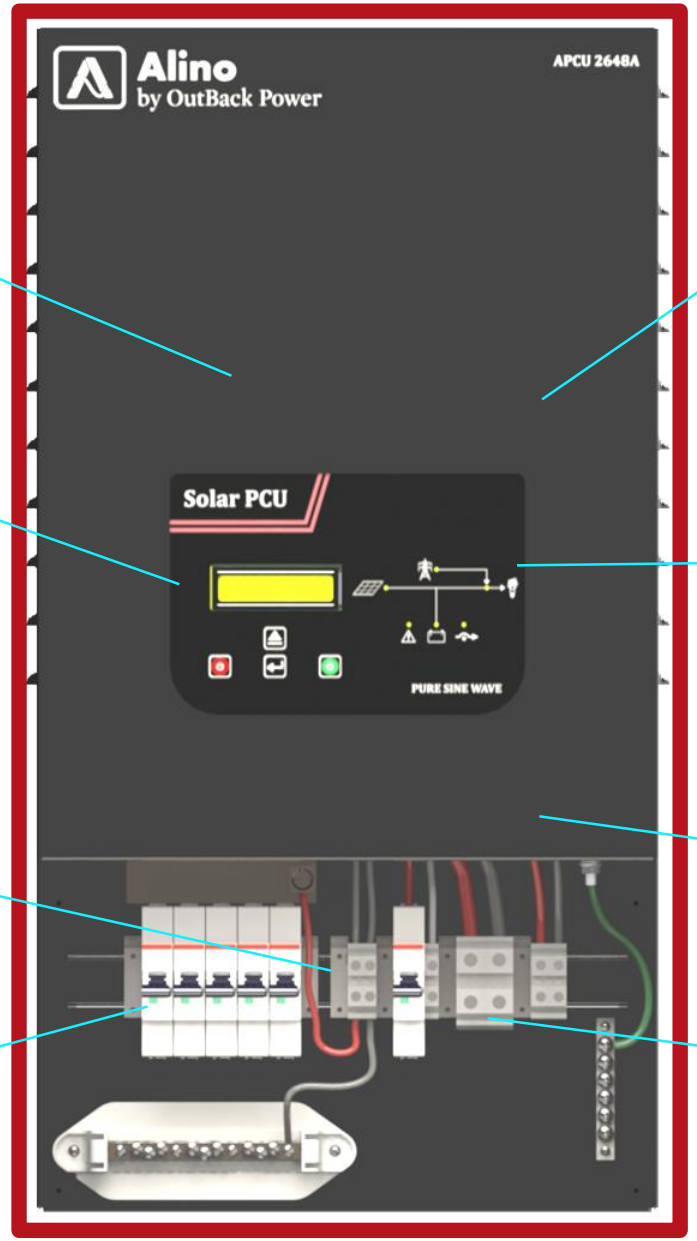
ALINO Overview

Conformal Coating

Front panel LCD for Monitoring and controlling

Integrated AC breaker

Built in Wire box with terminals and bus bar



Power Conditioning and backup unit in a single solution

System diagram shows where the power is coming from and AC source

Built in 40A solar charge controller

Input and Output terminals

Thank You!

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