NEW APPROACHES TO MINI GRIDS

BY GORD PETROSKI

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DAKAR, SENEGAL
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 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/VJa8SalNteg?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

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>12V Front Terminal AGM Maintenance-Free</th>
<th>12V Top Terminal AGM Maintenance-Free</th>
<th>2V High Capacity AGM Maintenance-Free</th>
<th>6V Flooded Lead Acid Maintenance-Required</th>
<th>2V High Capacity Flooded Lead Acid Maintenance-Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>EnergyCell PLC</td>
<td>EnergyCell PLC</td>
<td>EnergyCell NC</td>
<td>EnergyCell NC</td>
<td></td>
<td></td>
</tr>
<tr>
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</tr>
</tbody>
</table>

**Legend:**
- **OFF-GRID DEEP CYCLE**: Regular deep discharge
- **GRID-TIED SELF-CONSUMPTION**: Frequent partial discharge
- **GRID-TIED EMERGENCY BACKUP**: UPS high rate discharge
### Competitive Analysis

**Spec Comparison/Effective Cost Per kWh**

<table>
<thead>
<tr>
<th>Brand</th>
<th>OutBack 200PLC</th>
<th>OutBack 200NC</th>
<th>North Star NSB 170FT Blue+</th>
<th>Trojan L16RE-A</th>
<th>Full River DC210-12</th>
<th>Simpliphi PHI 3.4kWh</th>
<th>LG Chem RESU10H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12V</td>
<td>12V</td>
<td>12V</td>
<td>12V</td>
<td>12V</td>
<td>12V</td>
<td>48V</td>
</tr>
<tr>
<td>20hr Rate</td>
<td>3,000</td>
<td>2,600</td>
<td>2,050</td>
<td>1,600</td>
<td>1,300</td>
<td>1,300</td>
<td>-</td>
</tr>
<tr>
<td>Cycles at 50% DoD</td>
<td>-40˚ to 149˚F</td>
<td>-40˚ to 149˚F</td>
<td>-4˚ to 113˚F</td>
<td>-4˚ to 113˚F</td>
<td>-4˚ to 113˚F</td>
<td>13.5 x 8 x 14</td>
<td>8.94 x 17.8 x 19.2</td>
</tr>
<tr>
<td>Terminal Type</td>
<td>T11</td>
<td>Threaded copper alloy insert</td>
<td>M8</td>
<td>LT</td>
<td>LT</td>
<td>13.5 x 8 x 14</td>
<td>8.94 x 17.8 x 19.2</td>
</tr>
<tr>
<td>Operating Temp Range</td>
<td>22 x 4.92 x 12.6</td>
<td>22 x 4.9 x 12.6</td>
<td>22.01 x 4.95 x 12.6</td>
<td>11.67 x 6.95 x 17.56</td>
<td>20.87 x 8.23 x 8.58</td>
<td>13.5 x 8 x 14</td>
<td>8.94 x 17.8 x 19.2</td>
</tr>
<tr>
<td>Dimensions LxWxH (in)</td>
<td>130/59</td>
<td>131/60</td>
<td>132/60</td>
<td>115/52</td>
<td>133.38/60.5</td>
<td>13.5 x 8 x 14</td>
<td>8.94 x 17.8 x 19.2</td>
</tr>
<tr>
<td>Weight (lbs/kg)</td>
<td>6 year full replacement</td>
<td>2 year full replacement</td>
<td>2 year full replacement</td>
<td>2 year full replacement</td>
<td>2 year full replacement</td>
<td>10 year full replacement</td>
<td>10 year full replacement</td>
</tr>
<tr>
<td>Warranty</td>
<td>24 months</td>
<td>6 months</td>
<td>24 months</td>
<td>6 months</td>
<td>6 months</td>
<td>12 months</td>
<td>12 months</td>
</tr>
<tr>
<td>Shelf Life @ 25˚C</td>
<td>24 months</td>
<td>6 months</td>
<td>24 months</td>
<td>6 months</td>
<td>6 months</td>
<td>12 months</td>
<td>12 months</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Qty batteries needed ~8-10 kWh 48V Bank</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>3</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg Retail Price (excl. delivery/installation)</td>
<td>$4,586.32</td>
<td>$4,389.36</td>
<td>$4,011.60</td>
<td>$2,642.48</td>
<td>$4,525.36</td>
<td>$12,178.59</td>
</tr>
<tr>
<td>Effective kWh Size (20hr Rate)</td>
<td>8.54</td>
<td>8.54</td>
<td>8.69</td>
<td>7.8</td>
<td>10.08</td>
<td>10.2</td>
</tr>
<tr>
<td>Total Effective kWh Delivered</td>
<td>25,620</td>
<td>22,204</td>
<td>17,814.5</td>
<td>12,480</td>
<td>13,104</td>
<td>112,200</td>
</tr>
</tbody>
</table>

| Effective Cost Per kWh Delivered | 0.18 | 0.20 | 0.23 | 0.21 | 0.35 | 0.11 |

**Effective kWh Size**

- **OutBack**: 8.54 kWh
- **OutBack**: 8.54 kWh
- **North Star**: 8.69 kWh
- **Trojan**: 7.8 kWh
- **Full River**: 10.08 kWh
- **Simpliphi**: 10.2 kWh
- **LG Chem**: 9.3 kWh

**Total Effective kWh Delivered**

- **OutBack**: 25,620 kWh
- **OutBack**: 22,204 kWh
- **North Star**: 17,814.5 kWh
- **Trojan**: 12,480 kWh
- **Full River**: 13,104 kWh
- **Simpliphi**: 112,200 kWh
- **LG Chem**: 55,800 kWh

**Effective Cost Per kWh Delivered**

- **OutBack**: $0.18/kWh
- **OutBack**: $0.20/kWh
- **North Star**: $0.23/kWh
- **Trojan**: $0.21/kWh
- **Full River**: $0.35/kWh
- **Simpliphi**: $0.11/kWh
- **LG Chem**: $0.12/kWh

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

### 10 Year Cost of Ownership – 10 kWh 48V Battery Bank

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<tr>
<td>Effective Cost Per kWh Delivered</td>
<td>0.18</td>
<td>0.20</td>
<td>0.23</td>
<td>0.21</td>
<td>0.35</td>
</tr>
<tr>
<td>Life in years w/ daily cycle @ 50%</td>
<td>8.3</td>
<td>7.2</td>
<td>5.6</td>
<td>4.4</td>
<td>3.6</td>
</tr>
<tr>
<td>10 year cost of ownership</td>
<td>$5,525</td>
<td>$6,096</td>
<td>$7,163</td>
<td>$6,006</td>
<td>$12,569</td>
</tr>
</tbody>
</table>

- **OutBack**: Models 200PLC and 200NC
- **North Star**: Model NSB 170FT Blue+
- **Trojan**: Model L16RE-A
- **Full River**: Model DC210-12

**Battery Models**:
- OutBack: 200PLC, 200NC
- North Star: 170FT Blue+
- Trojan: L16RE-A
- Full River: DC210-12
Real World Applications – 34 KW Radians & Simplify Li-ion Batteries
Monitoring and Serviceability
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!

Gord Petroski

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