Making renewables the power supply of the future
Closing the electricity access gap and securing grid resilience today
About Autarsys GmbH

Autarsys energy storage systems (ESS) make renewable energy systems, like solar and wind farms, more efficient and cost-effective and stabilize power supplies.

The technology increases the share of renewable energy by up to 100%.

Customer types:
• Utility scale
• Rural electrification
• Commercial and Industrial (C & I)

Autarsys won Alliance for Rural Electrification's 2018 award in the category of Private Sector in Australia, Europe & North America.
Pain Points: Off-Grid Systems

Pain Point
- no or unreliable power
- environmental and noise pollution

Solution
- EES: 24/7 access to power
- minimal reliance on fossil fuels

How it Works:
ESS transforms mini-grids into “smart” grids and reliable sources of power.

- Provides consistent and affordable 3-phase power from renewable system.
- Has the capacity to increase the share of renewable energy to 100%.
Energy Management for Off-Grid Hybrid Systems:

Maximizing Solar, Minimizing Diesel

Sample of a daily profile: diesel / PV without battery
Energy Management for Off-Grid Hybrid Systems: Reducing Levelized Costs of Electricity (LCOE)

![Graph showing LCOE and investment costs for diesel-only, diesel + PV, and battery hybrid systems as a function of renewable share.](image)

- **LCOE [US$/kWh]**: The blue line represents the levelized cost of electricity (LCOE) for each system configuration, decreasing as the renewable share increases. The diesel-only system has the highest LCOE, followed by diesel + PV, and finally the battery hybrid system, which has the lowest LCOE.
- **Investment [US$]**: The red line shows the investment required for each system, increasing as the renewable share increases. The diesel-only system requires the least investment, followed by diesel + PV, and the battery hybrid system requires the highest investment.

The graph illustrates the benefits of incorporating renewable energy sources into hybrid systems, leading to lower LCOE and reduced investment costs.
Pain Points: On-Grid Systems

**Pain Point**

- erratic voltage and frequency
- unstable grids
- untapped energy assets
- energy dependence

**Solution**

- "Renewable Support Mode"
- "Grid Support Mode"
- "Market Mode"
- "Island Mode"

**How it works:**

- Provides PV smoothing and ramping or peak shaving to stabilize the renewable system.
- Corrects weak grids with insufficient power supplies that experience load dropping and brownouts.
- Engages in energy arbitrage trading with national grid owners, returning profits to local grid operators from the sale of generated renewable energy. Ensures that in the event of power disruptions within the national grid, the local system can operate independently.
Stabilizing Grids & Reducing CO₂ Emissions

Frequency Regulation • Renewable Ramp Rate Control • Energy Arbitrage

Utility scale renewable plants expose grids to highly fluctuating currents that limit their ability to incorporate renewable resources.

That’s why they need energy management systems (EMS) like those developed by Autarsys.
Autarsys ESS: 3 standard sizes with additional modularity

<table>
<thead>
<tr>
<th>Nominal AC Power</th>
<th>30 – 90 kVA</th>
<th>100 – 800 kVA</th>
<th>3325 kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Capacity</td>
<td>33 – 274 kWh</td>
<td>65 – 1092 kWh</td>
<td>max* 3652 kWh</td>
</tr>
<tr>
<td>Dimensions (l x b x h)</td>
<td>2.44 x 2.20 x 2.26 m³</td>
<td>6.06 x 2.44 x 2.90 m³</td>
<td>12.12 x 2.44 x 2.90 m³</td>
</tr>
<tr>
<td>Output Current</td>
<td>43.5 – 130.5 A</td>
<td>175 – 525 A</td>
<td>max. 4000 A</td>
</tr>
<tr>
<td>Output Voltage / Frequency</td>
<td>3 Ø 230/400 V @ 50/60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Efficiency</td>
<td>96%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>10 to 50 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guarantee* / Lifetime*</td>
<td>10 years / 20 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ESS Features and Capabilities
- On-Grid & Off-Grid Ready
- Online UPS
- SWERnet Integration
- Fuel Save
- Diesel Generator Control
- Energy Management
- Dynamic Grid Support
- Reactive Power Compensation
- Blackstart

* The guarantee and lifetimes mentioned are under specific standard conditions of operation of the ESS. Actual product specifications and layout may vary depending upon the application.

* Autarsys ESS can be combined to scale and form bigger systems.
## Autarsys Batteries: Lithium-Ion Advantage

<table>
<thead>
<tr>
<th></th>
<th>Lead acid</th>
<th>Lithium-Ion</th>
<th>Advantage of Lithium-Ion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Round trip efficiency</strong></td>
<td>70-85%</td>
<td>85-95%</td>
<td>✓ Requires smaller PV plant, therefore lower investment costs</td>
</tr>
<tr>
<td><strong>Energy Density (Wh/Kg)</strong></td>
<td>25-50</td>
<td>75-200</td>
<td>✓ Requires smaller battery</td>
</tr>
<tr>
<td><strong>Cycles at Depth of Discharge</strong></td>
<td>500 @ 80%, 2000 @ 50%</td>
<td>1500-4500 @ 80%</td>
<td>✓ Longer lifecycle and fewer necessary replacements</td>
</tr>
<tr>
<td><strong>Investment Costs (per kWh)</strong></td>
<td>80-200 USD</td>
<td>200-800 USD</td>
<td>✗ While nominal kWh capacity values prefer LA, usable capacity costs should be taken into consideration</td>
</tr>
<tr>
<td><strong>Temperature range (°C)</strong></td>
<td>-5 to 40</td>
<td>Autarsys ensures 23± 5°C to fulfill warranty</td>
<td>✓ Li-ion is stable over a wider temperature range from -25 - 50°C</td>
</tr>
</tbody>
</table>
### Reliable Components: Warranty and Performance Guarantees

<table>
<thead>
<tr>
<th></th>
<th>Warranty</th>
<th>Performance Guarantee</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PV System</strong></td>
<td>10 years</td>
<td>20 years</td>
</tr>
<tr>
<td><strong>Batteries</strong></td>
<td>2 years</td>
<td>10 years</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Batteries performance is measured at
- 1 cycle per day
- Ambient temperature in the battery compart 23 ± 5°C
- max. current below XX A / rack, charge and discharge
Web-Based Monitoring: User-friendly control center

- **Responsive web interface.** Runs on any device with a modern browser.
- **Alarm chain.** Notifies operators of necessary measures needed to restore system to stability.
- **Local data storage.** Allows export and download of relevant data
- **Remote access via VPN (virtual private network)**
Featured Payment System: Transparent and Accessible Tariff Collection

- Mobile Payment System (e.g., M-PESA)
- Meter (Control, esp. unlocking)
- Payment Receipt & Monthly Statements
- SPV (Simple Payment Verification)

Autarsys ESS
Qi Palawan, Philippines

Off-grid holiday resort
Autarsys Mini ESS: 30 kW / 124 kWh scalable up to 248 kWh
New Ibajay, Philippines

Off-grid village
Autarsys Mini ESS: 60 kW / 248 kWh
Nicosia, Cyprus

Off-grid research with University of Cyprus
Autarsys Mini ESS: 30 kW / 83 kWh
Our Project: Mayo-Baléo, Cameroon

Electrifying an off-grid border town
Autarsys Medium ESS: 200 kW / 150 kWh
Lakeland, Australia

Grid-connected, utility scale storage
Autarsys Large ESS: 1.4 MW / 5.3 MWh
Solutions: From Ideation to Development

**Analysis & Engineering**
- Assess load profiles and forecast energy demand
- Evaluation of grids and renewable energy sources
- Customize energy storage systems (ESS)

**Installation & Commissioning**
- Provide onsite O&M training for technical personnel
- Develop web interfaces that facilitate energy control
- Commission for operational compliance and quality assurance

**Operation & Maintenance**
- Ensure remote monitoring of system performance
- Provide online support and troubleshooting
- Manage hardware and software throughout product lifecycle
What we offer: Our Business Model

- **EPC.** Engineering, Procurement and Construction
- **Leasing Models.** Facilitate acquisition of systems
- **PPA.** Power Purchase Agreements
Thank you!
Let’s work together.

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