NORLENSE ENERGY SYSTEMS

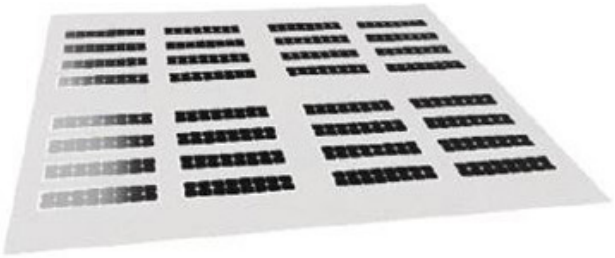
GREEN DOG

Green Deployment Off Grid

NorLense
SHELTER SOLUTIONS

INTRODUCTION

Norlense AS, Norway, have been serving the oil industry globally since 1975 with oil spill recovery equipment on sea and since 1999 we have served armed forces and humanitarian organizations worldwide with our unique high pressure inflatable shelter solutions.



As the first movers with high pressure technology in shelters, and with our close cooperation with armed forces, we know the demands for mission critical equipment, and the option of going dark and silent in special operations off grid are one of them.

With this in mind we developed a new energy shelter, in cooperation with Tarpon Solar AS and Axsol GmbH, that we call Green Deployment Off Grid or Green DOG.

WHAT IS GREEN DOG?

We specialize in military shelters with high pressure bearing beams with up to 8 bars pressure.

This 1-piece tent solution is delivered in a wide range of sizes and can be inflated with a simple air compressor, brake air from trucks or oxygen tanks for remote deployment completely off grid and without any sort of electricity.

A typical deployment of a 5x6 m shelter will take between 10-15 minutes depending on the type of air supply used for inflation.

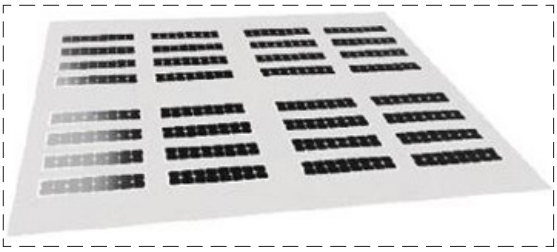
After the desired air pressure is reached there is no need for additional air supply and a semi-permanent structure is now available for a wide range of applications.

In the past, and still, electricity off grid is generated through a diesel generator as the most common supply of power. Diesel is expensive, resupply of fuel is often difficult and bears high costs, generators are noisy, and emissions can cause CO_2 pollution and particle pollution inside the shelters and other problems from an environmental aspect.

We wanted to change this and have developed a unique, smart integration power package for our shelters:

1. SWIFT high-pressure shelters for rapid deployment with wind resistance up to 140 km/h, snow load up to 40 kg per m² and a 1-piece solution with no lose parts designed for military use in warm and cold climates from -46ºC up to +70ºC.

2. a unique flexible and rollable solar panel sunscreen to put on top of the shelter to protect and insulate the shelter and to generate electricity.



3. a unique mobile battery storage system that represents the next evolutionary stage of mobile military power which stores and distributes electricity to all end loads.

4. a backup methanol fuel cell generator that converts methanol into electricity completely silent and free of emissions.

NorLense AS | Fiskebøl | N-8317 Strønstad | Phone +47 761 18 180 | shelter@norlense.com | www.norlense.no

SWIFT RAPID INFLATABLE SHELTER

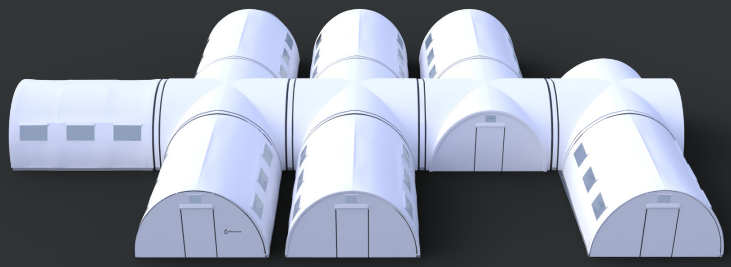
High-pressure technology

Norlense SWIFT shelters are known for their reliability, sturdiness and user friendliness. With watertight one-piece solutions, the SWIFT shelter is the number one choice of armed forces and humanitarian organizations, in mission critical scenarios, and for rapid sheltering in crisis.

Used as command posts, accommodation, communication tents, emergency shelters and field hospitals globally, our quality and experience in the field is converted into the design and functionality of our shelters.

The SWIFT is designed for both warm and cold climates, to resist heavy snow loads and to withstand heavy winds and rainstorms to keep the end user dry and warm.

With high-pressure bearing structures of 8 bars, the shelter is rigid and permanent, in no need of constant air supply after inflation.



Modularity and flexibility

Design and build the modular SWIFT shelters anyway you like, to accommodate your specific needs and purposes.

Connect the SWIFT in any direction, with special designed container connections and truck connection to give even more flexibility to your build. The shelters and all connections are 100% watertight.

Width:	3 meter	4 meter	5 meter	6 meter	8 meter	10 meter
Height:	2,1 m	2,4 m	2,5 m	3 m	4 m	4,65 m
Ø Air Beam Structure	Ø 75 mm	Ø 102 mm	Ø 102 mm	Ø 125 mm	Ø 125 mm	Ø 150 mm
W x L (m)	3 x 2,5	4 x 4	5 x 4	6 x 6	8 x 6	10 x 6
	3 x 4	4 x 6	5 x 6	6 x 8	8 x 8	10 x 12,5
			5 x 8	6 x 10	8 x 10	
			5 x 10	6 x 12	8 x 12,5	
			5 x 5 Connector	6 x 6 Connector		

Configuration options:

- Number of doors
- Number of windows
- Number of HVAC/Cable ducts
- Removable end-walls
- Width or without floor

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ARVEY B2

The ARVEY B2 is a mobile battery storage system that represents the next evolutionary stage of mobile military power.

The possibility of aggregating different energy sources (diesel generator, fuel cell, solar) even in mobile operations increases the resilience of the supply and the independence and autonomy of individual applications. For example, remote IT or radar stations can be operated completely autonomously for days or weeks. With up to 3 kW AC charging power, the battery is recharged in under 1 hour.

The ARVEY B2 has up to 2,400 W continuous power output and was developed according to military standards and can be used in all scenarios requiring a power supply in harsh environments.

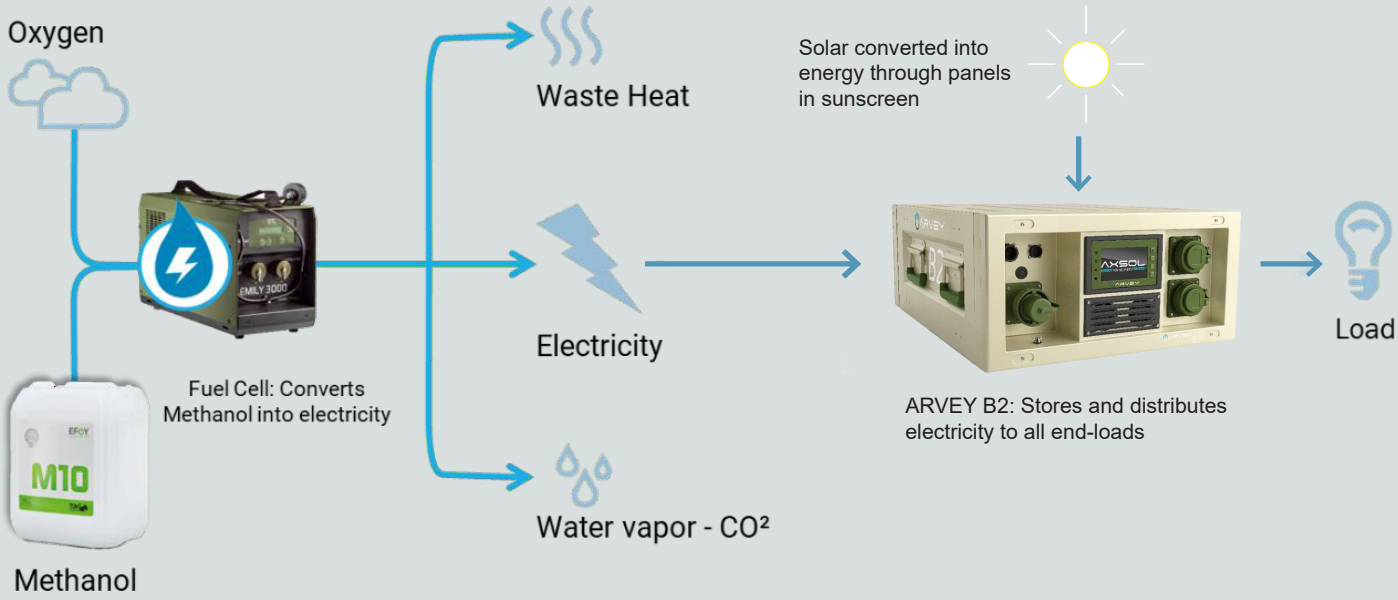
The ARVEY B2 has two sockets for connecting 230 or 110V AC devices and draws the electrical power from a safe lithium iron phosphate (LFP) battery. Additional sockets can be integrated on request. To recharge the battery, the ARVEY B2 can be charged over several generation sources (Diesel generator, PV, Fuel Cell) simultaneously. The AC input can be boosted up to 3 kW in the AC Boot mode.

All components are integrated in a 19" anti-vibration-frame located in a robust and hardened housing.

The housing is certified according to VG 95447 and MIL standards and is IP54 rated in operation. For freight and deployment, the system can be upgraded to IP65. For transport, the system has two handles on each side and can be carried by one or two people.

A modern battlefield server (~ 80 W, max. 150 W) can be powered for 30 hours on a single charge. During this time, the server is not dependent on power cables or renewable and conventional generators, so operational readiness can be established relatively quickly.

Electronics suffer especially in cold and very humid environments due to condensation. The ARVEY B2 has an active ventilation system to keep the operating temperature in the optimal range and the air inside the system as dry as possible. For particularly cold regions, an active heater is installed, which allows the system to operate even in extremely cold conditions.



One 10 l methanol fuel cartridge contains another 11 kWh of stored energy. If the generated solar energy is not sufficient due to dark periods or shading and the battery charge level falls below a certain threshold, the ARVEY B2 automatically starts the methanol fuel cell.

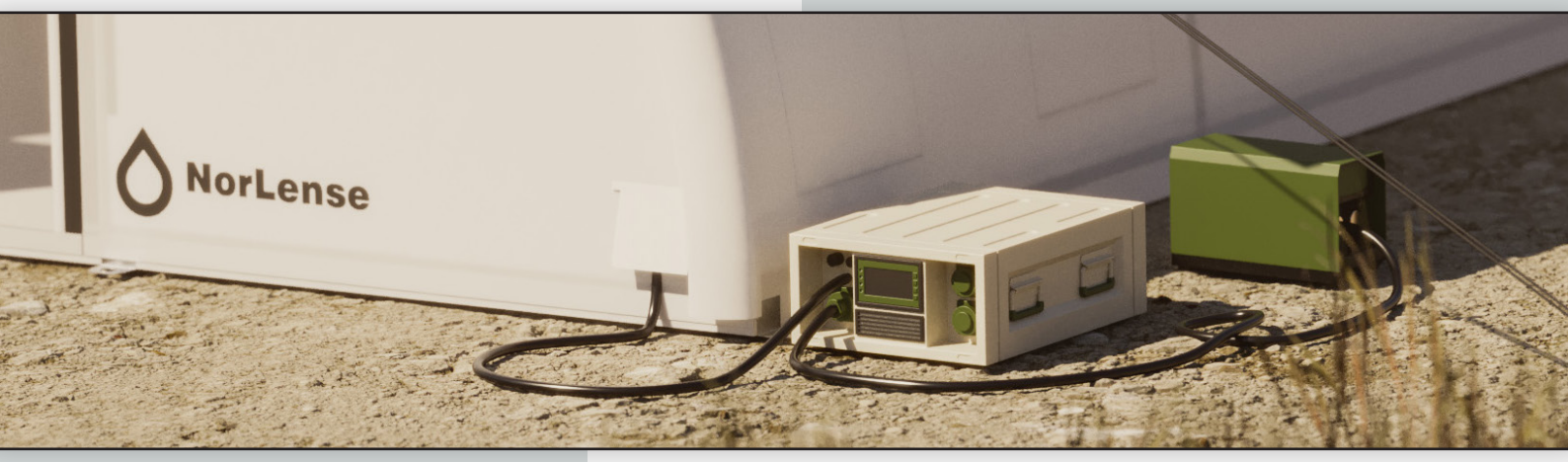
The direct current from the fuel cell is stored in the B2 and critical loads (laptops, monitoring, cooling equipment) continue to be operated safely and resiliently with alternating current.

METHANOL FUEL CELL

The methanol fuel cell uses methanol to produce a 125 W stable DC current in different voltage levels from 12 to 30 V DC charges the on-board battery automatically, quietly and without being detected.

It guarantees operation of the loads even when the engine is turned off. Therefore, camouflage remains intact. The fuel cell can charge modern lithium ion and lithium polymer batteries, as well as the conventional lead-acid batteries.

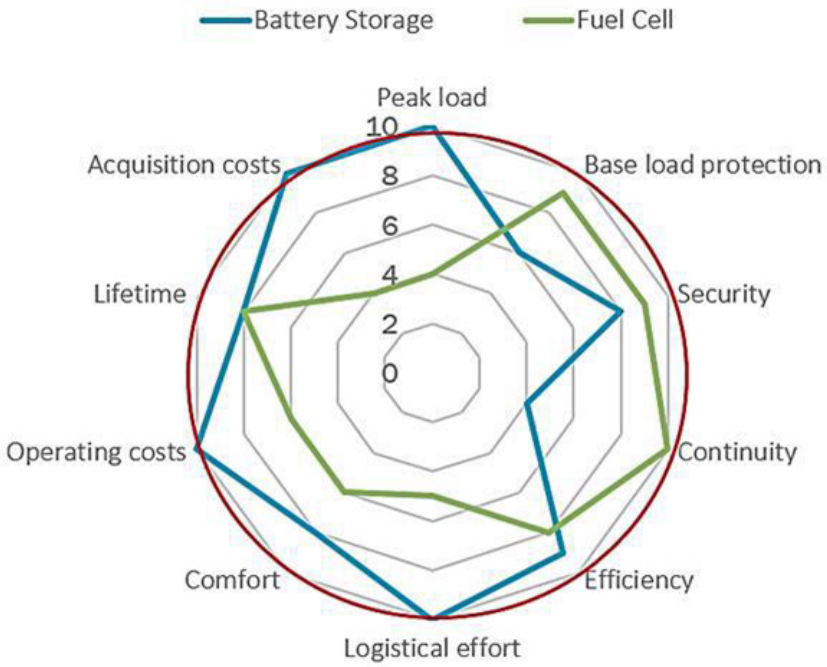
The fuel cell is characterized by virtually signature-free, silent, and emission-free operation, therefore making it the modern task forces' number one choice. Away from the vehicle, it is also suitable as a mobile field-based charging station for batteries.



KEY POINTS

Battery and Fuel cell

- Significant weight & emission reduction
- High autonomy and small footprint
- Fail-safe due to additional fuel logistics
- Non-detectable- no noise, no heat
- Simple operation without extensive training
- Fully automatic charge of battery storage without loss
- Substainable and efficient
- Expansion of the battery capacity
- Increased peak load due to power electronics



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Technical Data methanol fuel cell 3000

Energy	3000 Wh charging energy per day
Outputs	125 W continuous DC output 12 / 16 / 24 V DC
Life Design	over 3000 operating hours 12,5 kg 476 x 206 x 286 mm -25 °C to +50 °C (operating)
Certification Data-Interface:	MIL-C-5015 / VG 95234-20-11 SV (RS-232)
Fuel Cartridge	10 litres 8,4 kg 11,1 kWh (energy) 88 hours (autonomy @125 W) UN 3473 230 x 193 x 318 mm (LxWxH)

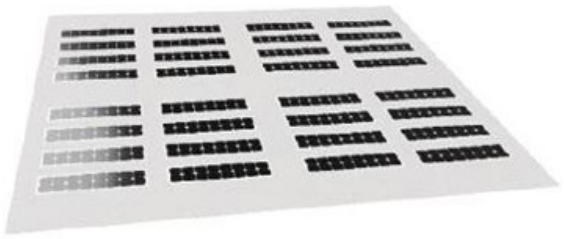
Technical Data Arvey B2

AC Output	2.400W W continuous 4.800 W peak (10s) 3.000 W (AC Boost function)
Outputs	2x AC socket (230 / 110 V) Optional DC outputs (12, 24, 32, 24 V DC)
Battery	LFP **2.400 Wh (nominal capacity)** 2.200 Wh (usable capacity) 2500 Cycles (>60 % EoL)
Life Design	over 10 years < 50 kg 695 × 534 × 259 mm (LxWxH) -10°C to +50°C (operating) -15°C to 60°C (storage)
Input	3 kW AC (while consumption) 2 kW AC (charging) 1 kWp Solar 1 kW DC fuel cell (24 & 48 V DC)
Certification	Device: VG 96968-1, CE (LVD, EMC, RoHS) Battery: CE, UN38.3, IEC62619, UL Housing: VG 95447 / AECTP Standards / MIL-STD-810 / MIL-STD-810 F / MIL-STD-285

ROLLABLE SOLARPANEL SUNSCREEN

Our solar panel sunscreen is a strong, light and long-lasting membrane using PV technology for high efficiency in demanding environments. This is a one-of-a-kind solution for lightweight solar products and is designed to operate with the Arvey B2 and the Methanol fuel cell on top of the SWIFt shelters.

We contribute to fulfill the Paris agreement by reducing the need of fuel consumption for electricity production.



Flysheet (Sunscreen)	Norlense Swift 5X6M (example)
Solar Cloth Dimension L x W:	6,20 m x 5,85 m
Square meter:	36,3 m²
Weight (solar membrane):	69,5 kg
Thickness:	2,5 mm
Handling:	Foldable
Waterproof:	100%
Construction:	Thin film flexible CIGS Solar cells, integrated in a composite construction
Uv- behavior composite cloth:	UVA and UVB over 99% Blockage
Tensile strength:	10 000DPI
Cloth color:	White or grey

Integrated PV solar system

A folded sunscreen

Nominal Power, PMAX	1 650 Wp (2 strings with each 825 Wp)
Maximum Power Voltage, VMPP	123 V per string
Connectors	MC4 Connector

DIESEL COST COMPARISON

In a conventional operation, a 2 or a 5 kW diesel generator would have been used.

The refilling of the diesel reserves and the generator on site generates additional effort and endangers lives.

The following table shows the diesel costs for the continuous supply with the diesel generator with 80 and 150 USD / l diesel in abroad mission operation:

ITEM	2 kW		5 kW	
	80 USD	150 USD	80 USD	150 USD
l / h	0,6 l	1.5 l		
Cost per hour	48 $	90 $ W	120 $	225 $
Cost per day	1.152 $	2.160 $	2.880 $	5.400 $
Cost per 30 days	34.560 $	64.800 $	86.400 $	162.000 $
Cost per 60 days	69.120 $	129.600 $	172.800 $	324.000 $

Resupply of fuel for troops in-theater costs lives. In conflict areas such as *Afghanistan* and *Mali*, transporting large quantities of fuel to military outposts require regular convoys through combatted areas, risking the loss of life and material. Resupply casualties have been significant in *Iraq* and *Afghanistan*.

According to the US Center for Army Lessons Learned (CALL), they have historically accounted for about 10-12% of total Army casualties – the majority related to fuel and water transport.

In operation environments, diesel can cost up to €180 per liter when reaching the military end-user.

With the large quantities of diesel that are required, the costs of diesel in a company tent, or group command post costs up to €3.600 per day. In addition, the system combination is less error-prone and maintenance intensive than conventional diesel generators.

According to current figures from the German Armed Forces Logistics Command, the price of a liter of diesel on foreign missions is between EUR 80 and EUR 150.

Other European forces report costs of up to EUR 200 per liter on deployment.

POWER SUPPLY AND COST CALCULATION

With our integration system we will calculate the need for electricity to run your equipment.

Please contact us for an initial estimate of both power output and project cost.

We are looking forward to serving you in your next project.

MANAGEMENT SYSTEM CERTIFICATION DNV ISO 9001 · ISO 14001

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TARPON SOLAR

AXSOL