

NATO Smart Energy - Enhancing our Military Effectiveness



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Challenges

Exploiting the promises that lie in technological innovation has always been critical for achieving military success. Matched with creative strategic thinking, advanced technology often made the difference.

“Smart Energy” is an important area where innovative technologies and creative thinking meet. Enhancing our armed forces’ energy efficiency means saving fuel – and this means spending less money on fuel. More energy-efficient equipment means having to transport less fuel over long and dangerous supply routes. This, in turn, means saving lives of our soldiers. This is a clear “win-win” outcome. And it explains why both in combat and humanitarian relief operations enhancing energy-efficiency has become a military imperative.

Many technologies that the military needs already exist in the civilian sector: Micro grids to improve a camp’s energy management; renewable energy sources, such as wind and solar power; insulation against heat and cold; low-energy technologies for water purification; LED lights; small portable fuel cells for our soldiers. Individually, many of these steps may seem small. Together, they can fundamentally change the way we conduct future military operations – provided, of course, that they have been thoroughly tested and their interoperability assured.

This is a major aim of Smart Energy in CL15. This exercise brings home what nations and industry are capable of if they embrace energy efficiency as a strategic objective. The range of Smart Energy technologies that you can find in CL15 demonstrates the enormous potential inherent in new energy-saving approaches and procedures. Above all, they demonstrate that the goals of saving cost, enhancing our military effectiveness and saving lives, are not mutually exclusive, but can be achieved together. If nations act in line with this logic, they can confidently meet the challenges of a changing security environment.

Welcome to **NATO Smart Energy** in Action

During Capable Logistician 2015 (CL15), 14 private companies and two public defence agencies contribute over 50 pieces of equipment and highly trained personnel to provide Smart Energy production, storage, distribution and consumption, as well as portable and wearable soldier power solutions.

The Smart Energy equipment is connected to and interacts with other CL15 logistic units, for example the Military Police, the Bulk Fuel Installation, the medical unit and NATO owned tents installed by the NATO Support and Procurement Agency (NSPA). The aim is to effectively reduce the fuel consumption and the soldier's battery burden.

This makes Smart Energy a genuine Multinational Integrated Logistics Unit (MILU).

What is a MILU?

A Multinational Integrated Logistics Unit (MILU) brings together logistics equipment from different nations aiming to test interoperability and to assess NATO Standardization Agreements (STANAGs). The observations will be discussed, and the conclusions will lead to recommendations that will be used to improve the capabilities for NATO's future missions.

What does the Smart Energy MILU offer in CL15?

Smart Energy production

Efficient diesel generators. Renewable energy technologies (photovoltaic panels and wind turbines).

Smart Energy storage

Containerised and portable rechargeable batteries.

Smart Energy distribution

Energy management systems with sensors and intelligent software.

Smart Energy consumption

Insulated tents and sunshades. Energy-efficient LED lights, water purification, heat pump/heat exchanger and capillary conditioner for cooling tents.

Smart Energy soldier power

Soldier wearable power management vests. Universal battery chargers.

Recent experiments with camps demonstrated that the combination of Smart Energy production, storage, distribution and consumption in a micro grid instantly reduces the diesel consumption by more than 50%.



What is a micro grid?

The heart of a micro grid is a computer-controlled energy management system that is usually connected to a rack or container with rechargeable batteries. The batteries are charged by various energy sources, for example diesel generators, photo voltaic (solar) panels or wind turbines. The energy management system measures the demand, sets priorities for power delivery and automatically powers-up and shuts down diesel generators as needed.

Batteries are an important enabler for Smart Energy because they store surplus energy and mitigate power fluctuation from renewable energy sources. The stored energy can then be continuously released without the need of permanently running a generator.

Come and visit Smart Energy in Action

In this exercise, Smart Energy equipment is located at four sites: Camp East, Camp West, First Aid and Water. (See map on page 18.) The equipment will be used to respond to scenarios including power cuts, diesel generator breakdowns, diesel and water contaminations and soldiers in need of batteries. CL15 is the first exercise that not only provides Smart Energy to several other logistic units, but that also includes private companies as fully integrated participants.

Furthermore, about 30 subject matter experts from defence agencies and research institutes will join the exercise to observe Smart Energy activities. Their participation is supported by NATO's Science for Peace and Security Programme under the workshop "Smart Energy in Capable Logistician 2015: From Observation to Recommendation".

The map on page 18 and the table on page 19 explain where Smart Energy players are located during CL15. The key to icons is given on page 20. Pages 4-17 describe the Smart Energy equipment that is installed in CL15.

You can also use the **Smart Energy Sites** map and play the **Smart Energy Treasure Hunt** that can be found as a separate leaflet at any Smart Energy site.

The Smart Energy Head Office is located in Camp East in front of the VIP tent. During the Visitors and Industry Days (15-18 June), all Smart Energy players will be represented here.

Smart Energy Camp East



ESTechnologies: The Deployable Power Module is the heart of a micro grid providing electricity to a part of the NATO owned camp installed by NSPA. The Power Module is based on an innovative concept of power management, coupled with hybrid energy sources and batteries. Production: 80 kW diesel generator and 20 kWp by 120 m² solar power field. Battery storage: 136 kWh.



Renovagen: The highly mobile Roll-Array solar power plant is connected to micro grids or island solutions to provide additional power when needed. The motorised photovoltaic (PV) Roll-Array rolls up into a trailer in 5 minutes. Production: 9.7 kWp by 100 m² solar power array. Battery storage: 26 kWh.

NOTE: Renovagen's Roll-Array will be moved in response to scenario events, e.g. to the NSPA camp, the Smart Energy First Aid, Smart Energy Water and the VIP tent.



Carbon Hybrid frame detail

G&G Partners: The highly insulated tent is made of light-weight carbon-aluminium frame and double thermo-canvas. The small detailed picture shows a cut-through of the hybrid frame that make the structure very stable while reducing weight. The cooling is provided by an energy efficient AC unit.



G&G Partners: The roofing system is installed between two containers, needing only half of the canvas compared to conventional tents. It is therefore a light weight alternative, reducing the logistical footprint.



Gruppo Rold places LED lights in the G&G tent and in the NATO owned VIP tent (installed by NSPA). Rold's LED flood lights are mobile and will be placed where needed in Smart Energy Camp East and First Aid. Consumption of 30 LEDs in the VIP tent: 1.5 kW.

DID YOU KNOW? Energy saving with LED lights reaches 80% compared with conventional incandescent or neon lights.

Smart Energy Camp East



IDE-INTRACOM Defense Electronic: The hybrid generator-battery system with solar power is an island solution providing energy to the VIP tent and the Smart Energy Head Office (G&G tent). Production: A 10-20 kW diesel generator connected to 20 m² solar power panels (3 kWp). Battery storage: 18 kWh.



smartflower runs its solar power plant REMULES (REnewable Mobile Ultra Light Energy System) as a stand-alone operation or connected to various energy storage systems and micro grids, e.g. PFISTERER or IDE-INTRACOM Defense Electronics. Production: 2 kWp.



Multicon Solar: The half-height container with solar power panels and batteries is an island solution to provide energy to the VIP tent. Production: 3.4 kWp. Battery storage: 5 kWh.



TIEGEL: A mobile air conditioning unit based on energy-efficient heat pump/heat exchange technology cools a tent of the Military Police. Also used temporarily in combination with the capillary conditioning system (STEEP). Consumption: 5 kW. Cooling/heating capacity: 15 kW.



Multicon Solar connects its Multicontainer with 100m² retractable photovoltaic panels as an island solution to power tents of the Military Police. Production: 16.5 kWp. Battery storage: 45 kWh.

DID YOU KNOW? When sunlight is directly converted into electricity the expert speaks of photovoltaic (PV). The efficiency of standard PV panels is still low (15-20%), thus requiring a large surface. The good news is: Sunlight is for free. And new materials and processes are pushing the boundaries of PV efficiency, with a world record of 46% achieved in December 2014.

Smart Energy Camp West



PFISTERER: The Mobile Energy Management System (MEMS) is the heart of the micro grid providing power to the Bulk Fuel Installation. Connected to the PFISTERER micro grid are 2 diesel generators (each 10 kW), a wind turbine (5 kWp), a solar power trailer (5 kWp) and the REMULES (solar power flow) by smartflower adding electricity, when needed. Production: 20-30 kWp. Battery storage: 60 kWh.



smartflower: REMULES (REnewable Mobile Ultra Light Energy System) can be installed as a stand-alone operation or connected to various energy storage systems and micro grids, e.g. PFISTERER or IDE-INTRACOM Defense Electronics. Production: 2 kWp.

DID YOU KNOW? Micro grids using hybrid power (diesel and renewable sources), battery storage and an energy management can reduce the fuel consumption instantly by 40-50%.



Schall: Alu-framed highly insulated tent with solar power panels providing shelter for the fuel laboratory at the Bulk Fuel Installation. Connected to the micro grid using the PFISTERER MEMS.



Schall: Inflatable highly insulated tents. One such tent is used as operational tent for the laboratory of the Bulk Fuel Installation. Lights are placed by SETOLITE. Powered by the PFISTERER micro grid and temporary island solutions.

Smart Energy Camp West



SETOLITE: LED lights are placed in the operational tents and containers of the Smart Energy Camp West and the Bulk Fuel Installation.



SETOLITE: External LED flood lights providing security lights for the Smart Energy Camp West, the Bulk Fuel Installation and other sites, as needed.

NOTE: The LED lights by SETOLITE are highly mobile and will be moved to various other locations, when needed.

DID YOU KNOW? LEDs consume up to 10 x less energy compared with incandescent lights and 2 x less compared with fluorescent lights.



Schall: Sunshade for tents and containers reducing the temperature, thus reducing the energy needed for Air Condition Units.



Schall: Inverter generator with integrated Air Condition Unit (ACU) providing energy and cooling to the laboratory and operational tent of the Bulk Fuel Installation. Production: 25 kW. Consumption by the ACU: 9 kW. Cooling capacity: 24 kW.

Smart Energy Camp West



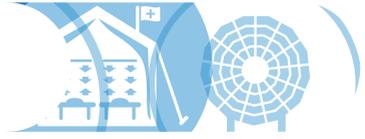
Bundeswehr, BAABW: Thermal solar container with 20m² solar panels on its roof for heating water directly by the sun. At CL15, the hot water is used for showers: The thermal solar container is connected to a 2000 l water reservoir, a shower container and a waste water basin. Consumption: zero kW. Production: 2000 litres of hot water (70°C) during one day, sufficient for 100 troops.

DID YOU KNOW? Thermal solar panels used for heating water are much more efficient than photovoltaic panels used for generating electricity. Furthermore, the water is heated directly by the sun and uses no electrical energy or fuel.



Blücher operates 2 portable water purification units as prototypes. One unit is placed permanently in “Smart Energy Camp West”, where it provides water for the thermal solar shower system of the Bundeswehr. Production: up to 400l/hr. Consumption: less than 1.5 kW. Powered by solar, wind or batteries or connected to a micro grid.

Smart Energy Water



MULTICON SOLAR: Solar Power Trailer used to power various electrical devices, e.g. the Blücher water purification unit. It will be transported where needed in response to scenario events. Production: 4 kWp; battery storage: 12 kWh.



Blücher: One water purification unit is placed at the site "Smart Energy Water" near Kádárta, side-by-side with conventional Reverse Osmosis Water Purification Units (ROWPUs). The Blücher unit has the size of a euro pallet, weighs approx. 100kg and can be carried by four soldiers. More information see page 12.

DID YOU KNOW? Today, the military uses primarily large scale Reverse Osmosis Water Production Units (ROWPU). A typical ROWPU produces as much as 6800 l/h purified water, weighs over 8 tonnes and uses an 35 kW diesel generator.

NOTE: The water purification unit and the Solar Power Trailer are mobile and will be transported where needed in response to scenario events. During the Industry Days (15-18 June) they will be moved to Smart Energy Camp East.

Smart Energy First Aid



STEEP provides the medical unit with an insulated First Aid tent and an innovative capillary conditioning system in form of mats that cool or heat a specific area, e.g. field beds. The system is normally connected to a technical container with thermal solar power, reducing even more the energy consumption. In CL15, it will run with a small heat exchanger using main power and mobile solar power. Consumption: 5 kW.



STEEP: Insulated tent with capillary conditioning systems connected to a technical container for thermal solar power. (Container not showcased in CL15.)

NOTE: Some of STEEP's capillary conditioning mats are mobile and used in various places, e.g. the laboratory of the Bulk Fuel Installation and a tent of the Military Police.



Gruppo Rold: Energy efficient LED lights are placed in the First Aid tent. Consumption: below 1 kW.



Gruppo Rold: The RoldSmartPower is a modular energy management platform based on Power Line Communication (PLC). The devices can be plugged into power sockets, from where they measure, communicate and control the energy consumption of any kind of electrical consumer. The management of the platform is done by using smart phone applications or Internet portals.

DID YOU KNOW? Monitoring the energy helps to make informed decision. Intelligent control and management can be decentralised, centralised and remotely controlled, depending on the required security environment.

NOTE: RoldSmartPower devices are mobile and will be used during CL15 for the Smart Energy First Aid tent and the Smart Energy Head Office at Camp East.

Smart Energy Soldier Power

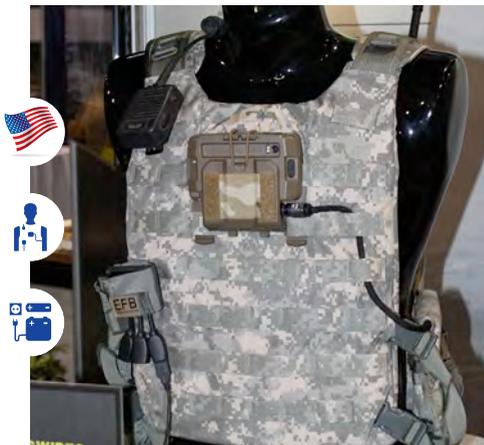


Thales Defense & Security Inc.: The Expeditionary Modular Universal Battery Charger (eMUBC) combines the functions and capabilities of multiple battery chargers into one small, scalable package. The eMUBC can harvest power from solar panels and batteries and a variety of other power sources.



Thales Defense & Security Inc. : The eMUBC directly connects to foldable photovoltaic blankets and solar power panels to charge batteries.

DID YOU KNOW? Today, a soldier carries an average of seven (7) different batteries weighing about 8 kg (15-20% of the total weight a soldier has to carry), plus reserve batteries and connecting cables. Reducing the battery burden by a one-for-all rechargeable battery and a battery health analyzer is vital for the security, resilience, and mobility of the soldier.



DoD/US Army: Soldier Worn Integrated Power Equipment System (SWIPES) with one rechargeable Conformable Wearable Battery (CWVB) that replaces up to 10 conventional batteries. The CWVB gives the warrior up to 24h energy supply, before it needs to be recharged. Battery storage: 140 KWh. Battery weight: 0.68 kg.



DoD/US Army: The Squad Power Manager (SPM) is a portable multi-configurable device that harvests and manages energy from various sources to recharge batteries and power devices that the soldier wears or carries.

DoD/US Army: The multi-fuel generator set weighs about 16 kg. It has a continuous power output of 0.9 kW and handles peak power demand of 1 kW.

NOTE: The highly mobile soldier power equipment will be used in both camps, Smart Energy Camp East and West, and moved around depending on CL15 scenario events and demonstrations.

Bakony Combat Training Center (BCTC) AREA MAP

Capable Logistician 2015
Smart Energy Sites
among other logistics units

1 0 Point Camp

- Smart Energy Camp East
- Receiving Staging & Onward Movement
- Military Police
- Movement Control
- NATO owned tents (NSPA)

2 English Camp

- Logistic Services

3 North West of Újmajor

- Smart Energy Camp West
- Infrastructure Engineering for Logistics
- Bulk Fuel Installation

4 North East of Újmajor

- Ammunition

5 Újmajor Base

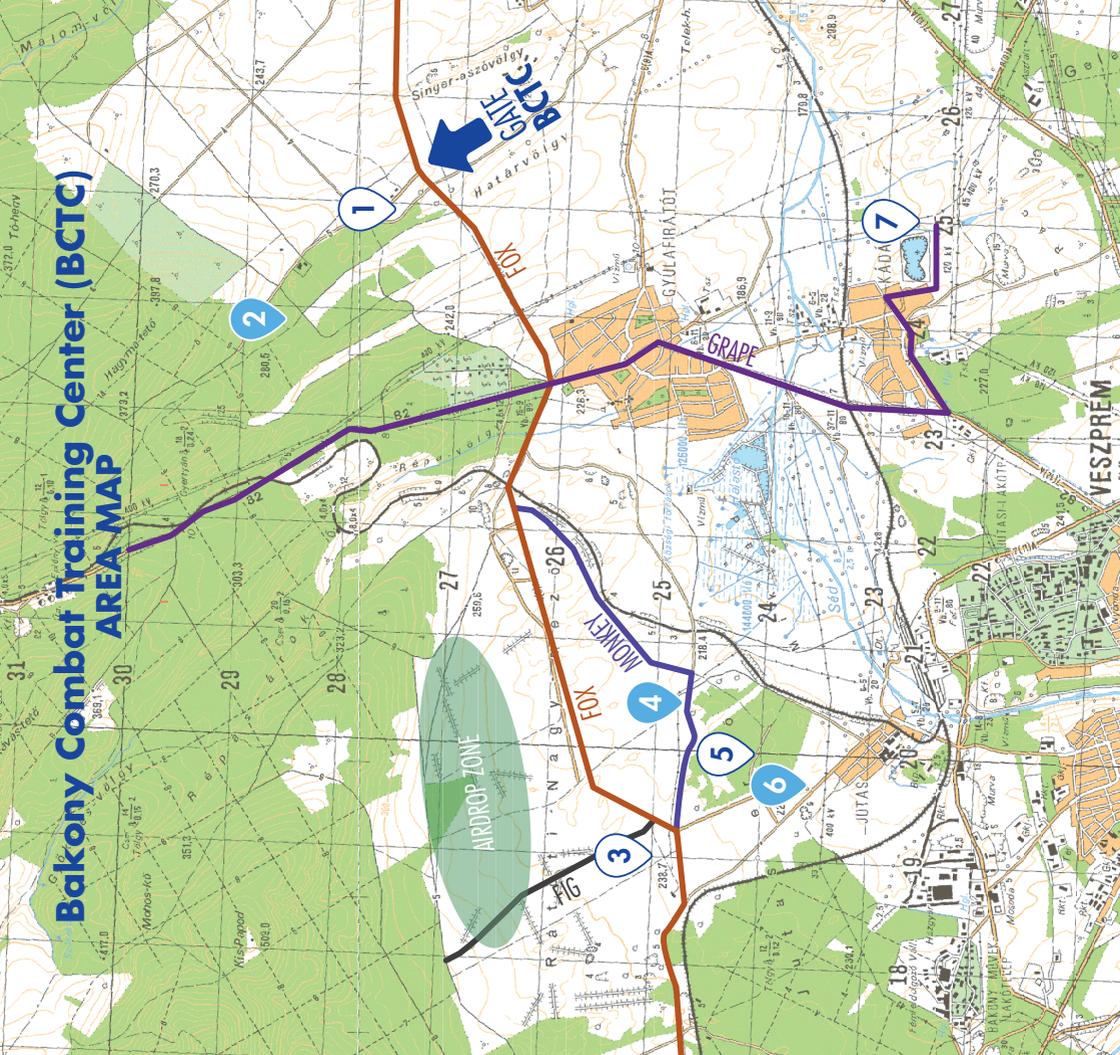
- Smart Energy First Aid
- Logistic Services

6 South West of Újmajor

- Movement & Transport
- Airdrop

7 Kádárta

- Smart Energy Water
- Reverse Osmosis Water Purification



Where can you find Smart Energy?

Smart Energy in CL15 has four basic locations: SE Camp East, SE Camp West, SE First Aid and SE Water. Mobile equipment, including soldier power, is moved to various locations depending on the CL15 scenario events and demonstrations.

SE PLAYERS	SE EQUIPMENT	SE SITES*		MORE INFORMATION
PUBLIC DEFENSE AGENCIES				
Bundeswehr, BAABw (DEU)	Solar showers	West		
Department of Defense/US Army (USA)	Soldier power, rechargers	West	mobile	www.peosoldier.army.mil/programs/pmswar/
PRIVATE COMPANIES				
Blücher (DEU)	Water purification	East, West Water	mobile	www.bluecher.com
ESTechnologies (NLD)	Micro grid	East		www.esttechnologies.nl
G&G Partners (ITA)	Insulated tent with LEDs and Air Condition (AC); roofing system	East		www.defshell.it
IDE – INTRACOM Defense Electronics (GRE)	Diesel-battery hybrid power with solar power	East	mobile	www.intracomdefense.com
Multicon Solar (DEU)	Solar power containers Solar power trailer	East First Aid	mobile	www.multicon-solar.de
PFISTERER (DEU)	Micro grid	West		www.mps.pfisterer.com
Renovagen (GBR)	Solar power	East, West	mobile	www.renovagen.com
Gruppo Rold (ITA)	LEDs (tent lights and flood lights); energy monitoring and controlling	East First Aid	mobile	roldlighting.rold.com
Schall (DEU)	Insulated tents; inverter generator with integrated AC unit	West		www.mschall.de
SETOLITE (DEU)	LEDs (tent lights and flood lights)	West	mobile	www.setolite.com
smartflower (AUT)	Solar power	East, West	mobile	www.remules.com
STEEP (DEU)	Insulated tent, LEDs, heat exchanger with capillary cooling; energy monitoring	East, West First Aid	mobile	www.steep.de
Thales Defense & Security Inc. (USA)	Soldier power, universal battery charger	East, West	mobile	www.thalesdsi.com
TIEGEL (DEU)	Heat pump/heat exchanger	East		www.tiegelgmbh.de

* Smart Energy Camp East, Camp West, First Aid; and Water. Mobile devices will be moved around.

Smart Energy Icon Key



Energy storage and management



Diesel and multi-fuel generator



Photovoltaic solar power (fixed or mobile)



Photovoltaic solar power flower (mobile)



Wind turbine power (fixed or mobile)



Heat pump/heat exchanger



Insulated tent with air conditioning



Insulated tent with capillary conditioning



Insulated tent and sun shade



Insulated tent with LED lights



LED flood lights (fixed or mobile)



Thermal solar power



Low energy water purification



Charger and rechargeable batteries (mobile, portable and wearable)



Foldable photovoltaic solar power (portable)



Soldier wearable power management vest



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An invitation to participate in CL15 was distributed to all Allied nations by the MLCC and the Host Nation. The resulting expressions of intent to contribute equipment to Smart Energy were all accepted. Potential Smart Energy players were invited to attend preparation meetings in January and April 2015. The 14 companies and two Defense agencies that remained committed to contribute to Smart Energy have signed an agreement with the Host Nation. They have invested more than 2 million EUR for equipment, transport and expertise. Their contribution has been instrumental for the success of Smart Energy in CL15.

Whilst the information in this brochure was collected with good intent, its correctness cannot be guaranteed. Nor does it represent any official opinion or policy of NATO or its member states.



Capable Logician 2015 is organised jointly by the **Multinational Logistics Coordination Centre (MLCC)**, Prague, and **Hungary as the Host Nation**.

Smart Energy is coordinated by **NATO's Emerging Security Challenges Division** located in Brussels, Belgium, with support by the **NATO Energy Security Centre of Excellence** located in Vilnius, Lithuania.

Learn more about NATO Smart Energy through our dedicated LibGuide:

www.natolibguides.info/smartenergy

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