SMEs of the STEPS Programme:

Testing innovative energy and power storage systems

Interreg North-West Europe
STEPS
European Regional Development Fund

Bright Energy

Technology: Mobile and modular battery systems
Testbed: Green Energy Park
Country: Belgium
Website: www.bright-energy.eu

PROJECT DESCRIPTION

Bright Energy develops mobile and modular battery units combined with an easy to use dashboard that allows a transition to a more reliable, hassle-free and sustainable power source. The system is designed to be easily moved between temporary projects where it is providing extra power to limited local grid connections. It is particularly intended to power heavy machinery on construction sites where it can be used as an alternative to a diesel generator. The system works in parallel to the grid so that it can also be used for energy arbitrage or grid flexibility services. This also makes it possible to combine the available power from the grid with that of the system for even more powerful solutions.

MAIN ACTIVITIES

A Cinergia grid simulator was used to mimic a wide array of different grid conditions, like under- and overvoltage, voltage dips and voltage harmonics. A powerful loadbank was used to test the behaviour of the tested system and find the absolute limits. For example, since the system works in parallel to the grid, it is very important that the reaction time of the system (time between a load being turned on and power being supplied by the system) is very short. Considering that grid access is limited based on current, it was also important to find out to what extent (if any) the system had trouble with bad power factors.

RESULTS

The capabilities of the system turned out to be quite impressive. When staying within the physical current limits, there was no detectable increase of current on the Cinergia grid simulator, both with good and bad power factors. Due to the way the loadbank creates a reactive load (lots of coils), high inrush currents were detected when these were being switched. The system successfully supplied these currents, but if the magnitude of the currents exceeded the limits of the system, the current supplied by the Cinergia jumped for up to 10ms. Sustained under-voltage proved to be the most difficult scenario which yielded inconsistent results in which the system partially derated.

VALUE OF STEPS

The results of the STEPS testing are very positive. The main thing being improved upon is the sustained stability in under-voltage cases. Because the limits are well known now, it will be possible to be less conservative when dimensioning systems, saving costs for our customers.

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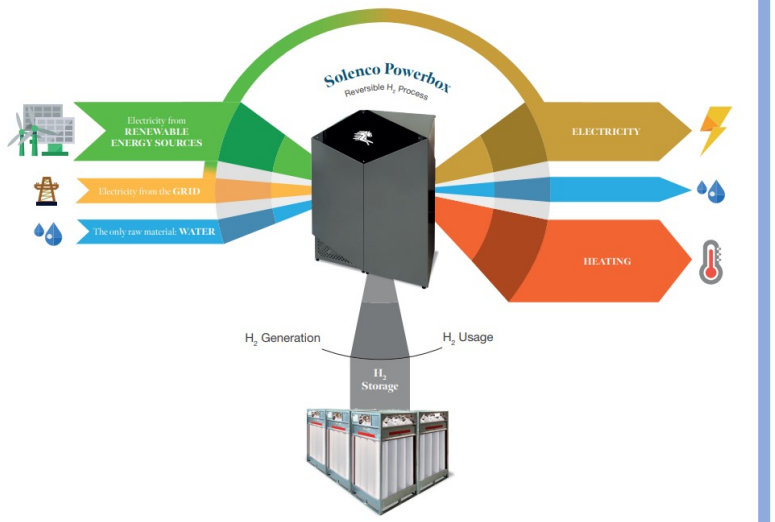
Solenco Power

Technology: Small scale Hydrogen Energy Systems
Testbed: IZEN Energy Systems
Country: Belgium
Website: www.solencopower.com



PROJECT DESCRIPTION

Solenco Power specializes in innovative Hydrogen Energy Systems for family homes and commercial buildings. Their "Powerbox" enable EU households to be 100% independent from the grid and from price fluctuations of fossil fuels. The products are considered to be the missing link for mass uptake of residential Solar PV and give an insurance against rising energy prices. This next generation technology will eliminate the uncertainty of supply and cost of energy by using small-scale energy storage based on hydrogen technology. The storage solutions uses batteries for short term energy storage and hydrogen for seasonal energy storage.

During the STEPS project an energy management system has been developed to optimise the energy flows of the storage solution specific and the total building in general. Large energy consumers (e.g. EV chargers, heat pump) are monitored and could be controlled to directly consume from solar PV.

MAIN ACTIVITIES

Reading out the individual assets and storing the data to post-analyse energy consumption and production over different seasons. Real-time data and relevant aggregates over time were visualised for the project managers. After the first data was read out, other components were added for new visualisations and optimalizations.

RESULTS

Visualisations of the data gives a good overview of the consumption and production of the building. Controlling the Powerbox optimizes the flow. The test site has a huge overproduction in solar PV, during some moments in the morning and evening. During the winter hydrogen stored power fills part of the deficit. Controlling EV chargers based on the solar PV is difficult due to different user profiles.

VALUE OF STEPS

Testing was a steep learning curve and accelerated Solenco Powers development. This will help with ease of installation in future projects. By setting up the energy management system they gained knowledge about installing the Powerbox as part of a larger system. A standard communication protocol has now been built in into their products, including control of the Powerbox by the energy management system. In general, new knowledge has been build up about monitoring and controlling other assets.

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Octave

Technology: Storage systems with second life EV-batteries
Testbed: Terranova Solar
Country: Belgium
Website: www.octave.energy

octave .energy

PROJECT DESCRIPTION

Octave develops battery Energy Storage Systems built with second-life batteries from electric vehicles. Their product range is specifically designed for small and medium enterprises or industrial sites. During STEPS, Octave has implemented on of their second-life battery storage system with a storage capacity of 75kWh and 30kW power at the testbed Terranova Solar. The goal of the project was to demonstrate the technical feasibility and the economic value of Octave's second life battery rack equipped with a proprietary energy management system. The second life battery rack were demonstrated at the Terranova North connection point (400V connection). At this connection point, there is both consumption from the water treatment facility and production from the solar panels.

MAIN ACTIVITIES

The project consisted of the implementation of the system including grid study, electrical installation and electrical validation by an independent body. The commissioning of the battery energy storage system at Terranova Solar took place in July 2021. In the six months that followed, the Octave battery system was tested for three different use cases:

- Reactive power compensation;
- Self-consumption;
- Self-consumption with Day Ahead arbitrage.

RESULTS

Testing within the business support programme of STEPS enabled Octave to increase the TRL of the solution from 5 to 7. We have been able to show our capability to build a working and CE certified battery energy storage solution. The main spoc for the test bed also got access to a dashboard with the main KPIs of the battery and was able to validate the revenues generated by the system.

The piloted solution will continue to optimize the self-consumption of the Terranova Solar site and perform day ahead arbitrage.

VALUE OF STEPS

The STEPS business support programme enabled Octave to validate the technical feasibility of their second-life battery energy storage solution. Moreover, participating in the STEPS programme got Octave significant press exposure and it launched their commercial rollout in Belgium.

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Volta Energy

Technology: Mobile hybrid solar generators with hydrogen
Testbed: H2Hub, Twente University
Country: Netherlands
Website: volta-energy.com

Volta Energy

PROJECT DESCRIPTION

Volta Energy builds mobile hybrid solar generators for construction sites and events. In the STEPS programme, Volta Energy researched a hydrogen storage solution for their generator. Instead of using a diesel generator for backup power we built a prototype that uses a hydrogen fuelcell for backup power. By building the prototype on a larger trailer, more solar panels can be used. This reduces the backup requirement and allows for external hydrogen storage. This external hydrogen storage is a bundle with 16 gas cylinders good for a total of 16kg of hydrogen. External storage is desirable because customised internal storage is expensive and heavy. In addition, there is no need to train our drivers to transport dangerous goods (ADR). A custom Swagelok pressure manifold was designed to fit different kinds of hydrogen storage bundles.

MAIN ACTIVITIES

With testing, Volta Energy used a Linde Gas hydrogen bottle and a Rijngas Hydrogen Bundle. After connecting the storage and checking for leaks we turned on the fuel cell. We tested the fuelcell with different battery percentages to gather information about the hydrogen consumption.

RESULTS

The small Linde bottle was not sufficient for the energy needs. We found the 16kg Rijngas bundle more suitable. With the custom Swagelok manifold two bundles can be connected at once.

VALUE OF STEPS

"Working with hydrogen is complex. By testing and working with it we learned a lot." Volta Energy said. The STEPS programme supported Volta Energy to improve their energy storage solution and bring it closer to a market-ready state. "*We achieved a workable solution. The operational costs are still high but this way we can start with test rentals to learn more about the system.*"

As a next STEPS, Volta Energy is looking into a feasible way to rent out this hybrid hydrogen generator. To do this they need hydrogen usage profiles, hydrogen logistics and permit application procedures to be of the most help for their clients.

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Borg Energy

Technology: Underground thermal energy storage (UTES)
Testbed: WoonFriesland
Country: Netherlands
Website: borg.energy

PROJECT DESCRIPTION

Borg has been developing a first-of-its-kind underground thermal energy storage (UTES) solution to tackle the critical issues in the energy transition in households. Their product is a buffer tank with a capacity of 4000 litres of water made from high-quality expanded polystyrene (EPS) with an intricate ventilating system integrated within the moulds, which guarantees high insulation values during it lifespan. The insulated design is proprietary and patented. The buffer tank is stored underground and can store heat for approximately 1 week in winter and up to 1 month in summer, depending on the size and energy use of the building.

The system is integrated with smart software that combines data from the buffer tank, the weather forecast (which influences renewable energy production, but also the efficiency of heat pumps), dynamic energy prices (as well as predictive price models) and the expected heat demand. The system allows the users to store energy during renewable production peeks and in general when prices are low, and then to use such energy later. The smart energy management system can also allow an increased consumption of rooftop solar panels installed on the house and energy efficiency improvements for heat pumps during cold periods.

MAIN ACTIVITIES

The Borg Energy hardware and software was placed underground and in house at WoonFriesland housing cooperation. Testing the system will continue for data gathering purposes through 2023.

RESULTS

Building the system in an existing house was challenging. Back-up measures and hydraulic bypasses had to be placed wich was more work than expected in the specific set up that was encountered.

The insights from the testing will be used to further develop the technology and first experience with home integration. As a next step, Borg Energy will be deploying charging and uncharging strategies for the locations and will be measuring effects.

VALUE OF STEPS

The STEPS business support programme supports Borg Energy with the opimalisation of design of their underground thermal energy storage system. It provided experience and insights with regard to home integration.

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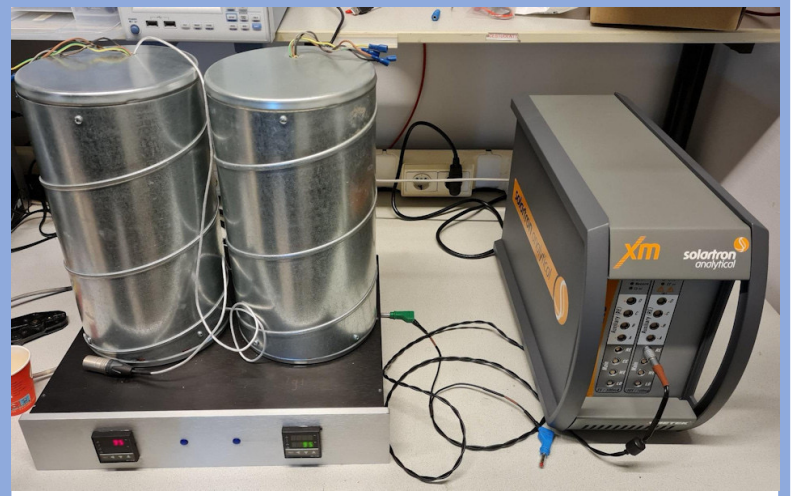
Exergy Storage

Technology: Novel battery technology with abundand, low-cost materials
Testbed: H2Hub, Univeristy of Twente
Country: Netherlands
Website: exergy-storage.nl



PROJECT DESCRIPTION

A novel battery technology based on abundant, low-cost materials, like rock salt, (recyclable) aluminium and iron. It does away with the disadvantages of current battery technologies, as it is intrinsically safe and has a minimal environmental impact, while offering comparable system energy density to Li-ion (LiFePO4). The technology is easy to scale and fully recyclable and can be employed in large utility-scale systems as well as residential storage. The usage of abundant and simple materials allows for circular usage and even makes it refillable and reusable.

MAIN ACTIVITIES

In this part of the STEPS project, Exergy's portable battery setup was placed at the testbed at University of Twente for four months. During this time, University of Twente used a Solartron impedance analyser in combination with the XM-studio software to accurately measure the voltage and resistance data from the Exergy cells. This data was compared with the data measured by the monitoring & analysing equipment from the battery setup. It served as a follow up of the first part of the project, where the impedance of Exergy lab cells was measured by the University of Twente through electrochemical impedance spectroscopy (EIS).

RESULTS

The results successfully show that the battery cel voltage and resistance measured by measuring method by the monitoring and analysing equipment is very accurate and similar to the data gathered by the Solartron equipment (which acted here as an accurate reference for the data).

VALUE OF STEPS

STEPS supported Exergy to obtain new knowledge for measuring and analysing battery cells and provided the opportunity for extra testing of battery cells with the University of Twente.

The impedance data has been proven useful to further inform Exergy about ion transport in its cells, especially within the cathode. In parallel, the data from EIS was compared with impedance data which can be obtained from relaxation measurements on cells by means of voltage relaxation to open-circuit voltage (OCV) versus time. From the OCV time the curve relaxation time from curve fitting yield RC time value which can be compared with the values from EIS experiments. The practical use is large: OCV relaxation measures can be carried out more easy than EIS and are quick enough to use during cycling measurements of running batteries.

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Sun Harvester (Zhyphen)

Technology: Batteries with a proprietary battery management system
Testbed: James Dairy, Ireland
Country: UK & Ireland
Website: zhyphen.com

Zhyphen®

PROJECT DESCRIPTION

Sun Harvester (Zhyphen) is an Energy Storage Systems manufacturer for smart energy & grid solutions based on battery storage. They offer full turn key solutions with Zhyphen proprietary software & unique modular hardware. Zhyphen is a registered trade mark and trading style of Sun Harvester Limited.

They provide innovative high quality energy storage solutions for harvesting and storing free low carbon renewable energy. Their technology can be applied to applications from small 50w Mobile Units to Mini-Grid Systems and beyond. Zhyphen's in-house R&D facility develops unique system architecture used in all their systems, coupled with their proprietary Battery management system.

MAIN ACTIVITIES

The battery that Zhyphen installed at the James Dairy farm has a unique system architecture that when it is coupled with the Zhyphen proprietary Battery Management System, it offers maximum usable energy and sustainability. The battery will store excess solar power generation as well as cheaper night-time electricity. It is fully automatic with smart controls. A cellular router was also installed in the testbed to provide network connectivity and a data gateway for monitoring and troubleshooting.

RESULTS

The testing is ongoing, but the results will allow Zhyphen to develop a use case of the battery at this testbed.

In the future, Zhyphen will continue to develop energy storage solution technology ranging from grid-connected, off-grid, and hybrid interactive systems as well as commercial-sized systems in bespoke designed solutions in single or three phase from 3kVa up to 120kw output and beyond.

VALUE OF STEPS

The STEPS Business Support Programme has given Zhyphen the opportunity to install the battery at James Dairy. This has proven to be a great opportunity to monitor their energy storage solution and develop a use case for the battery. This use case can be used to show to potential customers in the future.

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ZEBRA

Technology: Smart energy management systems
Testbed: Terranova Solar
Country: Netherlands
Website: zbr.nu

PROJECT DESCRIPTION

ZEBRA is specialized in smart management systems for sustainable energy. In the STEPS project they have tested energy management on mobile energy solutions. These mobile energy solutions are used in applications such as construction sites, cultural events or telecom. Mobile energy solutions contain more and more PV and batteries, next to the standard generators. ZEBRA tested if charging plans can be made for mobile batteries and generators based on the ZEBRA energy management system (EMS). This way, mobile energy solutions can become more sustainable by cleverly taking into account consumer use and weather forecasts.

MAIN ACTIVITIES

ZEBRA tested this innovation over a period of a year. The first half focused on the optimization side of this problem. ZEBRA wanted to be able to algorithmically plan the charging of several battery packs, for application in a smart charging hub. To that end, ZEBRA investigated several mathematical and algorithmic methods for optimization, to see if they could be applied to this use case. In the second half, the focus was on the practical application. Together with Locquet, ZEBRA started working on controlling a mobile energy system with PV, battery and generator used for powering a telecom pole on a remote location. The main goal was to get acquainted with controlling a remote system. For this, they cooperated with a third party, Calculus, that already performed the read-out of the Locquet systems.

RESULTS

As a result, ZEBRA found the mathematical method of linear programming very suitable to optimize the charging of several battery packs, taking into account availability of renewable energy and consumer deadlines. Calculus developed an API for remote control of the system. With benchmark tests ZEBRA investigated the up- and downsides of using remote control instead of running the software locally on a PC system. They have further developed their algorithms to model a diesel generator, in efforts to reduce the use of diesel by smart planning.

VALUE OF STEPS

ZEBRA: *"With the linear programming method, we have found a new way to tackle optimization problems that come our way. We have gained experience with remote control of a energy system and modelling diesel generators. We expect this will leave us as an attractive party for the mobile energy world in making their solutions more sustainable."*

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ELESTOR

Technology: Energy Storage using Hydrogen Bromine flow battery
Testbed: Elestor pilot field at IPKW
Country: The Netherlands
Website: www.elestor.nl

elestor electricity storage

PROJECT DESCRIPTION

Elestor developes large scale energy storage using Hydrogen Bromine flow battery technology. For the STEPS project, they installed a 50 kW flow battery with 250 kWh storage capacity on the Elestor pilot field at IPKW, connected to the IPKW power grid via a 400 VAC cable.

MAIN ACTIVITIES

Two things were tested with this set-up: 1. Stack connection in series and the verification of corresponding shunt currents. 2. safety validation by an external expert (DNV). A third desired test, to connect the battery to a Solar PV set-up from IPKW, was not executed in the context of this voucher.

RESULTS

The tool to measure the shunt current via an external clamp-on device was successfully validated. With 2 and 3 small (10- resp. 20-cell) stacks in series it could be demonstrated that shunt currents are not contributing significantly at this scale.

DNV (Arnhem office) conducted a safety validation of the system based on documentation review and actual installation inspection. There were no 'red flags' found where the system was non-compliant to existing laws, standards & norms in scope for this assessment. They made some recommendations for follow-up systems, related to the new code for Safety requirements for Flow battery energy systems for stationary applications (IEC 62932-2-2:2020, Part 2-2)

VALUE OF STEPS

The voucher has enabled to overcome a difficult obstacle for faster learning, being certification or safety audits of the systems by a Notified Body. Typically for a prototype system this is not considered due to the significant costs involved (a big hurdle for a small company), even though the external review will provide significant potential for improvement. With this voucher it was possible for Elestor to speed up this way of learning.

Also, for the shunt current measurements, the voucher supported a faster overall learning and validation of the technology, by widening the scope of the data gathering that beforehand was deemed to be infeasible due to relatively high extra costs for the extra measurement tools.

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Powerquad

Technology: Mobile energy storage solution to replace generators
Testbed: Oxford Innovation
Country: The United Kingdom
Website: powerquad.co.uk

PROJECT DESCRIPTION

Powerquad tested a mobile energy storage solution aimed at replacing diesel generators for professional use. Their storage solutions is specifically aimed at industries using temporary outdoor power such as construction, events and catering. While mobile energy storage is often aimed at smaller consumer use such as camping, Powerquad choses to address industrial use, where the largest impact comes from.

An innovative approach was taken to help overcome barriers to market. This includes the novel use of the electric vehicle (EV) charging network to charge the system when away from typical grid charging. This increases mobility and provides higher power outputs to meet the need of professional users.

MAIN ACTIVITIES

Testing was split into three tracks. First, initial lab system testing on the bench for subsystems with battery modules. Secondly, testing with EV charger subsystem protocol and the integration testing on site with EV charger points at testbed Oxford Innovation. Lastly, Powerquad tested the full system with EV charger points at the testbed. The tests also provided evidence for pre-compliance testing.

RESULTS

The first results indicate Powerquad will validate their solution for use with the EV charger network and reach pre-compliance for the product.

During the pilot, Powerquad received feedback from potential customers, including very positive feedback from construction and events industries. Moreover, they won an industry award, partly due to the innovation from this pilot. This process convinced Powerquad to further commercialise their storage solution. Next steps for this are to complete full compliance testing, implement design changes from customer feedback and the pilot testing, create case studies to communicate benefits, and complete further pilots with end-customers.

VALUE OF STEPS

The testing within the STEPS business support programme helped Powerquad to verify their solution to themselves and potential end-customers. It has allowed them to test their solution in a controlled real-world situation. The testing has shown them the future design iterations that are still needed. This has moved the company closer to accreditations and commercialisation of the solution.

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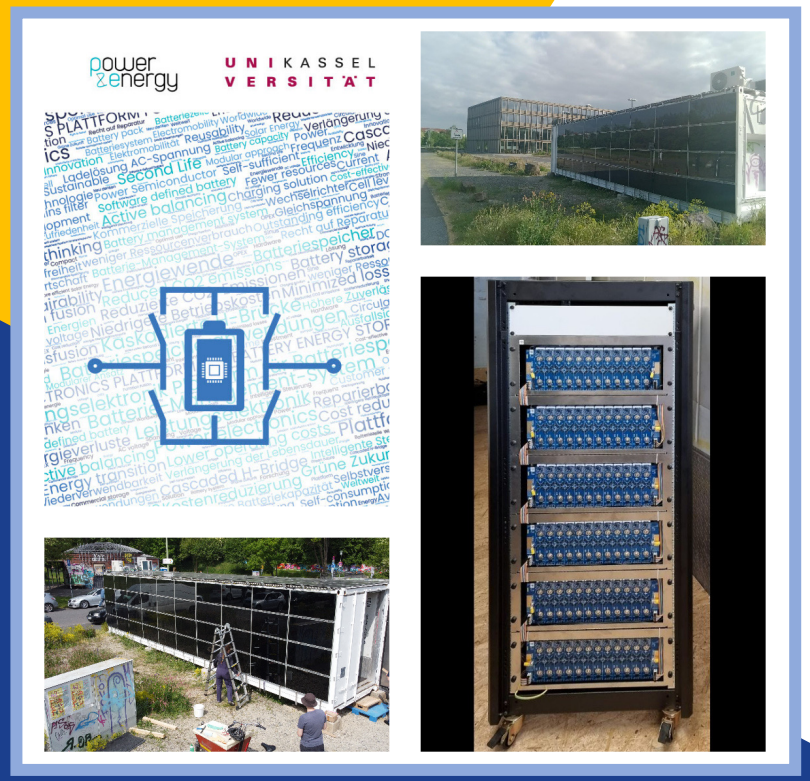
P&E Power & Energy

Technology: BESS based on a new power electronics platform
Testbed: SP / University Kassel
Country: Germany
Website: p-and-e.com



PROJECT DESCRIPTION

P&E Power & Energy has developed a Battery Energy Storage System (BESS) based on a new power electronics platform on battery cell level. They tested their BESS consisting of 132 cascaded H-bridges on as many prismatic 50h battery cells. This system can be operated parallel to the mains on the 230V/50 Hz low-voltage mains without additional converter. Their solution is hightly innovative and can in the future be applicable to all areas with more than two battery cells connected in series.

MAIN ACTIVITIES

The test phase was divided into two tests. The first test was carried out using new, improved power electronics hardware developed as part of the STEPS project. This included operation on a DC source/sink in a specially designed test bench. This work took several months and required and enabled incremental improvements, especially in the software. The test bench was specially built as part of the STEPS project. With the hardware in place, the important milestone of grid-parallel operation was achieved during the second test, and important potential for improvement was identified during several months of endurance testing. For the sake of transparency, it should be mentioned that not all identified weaknesses could be eliminated during the project due to lack of time and very limited financial resources.

RESULTS

On the one hand, the HW and SW solutions could be improved and integrated into test environments that are closer to the later application area (temperature, clamping quality). In addition, additional software functionalities could be developed, implemented and tested during the project.

VALUE OF STEPS

"To summarize, the most important result is that we continue to get closer to deploying the solution in the field. The business support and networking opportunities of the STEPS programme have been good, but in our case have not yet resulted in relevant new contacts" explained P&E Power & Energy. And although the STEPS programme has not brought the Battery Energy Storage System of P&E Power & Energy close to market readiness, incremental progress was made. Moreover, they acquired new knowledge and new possibilities due to new test bench.

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AMTE Power

Technology: Sodium-ion battery cells for home energy storage
Testbed: Harwell Campus
Country: United Kingdom
Website: amtepower.com

PROJECT DESCRIPTION

Interest for home energy storage continues to grow across the EU. The energy storage solution of AMTE Power aims to address the development of sodium-ion cells in a home energy storage product. Almost all their research and development of sodium-ion batteries has previously been conducted at the cell level. AMTE Power has the facilities to conduct this testing but due to the development stage of the technology, tests against a real-world application are limited.

AMTE Power has built a prototype battery pack but needed a test bed to run real word application duty cycles from energy storage to see how the technology runs in a pack. Sodium-ion has several different characteristics compared to lithium-ion technology so testing would also be conducted on the interaction of the technology with a battery management system to pinpoint advantages of the sodium-ion and any limitations in using lithium-ion BMS technology.

MAIN ACTIVITIES

For the testbed, AMTE Power combined their sodium-ion battery with the battery management system of Brill Power. The energy storage system was implemented at Harwell Campus. As a benchmark, in the project's first phase they have deployed lithium-ion cells before switching to use AMTE's Ultra Safe sodium-ion cell technology in the second demonstration phase of the project. AMTE Power was able to evaluate a standard product set and compare the data from the sodium-Ion pack. The data collected enabled AMTE to reset the Battery Management System parameters.

RESULTS

The testing provided quality data and the ability to prove the use of sodium-ion in Home ESS application. Work on the Battery Management System and inverter integration was needed, this was due to current Inventors have been developed using LFP battery's, due lower Voltage level in sodium packs.

VALUE OF STEPS

The support from the STEPS program enabled AMTE Power to invest in a dedicated test program. The data collected was very useful and high lighted areas of improvement. AMTE Power will continue to download data and monitor the cycle life of the sodium battery.

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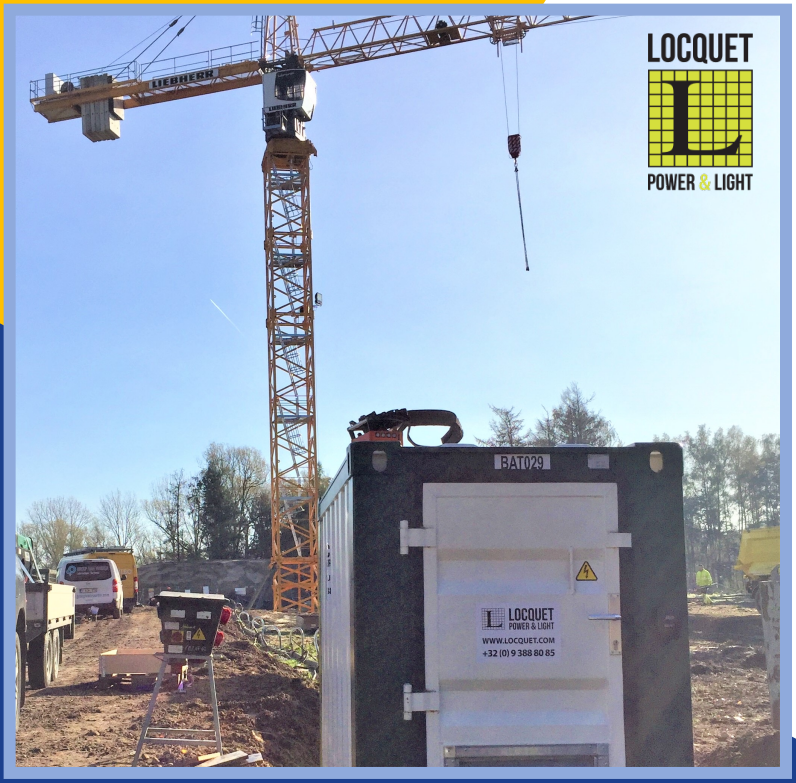
Locquet Power & Light

Technology: Mobile containerized battery packs
Testbed: Terranova Solar
Country: Belgium
Website: www.locquet.com



PROJECT DESCRIPTION

Locquet Power & Light offers complete solutions for mobile power and light supply. In the STEPS business support programme, they tested a containerized mobile battery pack for peak shaving applications. The field of application is taking start currents of tower cranes, enabling the crane to run on a small mains connection. Therefore, there is no longer a need for diesel generators to power the tower crane.

MAIN ACTIVITIES

The test included logging of data from tower cranes and doing a real time test. The units consists of lead AGM batteries with UPS based inverter in a customized container and electrical cabinet. To display the logging and reporting a link was made to an existing portal. Locquet Power & Light also started investigating if their unit could be charged not only with mains power but also with solar power.

A demo server was first installed on site to grant access to the third party software development company that made the coupling of the inverter data to the portal. Multiple iterations have been done to get the right data out of the system. Then testing was done on a actual live system being used on site.

RESULTS

The tests gave Locquet Power & Light real life data of their battery pack. It proved the system was working. The prototype unit has now been commercialised as a rental product and the production of more units is planned for 2023. Next steps are scaling up production and further development of the battery system. Because battery technology is changing fast, other typologies of batteries (for other application) will also be tested.

VALUE OF STEPS

The STEPS programme enabled Locquet Power & Light to purchase the logging devices to measure parameters that were not readily available in the unit. The technical issues on software and network levels that they encountered during the testing were not in their knowledge domain, but were overcome thanks to the collaboration with the thirds parties in the STEPS programme. Most importantly, the software link between inverters and the Locquet Power & Lights portal that the testing has provided, can be reused for all other battery packs they develop on the same technology. This gives Locquet Power & Light a major advantage in the ready to market cycle.

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Clean Tech

Technology: Smart Energy Management System (SEMS)
Testbed: Wexford County Hall
Country: Ireland
Website: www.e2t.earth

PROJECT DESCRIPTION

Clean Techs energy storage solution SEMS (Smart Energy Management System), incorporates control and intelligence into an energy system through machine learning, algorithms, and big data analysis. SEMS is designed to be self-managed and makes automatic decisions to achieve maximum savings in the electricity bill. It offers the following features:

- SEMS predicts solar resource availability to optimize energy generation from solar panels.
- The system learns and adapts to user consumption patterns, optimizing energy usage based on individual needs.
- SEMS analyses and predicts electricity prices in real-time, allowing for strategic energy usage to take advantage of favourable rates.
- The system autonomously manages and adjusts energy flow based on real-time data and user preferences.

MAIN ACTIVITIES

Clean Tech installed their Smart Energy Management System at Wexford County Hall. The testing began in November 2021 until December 2022. They installed a data gateway to monitor performance.

RESULTS

The test results are positive. From the monitoring app, it is evident that SEMS has successfully achieved smart control over the energy flow to maximize the utilization of free energy and perform peak shaving based on the grid electricity tariff.

VALUE OF STEPS

The support received through the STEPS Programme allowed Clean Tech to demonstrate the expected functionality of our energy storage solution and identify areas for further development. The battery test provided valuable insights into customer preferences and expectations to reduce energy consumption during the peak hours, helping Clean Tech to improve their solution and bring it closer to the market.

The success story of Wexford County Hall, which had already benefited from solar PV installation, was further amplified by the incorporation of the Clean Tech battery. The collaborative effort through Interreg NWE STEPS showcased a synergistic approach to sustainable energy generation and storage, setting an example for other regions to follow.

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Interreg North-West Europe STEPS
European Regional Development Fund

Voltfang

Technology: storage from second hand batteries from electric vehicles
Testbed: Walbert-Schmitz
Country: Germany
Website: voltfang.de

PROJECT DESCRIPTION

Voltfang uses batteries pre-used in electric vehicles. This second-life approach saves investment costs and resources, offering a sustainable and affordable solution. However, quality inspection is an important issue. Due to their previous application, the purchased batteries can differ in lifetime. Voltfang has set up a procedure to test the capacity of each battery module, guaranteeing a long lifetime of the storage system. Voltfang's system consists of three main components: an inverter, pre-owned lithium-ion batteries and the main component, which enables communication between the batteries and the inverter. The innovative energy management system allows all energy flows to be recorded, controlled and monitored. The energy storage system can be connected to dynamic power sources. Due to the modular setup, the storage system can be scaled up to 1000 kWh with the right inverter.

MAIN ACTIVITIES

The test setup was placed in a container. Different modi could be set up In the EMS. The operating strategy of the storage system had to be configured with respect to various boundary conditions such as voltage and temperature. Hardware-in-the-loop testing was an important aspect and use case at the testbed. Various safety functions, like automatic shutdown were tested and the battery ageing was examined. In addition, EMS functions such as peak shaving and the behaviour of the battery storage unit in this use case were tested.

RESULTS

Testing the system with different sizes of power sources and load profiles helped Voltfang to gain further experience, evaluate their value proposition and figure out the optimum product size for various use cases. The test environment generated valuable data that can be used for further optimization. Functional safety tests of the self-programmed innovative energy management system helped to improve the recording, controlling and monitoring of the energy flows. The current state of charge and other technical details could be accessed online at any time.

VALUE OF STEPS

The STEPS programme provided Voltfang with a platform to assess the real-world performance and applicability of their storage solution and to test and showcase their innovation.

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Glas

Technology: Mobile energy storage solution to replace generators
Testbed: O'Shea Farm
Country: Ireland
Website: glas.ie

PROJECT DESCRIPTION

Glas' battery has an integrated inverted system, to which they have added a controller that communicates with the converter. They then send signals using the battery protocol to charge and discharge on command. The decision-making around these signals is based on gathered information from the grid operator, the market pricing, and weather forecasts, the predicted solar generation. With this system, Glas offers an intelligent battery control system that can make decisions on what the battery can do at a point in time.

MAIN ACTIVITIES

At the testbed at O'Shea Farm, Glas had a monitor in place at the main incomer to the grid and sub-meters at various sub-boards around the plant. This sub-meters send data every two seconds, and this could be sped up to milliseconds. The first step was to install this monitoring to get a full understanding of what the power profile looks like and identify the sweet spots. Increased sample rates will allow Glas to see the sub-second level of what the battery is doing. A next step was to test the battery to the sub-second level to gain an understanding of how the battery is acting in the system and help us develop intelligent battery controls.

RESULTS

Glas hopes to offer an intelligent battery control system that can make decisions on what the battery can do at a point in time. To the testbed, the battery will maximise the use of solar and charge at a low tariff time. It has a load management function that will monitor the level of demand at any point in time and as it gets close to maximum import demand, the battery can support the load rather than having to switch off loads. We want to demonstrate the potential to add the battery to their grid services income scheme. The battery reacts within milliseconds to enhance the income stream they get from grid services.

VALUE OF STEPS

The STEPS Business Support Programme gave Glas the opportunity to install their battery at the testbed O'Shea Farm. The testing allowed them to test, determine and better understand the most valuable service the controller can offer to end-users, and gave them insights on how to optimise the controller.

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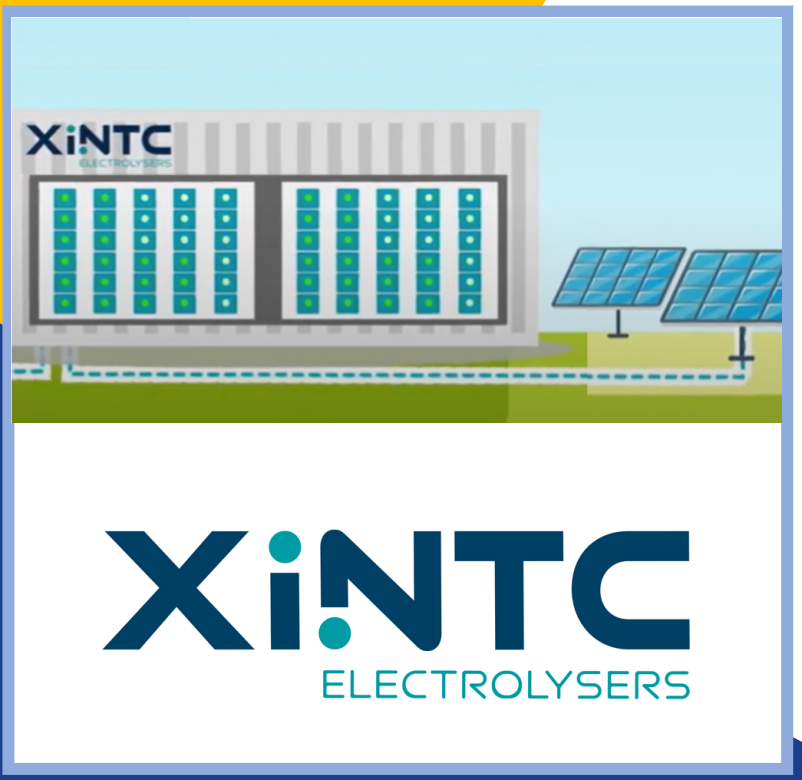
XINTC

Technology: Scalable and modular alkaline electrolyser systems
Testbed: Kootwijkerbroek
Country: The Netherlands
Website: www.xintc.global



XiNTC
ELECTROLYSERS

PROJECT DESCRIPTION

XINTC develops scalable and modular alkaline electrolyser systems specifically targeted at optimally utilising renewable energy sources which have a fluctuating nature. The core of the technology consist of polymer-based electrolysis units ('gas modules') which are combined in frames to building-block units ('sections') of ~180kW. The modular approach allows for a much wider dynamic range of operation while still maintaining system safety and optimal conversion of the renewable energy source into hydrogen gas (Power to Gas, P2G).

The aspects to be tested at scale are how the gas modules perform under dynamically varying operating conditions and the distribution of conversion performance in the safe operating window.

MAIN ACTIVITIES

The test system operates directly from a PV (solar) source, with grid power as backup, and requires a 350kW power coupling to the PV field and electronics to combine the PV power with the grid backup. Internally, the set of gas modules are controlled by intelligent pulse-width modulated (PWM) electronics to regulate the power into a gas module, and extra intelligent electronics to coordinate the ensemble of gas modules to closely follow the power output of the PV field.

RESULTS

The objection is to determine the performance and operating window of the modular electrolyser system with a renewable energy source in this case a PV field. Aspects to be demonstrated are the flexible up- and downscaling of the gas module in response to the dynamic power available from the PV source with the intelligent electronics and PWM modules, the effect of turning individual gas modules on and off to widen the operating window while maintaining safe operating conditions, and the resulting gas compositions and hydrogen purity in the system. For the latter, either samples can be taken and analysed off-line, or a dedicated online system may be employed.

VALUE OF STEPS

XINTC collaborated with Oost NL, the University of Twente, TU Delft and University of Galway. Partly due to the STEPS programme, XINTC was able to speed up the intensive R&D process of their electrolysers.

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Brill Power

Technology: Intelligent Battery Management System
Testbed: Harwell Campus
Country: United Kingdom
Website: brillpower.com

PROJECT DESCRIPTION

Brill Power has designed an intelligent battery management system to monitor and manage batteries. The system monitors the health and performance of the battery cells and adapts the electrical currents accordingly. If one cell fails, it is bypassed, preventing the battery from failing as a whole. Moreover, the system maximises charge rates and safety and supposedly can increase battery life by up to 60%.

MAIN ACTIVITIES

For the testbed, Brill Power combined their battery management system with the battery of AMTE Power. The energy storage system was implemented at Harwell Campus. As a benchmark, in the project's first phase they have deployed lithium-ion cells before switching to use AMTE's Ultra Safe sodium-ion cell technology in the second demonstration phase of the project.

Brill Power's battery intelligence technology will be deployed to ensure optimal battery usage, lifetime, performance, and safety. Real-world data and operating parameters will be collected, which will support further optimisation of the technologies deployed in the demonstrator. Brill Power launched its first battery management system (BMS) product in 2021, which is supported by its proprietary battery monitoring and analytics software platform.

"Brill Power's battery intelligence technology can improve all aspects of advanced battery systems, including performance, cost of ownership, reliability and safety," commented Brill Power's CEO and Co-founder Christoph Birkl.

RESULTS

The testing provided Brill power and AMTE power with quality data. Work on the Battery Management System and inverter integration was needed, this was due to current Inventors have been developed using LFP battery's, due lower Voltage level in sodium packs.

VALUE OF STEPS

Working with a testbed in the STEPS Business Support Programme has enabled Brill Power to integrate their technology with other cutting-edge battery innovations and collect real-world data on a commercially relevant site.

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