RWE

ANUBIS
DEI+ Subsidy

End report

Second life for electric bus batteries: RWE and VDL create novel energy storage system in Moerdijk

VDL Bus & Coach and RWE cooperate in an innovative project called Anubis, in which 43 ion-lithium batteries are given a “second life”: after intensive use in electric buses from manufacturer VDL, decommissioned battery units will be linked by RWE at the Moerdijk power plant site, in order to form a stationary power storage facility. In this way, the second life batteries make an important contribution to the stability of the power grid and help to relieve the grid by helping to keep supply and demand in balance.

RWE is leading the way in developing innovative energy storage solutions. Batteries are well suited for keeping supply and demand of electricity in balance and thus for helping to stabilise the grid. With Anubis we will put second-life batteries to further use as a sustainable alternative to new batteries. This is an opportunity to provide high-performance storage solutions quickly, economically and sustainable. With this project we gain experience that will help us to conduct future battery projects of this kind.

Roger Miesen, CEO RWE Generation

In this project, we will initially use the batteries from 43 electric VDL buses that have been in operation in the Dutch city of Eindhoven since 2016. These vehicles are currently receiving a new and larger battery pack, but the used batteries still have enough capacity to be used in stationary applications. In Europe we are a forerunner in the field of electric public transport. Offering a sustainable circular solution for our batteries fits into our strategy. However, its application still requires a lot of new knowledge and development. Together with RWE, we will therefore be taking a lot of measures and collect data in this project, so that we can contribute even more making our society sustainable.

Paul van Vuuren, CEO VDL Bus & Coach

VDL and RWE intend to deploy many more decommissioned batteries in this way over the coming years. The demand for electric buses is increasing rapidly in the Netherlands and surrounding countries while the need for storage capacity is growing. Assuming that after 2030 all buses and an increasing number of cars and trucks in the Netherlands will run on electricity, each year more than 150,000 tons of batteries will reach the end of their first life cycles. These are currently classified as waste and as such mostly taken to recycling plants abroad. By using these batteries in stationary storage facilities instead, their productive life is being prolonged. This also reduces the use of resources such as rare earths. Furthermore Anubis contributes to CO2 reduction as it spreads the carbon footprint of manufacturing batteries over many more years and charging cycles. At the end of their life cycle, the batteries are dismantled in a responsible way and materials are reused as much as possible.

Wind and solar energy are weather-dependent and therefore the energy supplied to the network fluctuates. Battery storage can in three ways support the transition to a more sustainable energy supply. First of all, at times of high or low production from intermittent renewable sources, batteries can store or supply energy to balance supply and demand. Secondly, by reducing peak supply and demand, the existing grid capacity is used more efficiently and more suppliers and off takers can be connected to the network. Finally, at the request of electricity transmission system operator TenneT, the batteries can store or supply energy quickly and in this way help to stabilize the frequency of the power grid.

The planned storage facility in Moerdijk was expected to become operational in 2023. RWE is already working on battery projects in Germany, Belgium, the United Kingdom and the US. In its tender bid for the Hollandse Kust West offshore wind farm, RWE has also included a plan for the largest battery in the northern part of the Netherlands. This will make it easier to connect renewable production capacity to the grid in the coming years.

RWE planned and worked on several work packages for the project realisation:

Basic design (Completed)
This phase involved creating the initial design and layout of the battery system. It included determining the specifications of the second life batteries from buses, such as their capacity, voltage, and physical dimensions. The design also considered the arrangement of the batteries and the overall system architecture.

Battery testing (Completed)
The second life batteries were tested for their performance and reliability. This included tests for capacity, energy efficiency, charge/discharge rates, and lifespan. Any batteries that did not meet the required standards were discarded or sent for further processing.

Electrical/mechanical detail engineering incl. enclosure (Completed)
This phase involved the detailed design of the electrical and mechanical components of the battery system. It included designing the battery management system (BMS), wiring diagrams, cooling systems, and safety mechanisms. The design of the enclosure was also completed, which involved considerations for heat dissipation, protection from physical damage, and ease of maintenance.

Design of control system (Completed)
The control system for the battery system was designed in this phase. This included the development of algorithms for optimal charging/discharging, state of charge (SOC) estimation, and fault detection. The user interface for monitoring and controlling the battery system was also designed.

Civil and balance of plant detail engineering (Completed)
This phase involved the detailed engineering of the civil works and balance of plant (BOP). This included the design of the foundation and structures to house the battery system, as well as the auxiliary systems such as HVAC, fire protection, and security systems.

Permit incl. fire protection, suppression and other safety topics (Completed)
In this phase, all necessary permits and approvals were obtained, including those related to fire protection, suppression, and other safety topics. This involved ensuring that the design and planned operation of the battery system complied with all relevant regulations and standards.

Construction (Started)
The construction phase was started. This involves the actual building of the battery system based on the detailed designs and plans. It includes the installation of the batteries, electrical and mechanical systems, control system, and auxiliary systems.

Commissioning
This phase involves testing the completed battery system under operational conditions to ensure that it functions as designed. It includes checking all systems, correcting any issues, and making final adjustments before the system is put into service.

Testing and validation of test results
After commissioning, the battery system undergoes further testing to validate its performance. This includes verifying that the system meets all specified requirements and that it operates safely and efficiently.

Others
There are likely other tasks involved in the project, such as training for operators, development of maintenance procedures, and preparation for lifetime operation and management of the battery system.

During the project, the team encountered a series of challenges that were primarily technical in nature and had a significant impact on both the costs and the timeline of the project:

- A key challenge was dealing with the State of Health (SoH) of the individual second-life batteries. The SoH of these batteries varied widely, reflecting the diverse histories and usage patterns of the buses from which they were sourced.
- The wide variability in the State of Health (SoH) of the second-life batteries meant that a significant amount of time and resources had to be invested in testing and sorting the batteries. This increased the labour and equipment costs. Additionally, the complexity of the communication between the batteries and the battery management/control system required the development of sophisticated software and hardware solutions.

In addition, throughout the course of the project, market shifts significantly altered the suitability of second-life batteries for RWE:

- A primary market change that impacted our project was the unexpected decrease in the prices of new batteries. This development has profound implications for the economic viability of utilizing second-life batteries. The cost advantage that second-life batteries initially offered has been diminished due to the falling prices of new batteries, making the latter a more economically attractive option for energy storage projects.
- Furthermore, we have observed an increase in the average size of battery projects. This trend towards larger projects requiring a greater number of batteries, presents a challenge for the deployment of second-life batteries. The supply of second-life batteries, primarily sourced from the automotive sector, is currently limited and is not projected to reach substantial volumes in the immediate future. This supply constraint makes it challenging to source the large number of second-life batteries required for larger projects.

In June 2023, during the realisation phase, RWE decided to terminate the project due to strategic reasons.

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