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CLIENT II
Internationale Partnerschaften
für nachhaltige Innovationen

BiNiFe – Developing a low-cost bipolar Ni-Fe battery for energy storage

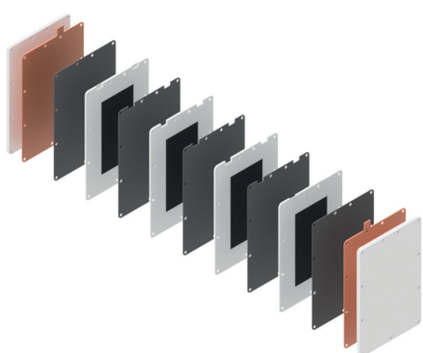
Client II – International partnerships for sustainable innovations

In Germany and South Africa, the closure of coal-fired power plants and the increased use of volatile renewable sources of energy are leading to increased demand for stationary energy storage systems. These are necessary to cover peak requirements in the electricity grid. The German-South African project "BiNiFe" is developing and testing a robust and cost-effective battery for use in South Africa. Among other things, this technology should help make local mobile phone masts more environmentally friendly as many of these are still operated with diesel generators.

Replacement for diesel generators

The increasing use of renewable energies means that many places are looking for innovative solutions for efficient and cost-effective stationary energy storage in order to ensure the stability of the power grid. This is especially true for South Africa, where electricity demand is high in the early morning and early evening, when renewable electricity generation is minimal. The need for energy storage in South Africa is also enhanced by the high number of mobile phone masts which are currently not connected to the power grid and are therefore usually supplied by expensive and polluting diesel generators. The use of diesel generators for power generation in off-grid hybrid energy systems is widespread in many African countries due to their lack of a robust energy infrastructure. They are often used in remote locations where there is insufficient or no connection to the power grid. Nickel-iron (NiFe) batteries, on the other hand, offer a location-independent, emission-free and very safe alternative for providing energy.

Electrochemical battery cells offer a high degree of flexibility for the design of energy storage systems. For such a large amount of battery storage, the materials and manufacturing processes used should be as inexpensive as possible. Maximum lifespan and high reliability are equally important features, while the size of the battery is less important. Electrochemical battery technologies with aqueous electrolytes are therefore particularly suitable considering these economic, safety and environmental factors. Lead-acid batteries currently dominate the battery market. They are a mature technology, but their use on a large scale is limited by low discharge depth, relatively short lifespan and poor temperature stability. Other technologies are unsuitable for large-scale energy storage due to relatively high costs and safety concerns. The "BiNiFe" project therefore makes use of the well-known, inexpensive and environmentally friendly technology of nickel-iron (NiFe) batteries to provide suitable stationary electricity storage. These batteries are known for their extreme longevity, high degree of safety – as there is no risk of spontaneous combustion – and largely non-critical chemicals. The project aims to develop, build and test a prototype bipolar nickel-iron battery with significantly improved performance and service life and which matches the requirements of the South African market.



Schematic structure of a bipolar nickel-iron battery.

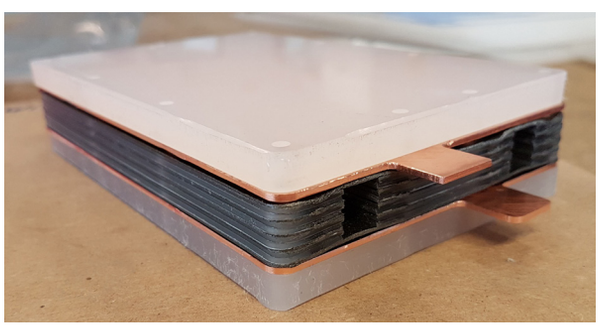
The innovation process

The "BiNiFe" project utilizes an innovative combination of battery materials and design optimization as well as applying new mass production techniques. By using corrosion-free conductive polymer film (bipolar plate), it is possible to make 80 percent reductions in conventional battery materials such as insulating material and cables. Run in cooperation with the University of the Western Cape and Volterion GmbH technology partners, this project will investigate the development and optimization of individual components and the production of individual battery cells. This knowledge will be used to make a prototype. The 5 kW and 5 kWh prototype will be fully welded and

built following a bipolar design before testing. Successful development of the bipolar battery demonstrator will create the foundation for a new generation of powerful and cost-effective storage batteries.

For the international market

The South African Department of Energy has made calls to use storage technologies for future solar and wind energy projects. This ruling provides favourable conditions for the application of the new bipolar NiFe battery technology. The market for this technology in Africa is estimated at 2.5 billion Dollar. After successful development, the project partners aim to put their new technology into practice to serve these target markets. For this purpose, a corresponding commercialization strategy is to be developed in collaboration with Connect'd Energy and Volterion GmbH. Acting as an external consultant both in the development and implementation phases, Eskom will provide client insights and establish the necessary connections with the relevant authorities in order to penetrate the target markets.



Laboratory prototype of a bipolar nickel-iron battery in DIN A6 format.

Thanks to the use of this innovative and sustainable battery technology, it will be possible to create an energy supply that is economic, safe and environmentally friendly, especially in remote areas. The technology enjoys a very significant market which will also have corresponding employment effects in the local area.

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Contact
Dr.-Ing. Anna Grevé
Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT
Osterfelder Straße 3
46047 Oberhausen, Germany
Phone: +40 208 8598-1271
E-mail: anna.greve@umsicht.fraunhofer.de

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