

2LIFEBAT – Robust solar powered storage systems with second-life batteries and their economic and ecological potential

Motivation and Main Objective

The Amazon region includes many isolated communities which are very difficult to reach due to the landscape and their remote locations. Brazil faces chronic energy shortages, especially in remote riverside communities in the Amazon basin region, where logistical issues, high demand for investment, low income for the riverine dwellers, and environmental impact are challenging issues. Besides the efforts to promote universal access to electrification, the Brazilian Amazon basin has yet 82,000 families (350,000 people) without electricity, according to the Brazil Federal Government. Some sources indicate that this number could reach 3.5% of Brazil's total population, or 990,000 'electrical excluded' people, mainly indigenous people and residents of environmental conservation units.

In order to provide universal electricity, decentralized systems led by solar photovoltaic (PV) in off-grid and mini-grid systems will be the lowest-cost solution for three-quarters of the additional connections needed; and grid extension will be the standard especially in urban areas. Therefore, considering the scenario described here, off-grid solutions for photovoltaic solar systems, which require the use of batteries, are the immediate choice for electrifying isolated communities in the Amazon region.



(Image source: evfriendly.ca)

For the development of solar-powered storage systems for isolated regions, lithium-ion batteries from previous use in electric vehicles ("second-life batteries") are suitable as a cost-effective alternative to new batteries. According to recent studies, the use of stationary storages powered by used batteries from electric vehicles has a great potential and their cumulative capacity could reach 185 GWh/year by 2025. For the most effective technical and economic use of second-life batteries in stationary applications with focus on the Amazon region, a number of research questions like the remaining lifetime, the reliability, the appropriate applications and their economic and ecological potentials must be clarified.



(Image source: theagilityeffect.com)

The main objective of the project is to establish an interdisciplinary research network in order to elaborate on the research questions shown above. Industrial companies as potential users of research outcomes will be part of this research network in order to benefit from the associated technology and application skills transfer. Potential funders will be involved in this network in order to find suitable funding possibilities.

Methodology and Planned Activities

The research consortium will be comprising three Brazilian (IFSC, UFAM, UFSC) and two German universities (THI, UDE). I) We are organizing research workshops in Brazil and Germany together with industry partners and funding authorities to share research results and to elaborate future research projects. II) We organize research stays for PhD students from Brazil and Germany. III) We organize student exchanges within their final theses between Brazil and Germany. IV) We organize online guest lectures from ongoing research which are available to students and researchers from all partner universities as well as for other interested persons from the battery community. V) We are carrying out measurements and simulations for battery related problems like swelling, ageing, thermal behavior and water condensation. VI) Based on the newly developed results we elaborate publications and VII) elaborate joint research proposals for subsequent funding after the end of NoPa 2.0 funding period.

Intended Outcome

The research cooperation network “Robust solar powered storage systems with second-life batteries and their economic and ecological potential” comprising three Brazilian (IFSC, UFAM, UFSC) and two German (THI, UDE) universities and industry partners in the field of solar powered storage systems with second-life batteries will be established. To promote industrial application of the storage systems based on second-life batteries, at least three Brazilian industry partners will be involved into the research network. By partnering directly with potential manufacturers, research results can be translated into applications more quickly and this procedure ensures the scalability of the achieved results. Contact with the Brazilian Electricity Regulatory Agency ANEEL as well as with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) will be established for possible cooperation and to find suitable funding programs.

The scientific performance of the participating Brazilian and German partner universities and the innovation ability of industry partners will be strengthened through technology and application skills transfer using newly developed research results. For this purpose, newly developed research results on the electrical and mechanical behavior of second-life batteries, the thermal behavior and corresponding thermal simulation methods, the climatic conditions in Amazon region and lifetime estimation will be

transferred into concrete project ideas for the development of applications and design proposals of stationary battery systems together with industry partners. The economic and ecological potential of such systems will be investigated and optimized by researchers from UDE. At least two joint research ideas will be elaborated and converted into research proposals.

The participating universities will gain expertise in sustainable cooperation by elaboration of research proposals. The cooperation between the international offices at partner universities will be established and intensified. By the end of 2023, at least two research proposals for subsequent research in the application of solar powered storage systems with second-life batteries will be elaborated between the universities and their industry partners in response to research grant opportunities. Furthermore, the cooperation between the international offices will be intensified. For this purpose, the existing cooperation between the strategic network AWARE at THI, which already has experience in international collaboration with UFSC will be used as basis for future cooperation with IFSC, UFAM in Brazil and UDE in Germany. Further master’s and PhD students will be encouraged to submit proposals to DAAD and CAPES to receive scholarships using regular funding programs.

Information	
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German-Brazilian Cooperation

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