

## Emerging Standards for Stationary Batteries and Battery Repurposing

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**Large battery systems present unique safety considerations, as they contain high levels of energy and may use hazardous materials and moving parts. UL works closely with code authorities, cities and fire departments as well as manufacturers and system integrators to better understand these considerations and address them. This presentation outlines new and emerging standards for energy storage systems (ESS), which can bring value and safety assurance to applications in South Africa.**

For successful deployment of energy storage, we need to learn from global experience of deployment of storage as well as understand the pain points of renewable developers and utilities to develop appropriate standards, policy framework and business models. Renewable developers face mounting challenges due to curtailment of wind & solar as well as restrictive regulations related scheduling of power. On the other hand system operators are struggling with ways to balance the grid with variable demand as well as supply. Energy storage technologies can provide the necessary flexibility for both by acting both as load and generation, thus helping in optimal utilization of renewable energy as well as T&D infrastructure.

UL is involved and has substantial experience in:

*Due diligence issues:* As part of UL, AWS Truepower has over 30 years of experience in the renewable energy industry. We support clients as they develop, acquire, and finance renewable energy projects. Two main due diligence issues, not including the regulatory framework under which projects operate, that we have vast experience with are performance and safety. The performance factors tend to focus on the ability of the asset to comply with the design criteria while the safety items care more about the long-term security.

*Performance:* Within performance, our efforts may focus on items such as Round Trip Efficiency, Response Rates, Peak Shifting, and Capacity. However, our analysis of the ESS focuses on the importance of understanding the primary purpose of the project, and tailoring the due diligence to fit.

*Safety:* Our presentation will touch on the issues surrounding the technology and how to take into account operational safety within designs.

*Documentation:* Part of due diligence involves reviewing issues that may exist in key documents such as contracts and the financial model. Within the contracts, we tend to focus on such things as interface risks, lack of benchmarks, and value guarantees. Over time, contracts may become more standardized, but until then we try to find key bankability criteria as they pertain to the market. Some key factors focused on in the financial model are Revenue Structure, replacement costs, long-term projections and decommissioning costs. With ESS, the process is not as simple as there are numerous variables that could affect the model.

**UL 9540** is the world's first standard for safety of energy storage systems, which includes electrical, electro-chemical, mechanical and other types of energy storage technologies for systems intended to supply electrical energy. It is accredited as the national safety standard in United States and Canada. The

standard covers a comprehensive review of energy storage systems, including charging, discharging, protection, control, and communication between devices, fluids movement and other aspects.

**UL 9540** provides a basis for safety of ESS that includes reference to critical technology safety standards and codes such as Stationary Batteries (UL 1973), Distributed Generation Inverters (UL 1741), Grid Interconnection (IEEE 1547 and 1547.1), USA Electrical Code (NFPA 70), USA Boiler, Pressure Vessel, & Piping Codes (ASME B & PV Code and ASME B31 piping codes), etc. It includes additional criteria to address a multitude of safety critical issues such as materials, enclosures controls, as well as special purpose interactive systems, hazardous moving parts, signage and instructions and many other safety critical consideration that may not be covered in current technology standards to more fully address energy storage system safety.

This standard, which has been globally viewed as a template for safety of ESS, fills a unique function, and is the result of cooperation between UL and stakeholders in the industry, government, research institutes and the insurance sector. ESS certification can be achieved through a product testing engagement (typically for off-the-shelf ESS products) or through an on-site, non-destructive field evaluation for unique systems.

**UL 1974**, Evaluation of Repurposing Batteries standard, was developed in response to the request of industry members and authorities to address the disassembly and re-assembly to repurpose batteries being used in the field currently. UL 1974 includes important considerations around the process of repurposing including common set of practices to be followed, battery information gathering and analysis before system is repurpose in the field and overall oversight process.

Although standards and accreditation requirements can vary by country, UL helps simplify multiple market compliance (including South Africa) by bundling product tests and certifications to meet all the requirements of national and regional market standards. A single streamlined process is available to reduce administrative and project management costs, and create faster access to global markets.

**UL9540A**, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, was developed at the request of the industry members and authorities to address fire characteristics of battery energy storage systems that undergoes thermal runaway. The data generated, as a result of this analysis and evaluation, will be used to determine the fire and explosion protection required for an installation of a battery energy storage system an support installation according the local codes and regulations.

Other requirements that address energy storage systems globally, are still under development.

**IEC 62933 Series** will contain parts that will address the safety of electrical energy storage systems. With many parts still remaining under development, there are parts currently published to address testing methods, guidance on environmental issues, and considerations for grid-integration. Parts still under development will address planning and installation, and safety considerations related to electrical energy storage systems composed of batteries. As the global requirements utilized many of the methodologies noted in **UL9540**, a path to future harmonisation is foreseeable.

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