

IEEE Recommended Practice for the Characterization and Evaluation of Energy Storage Technologies in Stationary Applications

IEEE Power and Energy Society

Developed by the
Energy Storage and Stationary Battery Committee

IEEE Std 1679™-2020
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Developed by the

**Energy Storage and Stationary Battery Committee
of the
IEEE Power and Energy Society**

Approved 5 March 2020

IEEE SA Standards Board

Abstract: Recommended information for an objective evaluation of an emerging or alternative energy storage device or system by a potential user for any stationary application is covered in this document. Energy storage technologies are those that provide a means for the reversible storage of electrical energy, i.e., the device receives electrical energy and is able to discharge electrical energy at a later time. The storage medium may be electrochemical (e.g., batteries), kinetic (e.g., flywheels), electrostatic (e.g., electric double-layer capacitors), thermal, compressed air, or some other medium. Devices recharged by non-electrical means, such as fuel cells, are beyond the scope of this document. The document provides a common basis for the expression of performance characteristics and the treatment of life-testing data. A standard approach for analysis of failure modes is also provided, including assessment of safety attributes. The intent of this document is to ensure that characterization information, including test conditions and limits of applicability, is sufficiently complete to allow valid comparisons to be made.

Keywords: battery, cycling service, electric double-layer capacitor, energy storage, flywheel, IEEE 1679™, standby service, stationary application

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Introduction

This introduction is not part of IEEE Std 1679-2020, IEEE Recommended Practice for the Characterization and Evaluation of Energy Storage Technologies in Stationary Applications.

Recent years have seen a significant increase in the number of energy storage devices being proposed for use in traditional battery applications. In addition, the characteristics of an emerging or alternative technology may be an enabling factor for new energy storage applications. A problem may arise, however, in the provision and analysis of information regarding the new technology. For existing applications, the technology developer may not be aware of the conventions already in use for submittal of technical data. Furthermore, the prospective user may not request or receive sufficient information to enable a full comparison to be made between technologies.

This recommended practice describes a format for the characterization of emerging and alternative energy storage technologies in terms of performance, service life, and safety attributes. This format provides a framework for developers to describe their products. The resulting information assists users in evaluating the possible application of emerging and alternative energy storage technologies.

Additional guidance on the application of this document for specific groups of technologies is provided in accompanying guide documents, both published and under development. These documents cover emerging technologies and newer, alternative technologies that can be considered commercialized. This series of documents is not intended to cover traditional battery technologies, such as lead-acid and nickel-cadmium.

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1. Overview

1.1 Scope

This document covers recommended information for an objective evaluation of an emerging or alternative energy storage technology by a potential user for any stationary application. Energy storage technologies are those that provide a means for the reversible storage of electrical energy, i.e., the device receives electrical energy and is able to discharge electrical energy at a later time. The storage medium may be electrochemical (e.g., batteries), kinetic (e.g., flywheels), electrostatic (e.g., electric double-layer capacitors [EDLCs]), thermal, compressed air, or some other medium. While many of the principles outlined in this recommended practice can be applied to a wide range of energy storage technologies, the primary focus is on stationary batteries. Devices recharged by non-electrical means, such as fuel cells, are beyond the scope of this document.

For the purposes of this document, *emerging* technologies are defined as those technologies recently, or soon to be, made available for sale under customary commercial terms (e.g., defined scope-of-supply, warranted performance). *Alternative* technologies are those that are currently mature but are less well-known or as frequently deployed as traditional technologies such as lead-acid and nickel-cadmium batteries or pumped-storage hydro. Stationary applications include both standby service and cycling operation.

The document provides a common basis for the expression of performance characteristics and the treatment of life-testing data. A standard approach for analysis of failure modes is also provided, including assessment of safety attributes. The intent of this document is to ensure that characterization information, including test conditions and limits of applicability, is sufficiently complete to allow valid comparisons to be made. The document does not specify test methods, minimum requirements, or pass/fail criteria.

This recommended practice does not describe individual energy storage technologies, nor does it provide guidance on their suitability for a particular application. This document does not cover sizing, installation, maintenance, and testing techniques, except insofar as they may influence the evaluation of a technology for its intended application.

1.2 Purpose

This recommended practice describes a format for the characterization of emerging or alternative energy storage technologies in terms of performance, service life, and safety attributes. This format provides a