Energy Storage Systems

Based on the IBC®, IFC®, IRC® and NEC®, Second Edition

Energy Storage Systems: Based on the IBC®, IFC®, IRC® and NEC®: Based on the 2021 *Energy Storage Systems®*

2nd Edition

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Preface

Energy storage devices surround us and are an everyday part of our modern world, from cell phone and laptop batteries to thermal storage in passive solar homes. Energy storage systems (ESS) have now become a key enabling technology to facilitate the shift to renewable energy sources, such as solar and wind power, for an ever-greater share of our electricity needs. ESS are playing a critical role in this transition, allowing for a variety of functions that provide much-needed support to the aging electrical grid, as well as providing the ability to store abundant renewable energy generated during periods of high sun or wind for later use. With the growing connectedness of electrical infrastructure, ESS are the glue that bind together variable resources and variable loads, providing the certainty that the average consumer expects when they turn on their equipment or appliances that they will, in fact, have access to sufficient energy to operate.

It would be a mistake, however, to envision ESS as a monolithic technology. In fact, the term ESS encapsulates a tremendous range of technologies, from flywheels to flow batteries, and most of these are generally unfamiliar to building officials, inspectors, emergency services, planners, architects and engineers. The goal of this guide is to provide a handy reference to ESS technologies with an eye toward the key information that these groups need to safely plan, design, permit and build ESS in the built environment. This information includes consideration of how the technologies function, safety considerations and the applicability of current codes and standards, which are evolving to address these, and other, related new technologies.

Beginning in 2010 and extending into the 2020s, lithium-ion battery-based ESS dominate the global market, representing over 90 percent of all new energy storage capacity installed; as such, much of this guide will focus on this group of technologies. Attention will also be given to a number of other technologies that are gaining ground and seeing successful commercial or near-commercial projects in construction globally.

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updated the original contents to this new second edition that is based on the 2024 International Codes® (I-Codes®) and *National Electrical Code®* (NEC®) 2023.

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About the International Building Code® (IBC®)

Building officials, design professionals and others involved in the building construction industry recognize the need for a modern, up-to-date building code addressing the design and installation of building systems through requirements emphasizing performance. The *International Building Code* (IBC), 2024 edition, is intended to meet these needs through model code regulations that safeguard public health and safety in all communities, large and small. The IBC is kept up to date through the open code development consensus process of the International Code Council. The provisions of the 2021 edition, along with those code changes approved in the most recent code development cycle, make up the 2024 edition.

The IBC is one of 15 I-Codes published by the ICC. This comprehensive building code establishes minimum regulations for building systems through prescriptive and performance-related provisions. It is founded on broad-based principles that make possible the use of new materials and new building designs. The IBC is available for adoption and use by jurisdictions internationally. Its use within a governmental jurisdiction is intended to be accomplished through adoption by reference, in accordance with proceedings established by the jurisdiction's laws.

About the International Fire Code® (IFC®)

Fire code officials, fire inspectors, building officials, design professionals, contractors and others involved in the field of fire safety recognize the need for a modern, up-to-date fire code. The *International Fire Code* (IFC), 2024 edition, is intended to meet these needs through model code regulations that safeguard the public health and safety in all communities, large and small. The IFC is kept up to date through ICC's open code development consensus process. The provisions of the 2021 edition, along with those changes approved in the most recent code development cycle, make up the 2024 edition.

One in a family of International Codes published by ICC, the IFC is a model code that establishes minimum fire safety requirements for new and existing buildings, facilities, storage and processes. It addresses fire prevention, fire protection, life safety and safe storage and use of hazardous materials. The IFC provides a total approach of controlling hazards in all buildings and sites, regardless of the hazard being indoors or outdoors.

The IFC is a design document. For example, before a building is constructed, the site must be provided with an adequate water supply for fire-fighting operations and a means of building access for emergency responders in the event of a medical emergency, fire or natural or technological disaster. Depending on the building's occupancy and uses, the IFC regulates the various hazards that may be housed within the building, including refrigeration systems, application of flammable finishes, fueling of motor vehicles, highpiled combustible storage and the storage and use of hazardous materials. The IFC sets forth minimum requirements for these and other hazards and contains requirements for maintaining the life safety of building occupants, the protection of emergency responders, and to limit the damage to a building and its contents as the result of a fire, explosion or unauthorized hazardous material discharge and electrical systems. The IFC is available for adoption and use by jurisdictions internationally. Its use within a governmental jurisdiction is intended to be accomplished through adoption by reference, in accordance with proceedings establishing the jurisdiction's laws.

About the International Residential Code® (IRC®)

The *International Residential Code* (IRC), 2024 edition, is a comprehensive, stand-alone residential code that establishes minimum regulations for the construction of one- and two-family dwellings and townhouses up to three stories in height, including provisions for fire and life safety, structural design, energy conservation and mechanical, fuel-gas, plumbing and electrical systems. The IRC incorporates prescriptive provisions for conventional construction as well as performance criteria that allow the use of new materials and new building designs. The provisions of the 2021 edition, along with those changes approved in the most recent development cycle, make up the 2024 edition.

The IRC is one of the codes in the family of International Codes published by ICC. All are maintained and updated through an open code development consensus process and are available internationally for adoption by the governing authority to provide consistent enforceable regulations for the built environment.

About the NFPA 70®, National Electrical Code® (NEC®)

NFPA 70, *National Electrical Code* (NEC) was first published in 1897 and is continually put through a rigorous review process to keep it up to date with the most current industry practices, emerging trends, and the development and introduction of new technologies. The latest requirements for safe and more effective electrical design, installation and inspection, including provisions for wiring, overcurrent protection, grounding and equipment, are covered. NFPA 70, NEC, is a standard of the National Fire Protection Association and is the benchmark standard for electrical safety in residential, commercial and industrial settings.

About the International Code Council®

The International Code Council is the leading global source of model codes and standards and building safety solutions that include product evaluation, accreditation, technology, codification, consulting, training and certification. The International Code Council's codes, standards and solutions are used to ensure safe, affordable and sustainable communities and buildings worldwide.

The International Code Council family of solutions includes the ICC Evaluation Service (ICC ES), S. K. Ghosh Associates, the International Accreditation Service (IAS), General Code, ICC NTA, ICC Community Development Solutions, Alliance for National & Community Resilience (ANCR) and American Legal Publishing.

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About the Independent Alliance of the Electrical Industry

Independent Alliance of the Electrical Industry (IAEI) is a 501(c)(6) not-for-profit professional trade association committed to public safety from electrical hazards by providing expert, unbiased leadership in electrical code and standards development and premier education and certification for electrical professionals. IAEI was established in, and has been in continuous operation since, 1928.

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