

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

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## Table of Contents

|   |           |
|---|-----------|
| <b>Chapter 1: Introduction</b> .....  | <b>1</b>  |
| 1.1 A Brief History of Energy Storage Technologies .....                                      | 1         |
| 1.2 Acronyms .....  | 6         |
| 1.3 Terminology .....   | 8         |
| 1.4 A Quick Overview of Common Energy Storage Technologies .....                              | 13        |
| 1.5 A Very Brief Overview of Lithium-Ion Batteries .....                                      | 19        |
| <b>Chapter 2: Understanding Utility-Scale and Large Commercial-Scale ESS Projects</b> .....   | <b>23</b> |
| 2.1. Major Parties Involved in Utility-Scale ESS Projects ..                                  | 24        |
| 2.2. Major Equipment on Utility-Scale ESS .....   | 26        |
| <b>Chapter 3: Residential and Small Commercial Scale Projects</b> ..                          | <b>33</b> |
| <b>Chapter 4: Fire and Explosion Risk in Lithium-Ion Battery Energy Storage Systems</b> ..... | <b>35</b> |
| 4.1. Battery Fire and Explosion Risk Background .....   | 35        |
| 4.2. Fire and Explosion Risk and Mitigation Measures ...                                      | 40        |
| 4.3. Key BESS Safety Systems .....  | 44        |
| 4.4. Emergency Planning and Response .....  | 49        |
| <b>Chapter 5: Key Standards for ESS Equipment and Installations</b> .....                     | <b>55</b> |
| 5.1. Brief Review of Applicable Standards .....   | 55        |
| 5.2. Making Sense of ESS Standards .....  | 58        |
| 5.3. Most Relevant Standards .....  | 59        |
| <b>Chapter 6: Applicable Codes</b> .....  | <b>61</b> |
| 6.1. International Building Code® (IBC®) .....  | 61        |
| 6.2. International Fire Code® (IFC®) .....  | 61        |
| 6.3. International Residential Code® (IRC®) .....   | 62        |
| 6.4. National Electrical Code® (NEC®) .....   | 62        |
| 6.5. Common Principles in Energy Storage Related Codes  | 64        |
| <b>Chapter 7: Reviewing and Inspecting Energy Storage Systems</b> .....                       | <b>67</b> |
| <b>Chapter 8: Checklists and Resources</b> .....  | <b>71</b> |



## Preface

**E**nergy 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. In the past few years, however, energy storage systems (ESS) have gained global attention as 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 play 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 oven that it will, in fact, have access to sufficient energy to operate.

It would be a mistake, however, to envision ESS as a stable or monolithic technology. In fact, the term ESS encapsulates a tremendous range of technologies, from flywheels to flow batteries, and most of these will be unfamiliar to building officials, 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, build and permit 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 quickly 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 the 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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## About the International Building Code® (IBC®)

**B**uilding 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®), in the 2021 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 process of the International Code Council® (ICC®). The provisions of the 2018 edition, along with those code changes approved in the most recent code development cycle, make up the 2021 edition.

The International Code Council (ICC), publisher of the IBC, was established in 1994 and is a nonprofit association that provides a wide range of building safety solutions including product evaluation, accreditation, certification, codification and training. The ICC develops model codes and standards used worldwide to construct safe, sustainable, affordable and resilient structures. The ICC's mission is to provide the highest-quality codes, standards, products and services for all concerned with the safety and performance of the built environment.

The IBC is one of 15 International Codes® (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®)

**F**ire 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), 2021 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 process. The provisions of the 2018 edition, along with those changes approved in the most recent code development cycle, make up the 2021 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, high-piled 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®)

**T**he IRC 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 IRC is one of the codes in the family of International Codes published by the International Code Council (ICC). All are maintained and updated through an open code development 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®)

**N**FPA 70, 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®, *National Electrical Code®* (NEC®), is the benchmark standard for electrical safety in residential, commercial, and industrial settings.



## About the International Code Council®

**T**he International Code Council is the leading global source of model codes and standards and building safety solutions that include product evaluation, accreditation, technology, codification, training and certification. The 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, the International Accreditation Service, General Code, S. K. Ghosh Associates, NTA Inc., Progressive Engineering Inc., ICC Community Development Solutions and the Alliance for National & Community Resilience. The Code Council is the largest international association of building safety professionals and is the trusted source of model codes and standards, establishing the baseline for building safety globally and creating a level playing field for designers, builders and manufacturers.

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