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U.S. Department of Energy
1000 Independence Ave. SW
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Via email: oilandgas.resilience@hq.doe.gov and grid.resilience@hq.doe.gov

Re: Comments of the International Code Council on the U.S. Department of Energy's (DOE) Request for Information (RFI) on Codes, Standards, Specifications, and Other Guidance for Enhancing the Resilience of Oil and Natural Gas and Electric Infrastructure Systems Against Severe Weather

The International Code Council (ICC) is a member-focused association dedicated to helping the building community and the construction industry provide safe, resilient, and sustainable construction through the development and use of model codes (I-Codes) and standards used in the design, construction, and compliance processes. Most U.S. states and communities, federal agencies, and many global markets choose the I-Codes to set the standards for regulating construction, plumbing and sanitation, fire prevention, and energy conservation in the built environment. ICC appreciates the opportunity to submit the following responses to DOE's RFI in the above-named matters.

ICC's comments describe the consensus-based process behind I-Code development, codes that provide hazard mitigation measures for structures supporting energy infrastructure, codes directly relevant to certain energy systems, and codes relevant to the integration of renewables and reducing demand curves and grid strain during extreme weather events. The comments also describe how the Alliance for National & Community Resilience (ANCR), a member of the ICC Family of Companies, is developing metrics and benchmarks to support the resilience of energy infrastructure.

I. I-Code Development

The Code Council facilitates the process of developing model codes that benefit public safety and support the industry's need for one set of codes without regional limitations. Consistent with the principles embodied in OMB Circular A-119, which governs the federal government's use of private-sector standards, the consensus process the Code Council uses to govern code changes promotes openness, transparency, due process, balance, and inclusion, and seeks consensus through a series of public forums that are free to attend and open to all.

Changes to the I-Codes are considered every three years. Anyone may submit an amendment, and all amendments are publicly posted. Public hearings are conducted on proposed amendments by code development committees, made up of members with expertise on the subject matter considered. Anyone can apply to be on a code development committee. Public comment is submitted on the outcome of these committee action hearings, which are also publicly available. Public comment hearings are then held on these comments. Following the public comment hearings, local and state governmental members, who are charged with protecting their communities' health and safety and who have no financial stake in the outcome, vote on the adoption of the proposed amendments. Governmental members can participate in this process without travel cost through the ICC's cloud-based voting app, cdpACCESS™.

The Code Council encourages a healthy debate about proposed changes and the process has built-in safeguards to prevent any one interest from dominating the proceedings. Given its rigor, this process results in codes that provide the highest level of building safety in the world and represent a consensus of interested parties. Free public access to every I-Code mentioned in these comments may be viewed online at <https://codes.iccsafe.org/category/I-Codes>.

II. Leveraging the I-Codes to Support Energy Infrastructure Resilience

The widespread use of the I-Codes is testament to their safety and resilience benefits and further offers DOE the opportunity to utilize consensus requirements that are already widely adopted. All 50 states use the International Building Code (IBC) as the basis for construction and safety regulations. The International Plumbing Code (IPC) and International Fire Code (IFC), which are incorporated by reference into the IBC, are the most widely adopted plumbing and fire codes in the nation and are in use or adopted in 37 and 41 states, respectively. The International Energy Conservation Code (IECC) is referenced by the IBC and the International Residential Code (IRC), and is in use in 49 states. The International Wildland Urban Interface Code (IWUIC) is in use across 15 states. The General Services Administration (GSA) requires the IBC, IPC, and IFC¹ for all civilian governmental buildings² and the Department of Defense (DOD) requires the IBC and IPC for all U.S. military bases.³ FEMA guidelines also require federal buildings within the wildland-urban interface (WUI) to adhere to the current IWUIC for new construction, alterations, and maintenance.⁴

Federal, state, tribal, and local governments recognize the implications of modern model building codes for disaster mitigation and the need for strong stewardship of public post-disaster recovery expenditures. The Mitigation Framework Leadership Group (MitFLG), composed of 14 federal agencies and departments (including DOE) as well as state, tribal, and local officials, just released the National Mitigation Investment Strategy (NMIS), which states “[u]p-to-date building codes and standard criteria should be required in federal and state grants and programs.”⁵ FEMA’s current strategic plan stresses: “[d]isaster resilience starts with building codes, because they enhance public safety and property protection.”⁶ FEMA has deemed adherence to current model codes to be so important that it will not fund rebuilding of public facilities post-disaster if that construction would not be built to the latest IBC and IRC.⁷ FEMA also credits the IBC and IPC’s mitigation benefits through its Community Rating System (CRS), which provides federal flood insurance discounts for communities undertaking disaster mitigation measures.⁸ The Building Code Effectiveness Grading Schedule (BCEGS), which insurance companies use to provide premium discounts based on community mitigation measures, also credits up to date IBC, IPC, IWUIC, and IECC adoption.

Numerous studies, conducted by FEMA and others, demonstrate the I-Codes’ mitigation benefits, which stem from their inclusion of the latest hazard-resistant designs. For example, the National Institute of Building Sciences (NIBS) Mitigation Saves study found that for every dollar invested, the 2018 IBC and IRC provide \$11 in mitigation benefits against flood, hurricane, and earthquake risk with a \$4 to \$1 return in wildfire

¹ Excepting means of egress provisions.

² General Services Administration, *Facilities Standards for Public Buildings Service (“GSA P-100”)* (July 2018).

³ Department of Defense, *Unified Facilities Criteria, DoD Building Code (General Building Requirements)* (Nov. 2018).

⁴ Implementation Guidelines for Executive Order 13728 Wildland-Urban Interface Federal Risk Management (2017).

⁵ Mitigation Framework Leadership Group, *National Mitigation Investment Strategy* (Aug. 2019).

⁶ FEMA’s 2018-2022 Strategic Plan (2018).

⁷ Public Assistance Program and Policy Guide, FP 104-009-2 (2018).

⁸ National Flood Insurance Program Community Rating System Coordinator’s Manual, FIA-15/2017 (2017).

mitigation benefits.⁹ A FEMA analysis from 2014 estimated approximately \$500 million in annualized loss avoided in eight southeastern states due to the adoption of modern building codes.¹⁰ A McClatchy analysis following the California Camp Fire in October of 2018 found that 51% of the structures built after a WUI code was implemented escaped damage compared to 18% of the 12,100 structures built prior.¹¹

A. The International Building Code (IBC)

Numerous structures support energy infrastructure. Building codes establish hazard mitigation measures for many of these buildings.

The IBC addresses risks posed by multiple hazards for all building classifications, including business, factory, high hazard, and storage facilities. Many of the requirements contained in the code are organized around the building's use and occupancy with associated provisions required to provide a reasonable level of protection or life safety for building occupants. Key considerations pertain to the level of fire hazard associated with the specific occupancy of the facility, the reduction of fire hazard by limiting the floor area and the height of the building based on the fuel load (combustible contents and burnable building components), and the level of overall fire resistance provided by the type of construction used for the building. The fire safety provisions in the IBC mirror those within the IFC.

In addition to the risks associated with a building's occupancy, the safety of a structure is determined by the characteristics of building materials and systems. The IBC includes chapters focused on materials typically used in building construction and how they should perform to meet the intent of the code. The materials captured include concrete, aluminum, masonry, steel, wood, glass and glazing, gypsum board, gypsum panel products and plaster, and plastic. Systems covered include electrical, mechanical systems, and plumbing systems. Where applicable, industry standards and related I-Codes are referenced.

Hazard maps incorporated into the IBC determine the structure's risk exposure and identify the measures to adequately mitigate such risks. The maps cover risks associated with snow loads, wind loads (including both hurricanes and tornadoes), rain loads, and seismic loads. Key IBC measures relevant to resilience against severe weather and seismic events are detailed below:

- Hurricanes: provisions address structural strength including wind and rain loads, protection of openings from flying debris and preventing the creation of flying debris, elevating structures to mitigate flooding and storm surge, preventing water intrusion and providing for storm shelters. Provisions for building enclosures (exterior walls and roofs) help maintain their integrity including through nailing patterns for roof decks and wall sheathing along with wind resistance of exterior materials including shingles, metal or tile, and siding, stucco, and masonry.
- Tornadoes: Like hurricanes, provisions for storm shelters, prevention of flying debris, and structural strength contribute to tornado resistance.
- Earthquakes: Protection from earthquakes relies heavily on designing for structural loads. Soil conditions also contribute to seismic risk and are addressed within the IBC. Securing appliances such as water

⁹ NIBS, *Natural Hazard Mitigation Saves: 2018 Interim Report* (2019).

¹⁰ FEMA, *Phase 3 National Methodology and Phase 2 Regional Study Losses Avoided as a Result of Adopting and Enforcing Hazard-Resistant Building Codes* (2014).

¹¹ <https://www.sacbee.com/news/state/california/fires/article228580459.html>.

heaters help prevent them from separating or falling, causing fires due to gas leaks or severed electrical connections.

- Tsunamis: In addition to requirements focused on structural integrity, the IBC includes an appendix covering specific conditions associated with tsunami-related flooding.
- Blizzards: Like heat waves, temperature control is an important aspect of resilience in the face of blizzards and other extreme cold events. In addition to measures in the International Energy Conservation Code (IECC), the IBC includes provisions to assure buildings can support anticipated snow loads and associated water management due to snow melt.
- Flooding: The IBC includes provisions covering flood loads and elevation of structures to reduce impacts of flood events. The Code prescribes overall structural strength to withstand hydrostatic forces of water and wave action. Grading of the building site is also included to reduce the impact of floods. Specific provisions covering flood-resistant design are included in an appendix.
- Subsidence: The IBC addresses soil characteristics, water drainage, site grading and foundation design to help avoid subsidence.
- Drought: Provisions specifically focused on water conservation appear within the IPC, IECC and International Green Construction Code (IgCC). The IBC includes provisions focused on soils which could be impacted by changing moisture content or water table levels. The IPC provides requirements governing the construction, installation, alteration, and repair of on-site nonpotable water reuse systems, nonpotable rainwater collection and distribution systems, and reclaimed water systems.¹²

B. International Wildland Urban Interface Code (IWUIC)

IWUIC code should be considered for energy infrastructure along the wildland-urban interface. The IWUIC code establishes requirements for land use and the built environment in designated wildland-urban interface areas based on test data and fire incidents, technical reports, and mitigation strategies from around the world. It addresses ignition resistant construction, noncombustible roof coverings, screens to prevent burning embers from penetrating into eaves and under foundations, controlling for direct connection to combustible decking, fencing and related exterior components, creating and maintaining defensible spaces around the building, fire service access to structures and to water supplies, and fire protection planning.

C. International Fire Code (IFC)

Chapter 12 of the International Fire Code (IFC) addresses a wide range of systems that generate and store energy in, on, and adjacent to buildings and facilities. Ensuring appropriate criteria to address the safety of such systems in building and fire codes is an important part of protecting the public at large, building occupants, and emergency responders. The chapter addresses the rapidly evolving landscape of technologies including standby and emergency power, photovoltaic systems, fuel cell energy systems, and energy storage

¹² ICC has also co-authored two additional standards, the CSA B805/ICC 805 Rainwater Harvesting Standard and ASABE/ICC 802 Landscape Irrigation Sprinkler and Emitter Standard, which provide additional criteria to support the safe use of nonpotable water.

systems. These systems are used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing, or similar capabilities. In many cases, these systems feed into the energy grid and can be managed as distributed generation resources, potentially enhancing resilience in the face of disasters (particularly if the site can be islanded or are part of a microgrid). The safety and ongoing operation of such systems can assure they are available when needed in a disaster or for grid stability.

IFC Chapter 12 requires a failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis for new battery technology types, where multiple battery technologies are utilized in the same vicinity, or where quantities exceed certain thresholds to help guard against thermal runaway and fire propagation. Such an analysis must demonstrate that toxic gases during fires or other fault conditions do not reach concentrations in excess of Immediately Dangerous to Life or Health (IDLH) levels in the building or egress routes during the time necessary for evacuation. Stationary storage battery systems are also required to comply with IBC seismic design requirements and not exceed the floor-loading limitation of the building.

D. International Energy Conservation Code (IECC)

The resilience of utilities is largely predicated on the resilience of generation, transmission, and distribution infrastructure. The demand placed on this infrastructure is directly tied to how buildings use energy. Residential and commercial buildings account for approximately 40% of total U.S. energy consumption.¹³ The IECC addresses the design of energy-efficient building envelopes and the installation of energy-efficient mechanical, lighting and power systems through requirements emphasizing performance. Between 2010 and 2040, the U.S. Department of Energy expects that model building energy codes will save up to 12.82 quads of primary energy associated with building energy use.¹⁴ Like other building codes, the IECC has advanced with each subsequent code cycle. The 2018 IECC represents a more than 30% improvement in efficiency over the 2006 IECC edition.¹⁵

Energy efficiency, including through use of an energy code can provide multiple resilience benefits at the utility, consumer, and community level.¹⁶ Effective adoption and enforcement of the latest IECC edition within the region that oil, natural gas, and electric infrastructure serves can contribute to reducing the need for additional generation, slow overburdening of transmission resources, and reduce energy demand during periods when the energy infrastructure is particularly stressed (e.g., extreme heat or extreme cold events).¹⁷ The IECC may also be utilized as the basis of utility incentive programs that help utilities and regulators achieve energy efficiency goals (thus contributing to resilience), increase reliability, and reduce utility costs.

The development of the IECC is supported by DOE's Building Technologies Office's Building Energy Code Program (BCEP). The BCEP supports both the development and implementation of building energy codes, by providing technical assistance for code development, adoption, and compliance.

¹³ Energy Information Agency, *Frequently Asked Questions. How much energy is consumed in US residential and commercial buildings?* (May 2019), <https://www.eia.gov/tools/faqs/faq.php?id=86&t=1>.

¹⁴ DOE Building Energy Codes Program Impact Analysis, <http://www.energycodes.gov/about/results>.

¹⁵ DOE IECC Determinations, <https://www.energycodes.gov/development/determinations>.

¹⁶ Ribeiro, D., et. al, *Enhancing Community Resilience through Energy Efficiency*, American Council for an Energy Efficient Economy (Oct. 2015).

¹⁷ Wisely, J. and C. Hall, *How Consumers Energy Customers Helped Avert a Michigan Gas Crisis*, Detroit Free Press (Jan. 31, 2019), <https://www.freep.com/story/news/local/michigan/2019/01/31/consumers-lower-heat-emergency-alert/2732252002/>.

E. Current, Well-Enforced, Codes Drive Resilience

Structures and the codes that apply to them have clear implications for resilience in the built environment. Recency matters, too. Codes include meaningful mitigation improvements with each new edition which are based on building science research, post-disaster after action reports, and improved best practices. For example, the 2018 IBC includes updated seismic maps, new wind structural design requirements for special wind regions, and Tsunami resistant design loads for essential facilities. Much of IFC Chapter 12, including the energy storage provisions, constitutes new requirements as of the 2018 edition. And, as discussed above, the 2018 IECC is 30% more efficient than the 2006 IECC. The importance of up to date codes is recognized in the NIBS report, within FEMA requirements, and by the private sector through BCEGS and the resulting insurance premium discounts.

Code enforcement is equally important and essential to ensuring the continuity of the I-Codes. FEMA quantified the cost of Dade County's inadequate code enforcement as a quarter of the \$16 billion in insured losses from Hurricane Andrew.¹⁸ Researchers found similar results about 15 years later: that implementing building codes at the local level by ensuring codes are properly administered and enforced provides an additional loss reduction value on the order of 15 to 25 percent.¹⁹ Energy code compliance has also been previously considered, with projected national savings from bringing a year's worth of new residential and commercial construction in the U.S. up to full compliance estimated at 2.8-8.5 trillion Btu annually, or \$63-\$189 million in annual energy cost savings. This equates to lifetime savings of up to \$37 billion for just five years of construction.²⁰ ICC provides vital education and training on the I-Codes to code officials, practitioners, and others interested in enforcement, including offering personnel certifications.

F. The I-Codes as a Tool to Mitigate Risk to Energy Infrastructure

The building codes governing our national energy infrastructure are largely set by states and localities, which determine whether and what codes apply, the recency of those codes, as well as the extent and effectiveness of building code enforcement. Adoption and application, correspondingly, varies state by state and jurisdiction by jurisdiction. This means, absent minimum standards, the safety and resilience requirements for energy infrastructure varies considerably. Twenty-eight states do not require an IBC edition with the latest hazard resistant provisions (defined by FEMA as the 2015 or 2018 IBC with either unamended or strengthened hazard mitigation measures). Although used in some communities in 15 states, provisions of the IWUIC are only adopted across all communities facing wildfire risk in 5 states. So far, only 2 states require the 2018 IFC, which includes provisions specific to energy storage. Twelve states require energy codes that are at least 25% less efficient than modern codes and another 7 states do not require energy codes statewide. ISO/Verisk, which scores states and communities through BCEGS, has reported that nearly half of states do not mandate code enforcement statewide.²¹

Given the importance of ensuring adequate protections for energy infrastructure and the current state of code adoption and enforcement nationally, ICC believes that at minimum DOE should consider the

¹⁸ Burby, R., *Hurricane Katrina and the paradoxes of government disaster policy: Bringing about wise governmental decisions for hazardous areas* (2006) citing FEMA Building Performance Assessment Team, *Preliminary Report in Response to Hurricane Andrew, Dade County, Florida* (1992).

¹⁹ Czajkowski, J. et. al., *Demonstrating the Intensive Benefit to the Local Implementation of a Statewide Building Code* (2017).

²⁰ Stellberg, S., *Assessment of Energy Efficiency Achievable from Improved Compliance with U.S. Building Energy Codes: 2013 – 2030*, Institute of Market Transformation (Feb. 2013).

²¹ ISO, 2019 National Building Code Assessment Report.

application within its programs of uniform minimum requirements that ensure up to date building codes (including the IBC, IPC, IWUIC, and IFC) for energy infrastructure. Doing so tracks the National Mitigation Investment Strategy’s statement that “[u]p-to-date building codes and standard criteria should be required in federal and state grants and programs.”²² DOE should also consider further incentivizing state and local adoption of the latest IECC as a means to curb demand on energy infrastructure during extreme weather events. Finally, DOE could consider leveraging components of the IBC, IPC, IWUIC, and IFC for additional structure types beyond those covered by the codes.

III. Coordination of Energy Infrastructure Standards with Community Resilience Benchmarking

ICC’s Alliance for National & Community Resilience (ANCR) aims to provide the information that communities need to understand to benchmark their current level of resiliency, to identify and understand options available to fill gaps and increase resiliency, and to understand the future benefits to be gained by investing in advance of the next hazard event. Through the development of Community Resilience Benchmarks (CRBs) for 19 key community functions, ANCR will provide communities with a coordinated, comprehensive tool to help facilitate decision making. Businesses and people can also utilize the tool to decide where to invest and where to live.

ANCR has completed Benchmarks for Buildings and over the next year will complete Benchmarks for Housing, Water Infrastructure, and Energy Infrastructure. As DOE collects relevant standards for energy infrastructure ANCR will look to this information to assure that its Energy Infrastructure Benchmark represents current practice and avoids undue duplication.

A fundamental basis for ANCR’s work is the recognition of the interconnectedness of community functions and the importance of a coordinated approach to resilience. As the energy sector examines the existing codes and standards landscape, we recommend that resilience be considered broadly, incorporating areas of overlap with other related important community functions including transportation, buildings, water and communications infrastructure. Without examination of codes and standards at the interface of systems, each individual system may develop criteria that may optimize their system but lead to sub-optimization across the community.

Thank you for the opportunity to provide comments. If you have any questions concerning ICC’s recommendations, please do not hesitate to contact me.

Sincerely,

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²² Mitigation Framework Leadership Group, *National Mitigation Investment Strategy* (Aug. 2019).