

## Editor's Letter

Welcome to the first issue of the *Journal of Critical Infrastructure Policy* (JCIP). The publication's launch coincides with the COVID-19 pandemic, an event that illustrates the fundamental need to ensure the resilience of critical infrastructure systems and the communities that they serve.

Each article in this issue has a direct or indirect bearing on the pandemic, grappling with its consequences, understanding supply chain dynamics and building infrastructure resilience to future disasters. While resilience may be conceived in different ways, the National Academies' definition—"the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events"—resonates deeply during this period of international challenge.<sup>1</sup>

Critical infrastructure (CI) refers to the national sectors identified by US Presidential Policy Directive and cross-sector CI functions defined by the US Department of Homeland Security.<sup>2,3</sup> Each sector is considered so vital that its incapacitation would have a debilitating effect on the country's security, economic viability, public health and safety or other devastating outcomes. They include: Healthcare and Public Health, Energy and Power, Information and Cyber-Technology, Transportation Systems, Communications, Financial Services, Critical Manufacturing, Emergency Services, Food and Agriculture, Water and Wastewater Systems, Nuclear Reactors, Chemical Facilities, Dams, Government Facilities, the Defense Industrial Base and Commercial Facilities.

CI is comprised of systems and systems of systems that are highly complex, interconnected and sometimes unplanned—and they are evolving at exponential rates. Impairment in one sector can cascade into multiple sector shutdowns leading to serious societal consequences. Each sector encompasses an array of physical assets, organizations and people as well as important cyberspace components. These factors can present unforeseen built-in vulnerabilities, and accidents are likely to be experienced as systems become more complex, opaque and interactive.

The premises underlying America's national security have also profoundly changed since September 11, 2001. Substantial advances to protect the Nation have been made by the Department of Homeland Security and the US Intelligence Community. Among existing and emergent threats, however, none are more challenging than changes in the security environment for CI. Many threats are attrib-

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1 Disaster Resilience: A National Imperative (Washington DC: The National Academies of Sciences, Engineering and Medicine, 2012)

2 Presidential Policy Directive 21: Critical Infrastructure Protection and Resilience (Washington DC: The White House, Feb 12, 2013)

3 National Critical Functions (Washington DC: US Department of Homeland Security, Cybersecurity and Infrastructure Security Agency, April 30, 2019)

utable to the widespread proliferation of disruptive technologies. CI is vulnerable to physical attack by adversaries, including the asymmetric warfare planning of many nations and sophisticated terrorist and criminal organizations.

Natural disasters including but not limited to severe weather events, seismic activity, fires and coastal flooding, can trigger cascading infrastructure failure. Global disease outbreaks can impact the CI system workforce and tax the ability of interconnected sectors to operate at nominal levels. There is growing recognition that space weather, particularly a solar coronal mass ejection hitting Earth, poses a serious threat to the electronic components of CI systems.

From a policy research perspective, CI policy has been relatively “under studied.” Depending on how it is defined, US critical infrastructure policy incorporates almost 25 years of federal, state and local policy-making, tracing back to the 106<sup>th</sup> Congress. It is bracketed by a Clinton Executive Order establishing a President’s Commission on Critical Infrastructure Protection and a Trump Executive Order on Coordinating National Resilience to Electromagnetic Pulses.<sup>4,5</sup> This concentrated period of policy-development is predated by years of disaster-related and national security policy that pertained, in part, to critical infrastructure.

Despite its relatively recent vintage, the critical infrastructure policy arena is exceedingly complex. CI policy needs to be predicated on systems-level technical judgements regarding risk, vulnerabilities, response options and strategies. Many CI assets are controlled by private entities, with a range of ownership and operating models. The ability to formulate cohesive policy is influenced by local and state responsibilities and jurisdictional prerogatives, technological change, the legal and regulatory provisions for individual sectors, market forces and mechanisms, a diverse stakeholder mix at each governmental level and the manner in which critical infrastructure resiliency interacts with other homeland security and disaster recovery priorities at the local and state levels.

This high degree of complexity has become the defining trait of the systems that undergird contemporary societies across much of the world. Building critical resilience is therefore an international imperative. Ideally, the best position for a nation to be in would be to have secure and resilient infrastructure as well as a population that is prepared to endure in the event of large-scale infrastructure collapse; what some refer to as a “culture of resilience.”

The *Journal of Critical Infrastructure Policy* was conceived as a new cross-disciplinary forum to engage these issues, providing common ground for researchers, policy-makers, public officials, a range of professional groups and others. As we begin publication in the year that the coronavirus emerged, we are

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4 Presidential Executive Order on Critical Infrastructure Protection (Washington DC: The White House, July 17, 1996)

5 Presidential Executive Order on Coordinating National Resilience to Electromagnetic Pulses (Washington DC: The White House, March 26, 2019)

hopeful that this worldwide challenge will stimulate incisive, scientifically grounded thinking—and broad consensus—to dramatically improve community and critical infrastructure resilience.

### *Current Issue*

Each Journal issue will include an Editor's Interview with a national thought leader in a critical infrastructure domain. The interview in these pages is with *Stephen Flynn*, Founding Director of Northeastern University's Global Resilience Institute (GRI). It addresses the infrastructure implications of the COVID-19 pandemic. On a variety of fronts, GRI has emerged as an influential center of CI research, including its stewardship of a worldwide consortium of research institutions dedicated to CI scholarship.

*Tara Kirk Sell, Onora Lien and Eric Toner*, from the Johns Hopkins Center for Health Security are in the organizational epicenter of the COVID-19 response. In "A Framework for Healthcare Resilience during Widespread Electrical Power Loss", they examine one of the most challenging contingencies that healthcare facilities can face. As the authors detail, hospitals require uninterrupted power supply. Key recommendations in the article have a direct bearing on national pandemic policy, including marshaling the national system of Healthcare Coalitions (HCCs) during and in the aftermath of long-term, regional power loss. Their call for a network of disaster resource hospitals, a new federal office devoted to catastrophic health events and specific pilot projects have broad relevance.

In "Energy Supply Chains and Change", *Diane Graziano, Elisa Alonso, Fletcher Fields and Diana Bauer*, from Oak Ridge National Laboratory, Argonne National Laboratory and the US Department of Energy, present a nuanced examination of the energy resource and technology supply chain. Their policy-relevant model illustrates the complex forces that drive energy technology markets and component production. Importantly, the framework permits systematic thinking about the interactions of various supply chain characteristics across multiple time horizons. Large gas turbines, the study's focal point, are used for utility-scale power generation, with over 23 percent of world electricity production dependent on this technology.

*Philip Palin's* article on "Food and Other Supply Flows in the Case of Catastrophe" is directly pertinent to the COVID-19 pandemic. The case study assesses the modern grocery supply chain for the Puget Sound region. It contains information for planners and decision makers on analyzing the flow of food into and within their jurisdictions. The article should enhance the ability of government officials to grapple with food supply problems under pandemic conditions. In a subsequent JCIP issue, Mr. Palin will examine grocery supply chain issues in relation to a "Black Sky" event in the same region.

In “Improving Healthcare Supply Chain Resilience during Extreme Weather Events”, *Richard Little and William Wallace* integrate findings of research conducted at Rensselaer Polytechnic Institute regarding the physical impacts of extreme storms on civil infrastructure systems, the impact of these events on healthcare delivery and healthcare supply chain challenges. Their focus is on the provider-consumer interface - the “last mile” in the delivery of healthcare goods and services. Based on increased climate uncertainty related to sea level rise, they suggest that risk based scenario planning may be more desirable than design-based thinking.

The Journal has established a relationship with the ‘Resilience Week Symposium’, the preeminent research conference on transforming the resilience of critical infrastructure systems and communities. With the participation of the country’s national laboratories, the annual conference sponsors an annual student research competition. JCIP will invite an expanded paper from winners of the conference’s best presentation award. “Opportunities and Challenges for Resilient Hospital Incident Management: Case Study of a Hospital’s Response to Hurricane Harvey”, by *Changwon Son, Ethan Larsen, Farzan Sasangohar and S. Camille Peres* becomes the first best presentation award publication in the Journal.

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Editor