

# Desperately Seeking Infrastructure

By Barbara E. Champoux, CREW Network Industry Research Committee

Urban societies depend heavily on the proper functioning of complex infrastructure systems. The convergence of several trends and conditions now pose unprecedented risks for those systems worldwide, including:

- urbanization, which is creating a larger human-built environment, where more significant damage can occur
- the growing importance of electricity in supporting modern economic systems
- the increasing frequency and relative ferocity of natural—and human-made—disasters on a global scale
- the dearth of new infrastructure projects, compounded by aging legacy assets

The consequences of this convergence demonstrate that infrastructure systems around the world, in both developed and developing countries, are highly vulnerable.

## Critical to Communities

There are three classes of infrastructure: transportation (e.g. roads, bridges, mass transit); energy and utilities (e.g. electric power, potable water, communication networks); and social (e.g. healthcare, education, certain housing and other civic uses). Communities rely on transportation and energy/utility infrastructure systems for carrying out essential social and economic functions, and social infrastructure enables those communities to thrive.

Once limited to the developed world, urbanization has become a dominant worldwide force. Many of the world's largest urban areas have become megacities, typically with a population of over ten million people. Contemporaneously, the world is electrifying at a rapid rate. The installed base of global power generation has grown almost 800% over the past 40 years, further exposing the inadequacies of existing foundational infrastructure.<sup>1</sup>

How crowded is your rush-hour subway or highway? How often is your flight delayed? Does your city experience frequent water main repairs? These minor annoyances hardly compare with the increasingly devastating effect the infrastructure dearth is having around the world. Ramifications range from stunting economic growth to undermining global competitiveness, significant job loss and lack of productivity, and injury and death.

There are site-specific reasons for infrastructure's deplorable state, but the commonality of these across nations include regulatory impediments, economic distress, suboptimal maintenance, bureaucratic red tape, and politics.

## Disaster Strikes

Disasters, both natural (e.g. hurricanes, floods, earthquakes), and unnatural (e.g. terrorist attacks), are an increasingly common experience, severely impacting already compromised infrastructure systems that billions of people rely on.

Infrastructure is inexorably intertwined with the economic and social well-being of a community. This reliance becomes painfully evident when critical infrastructure systems fail during disasters. Because of the network properties of infrastructure and increasing urban density, damage in one location often disrupts service in an extensive geographic area, significantly damaging complex, interdependent social, environmental, and economic systems, and leading to greater losses.

Global infrastructure desperately needs repair, replacement, expansion and resiliency. There is a global infrastructure investment gap of over \$1 trillion annually, and is forecasted to be over \$15 trillion by 2040.<sup>2</sup>

## Mitigation & Resiliency<sup>3</sup>

An analysis of disaster events commonly reveals the:

- inadequacy of critical infrastructure, sufficiently resilient to withstand the forces of calamities
- lack of mitigation strategies when they occur on the part of emergency-related organizations, industries, and communities
- many overlapping and competing governmental agencies and private companies involved in infrastructure recovery

Robin Franks, President & CEO, TGE Resources, Inc., and a CREW Houston member, knows firsthand the costly and tragic ramifications of natural disasters on deteriorating infrastructure. As disaster first responders, Franks and her team are among the first to enter impacted infrastructure facilities. TGE engaged with a major medical center that experienced massive flooding during a natural disaster, which resulted in a complete loss of power and fresh water supply, forcing the center to shut down. TGE played a pivotal role in rendering the center quickly operational again.

Although natural disasters are unpreventable, steps can be taken to minimize their impact on critical infrastructure. In addition to advance planning, preparedness and structural measures, consider these non-structural measures:

- strategically use regulatory tools (zoning and land use, subdivision and setbacks, building codes, mandatory LEED and sustainable design standards, safe construction practices)
- affordable insurance coverage
- collaboration across public and private sectors, and among governmental agencies
- explore available mitigation grants

Effective crisis management is needed now to avoid more shutdowns of critical services and avert a global infrastructure catastrophe. Our collective economies, security, and cultures all depend on it.

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(1) The Solutions Journal, September 2014, "Resilient and Sustainable Infrastructure for Urban Energy Systems"

(2) World Economic Forum Industry Agenda on Strategic Infrastructure, "Strategic Infrastructure -Steps to Operate and Maintain Infrastructure Efficiently and Effectively", April 2014; "Global Infrastructure Outlook", Oxford Economics and Global Infrastructure Hub (a G20 Initiative), July 2017.

(3) Resiliency refers to a system's ability to anticipate, maintain and quickly regain operational capacity, at low cost.