



The infrastructure transition

In an era of rising customer demands, the infrastructure industry needs to support new solutions, reshape capital markets, and take a long-term term approach to asset development.



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Few would argue against the virtues of renewable, resource-efficient, sustainable infrastructure and the central role it will play in future-proofing our society. The empirical data is unequivocal, be it the fact that more than half of energy-generation capacity added in the past four years has been renewable;¹ that it's often cheaper, safer, and more efficient to treat and then recycle industrial wastewater on-site instead of hauling it to the local municipal treatment facility;² or that it can be cheaper, fresher, and less polluting to grow lettuces in local greenhouses rather than shipping them from California to your favorite supermarket in Maine.³

Still, some industry leaders question the inevitability of an infrastructure transition—that is, toward more decentralized, more resilient, more efficient, less-polluting, and more privately financed and privately governed infrastructure. It's often easier to stick with the status quo than to accept and integrate new approaches, and the whole domain of building, owning, operating, and supporting infrastructure was set up to serve a different world—big, dirty, monolithic, and government-controlled—rather than the world that economics and innovation demand.

The current era of infrastructure doesn't look like nature-defying hydroelectric plants or pollution-belching coal-fired power plants. Instead, it looks like your neighbor's five-kilowatt solar system, the 44-kilowatt-hour battery in your electric car, the smart thermostat in your home and office, and the wind turbine you pass on your way to work, all intelligently intertwined on a dynamic electricity grid.

These solutions are neither new nor unproven, and faster, cheaper, better infrastructure is here—but it's not yet ubiquitous. Why? Because inertia is powerful and entrenched interests are deep. Because some still need convincing that infrastructure users have

far more choices than ever before. We need to engage with leaders on the economics of the infrastructure transition and continue to support industry in the development of new solutions. We need to reshape capital markets to support innovative, smaller-scale projects in anticipation of a future in which projects are likely to be more digital, decentralized, and privately funded. And we must balance the unabated momentum across industry, the capital markets, and government toward increasingly shorter-term incentives, favoring instead a long-term approach that supports fact-based, incentive-aligned approaches to building and managing long-lived assets.

Infrastructure must become increasingly customer focused and flexible

One of the first lessons MBA students learn is that the customer is always right. They also learn that providers of products or services win customers by delivering unique value.

But most infrastructure providers still don't think of their users as customers, referring to them instead as taxpayers, toll payers, or ratepayers. This definition ignores the fact that more and more infrastructure customers have choices in the infrastructure they use, from energy to transportation to food systems to waste management. This is particularly true of the biggest users of energy—large companies and wealthy individuals—whose high spending gives them the greatest incentive to reduce energy costs. These are the organizations and individuals installing solar panels on their roofs and batteries in their basements. Utilities are forced to respond, as their monopoly on centralized infrastructure is undermined, by revising their offering and approach to customers.

Progress on sustainable energy is not limited to the wealthy or to developed nations. In developing countries, people are turning to modular

infrastructure, such as solar power and mobile broadband, rather than centralized, fixed utilities and landlines. If legacy infrastructure providers don't start offering modular options, entire markets could very likely develop without them.

The smartest players are adapting now, before they have to. The leaders of the infrastructure transition see their customers as people—or companies managed by people—who want infrastructure services that are reliable, modular, and economically efficient. The solutions that offer customers the most compelling economic value proposition and consistent availability will therefore win, new or old.

Renewable, sustainable infrastructure has undeniable virtues

In the past, the rules of economics forced us to build large-scale, centralized projects to deliver the cheapest, most reliable power to the greatest number of people. Today, economies of scale often result from standardized manufacturing rather than from single-asset size, thanks to the tremendous growth of manufacturing in related end markets such as consumer electronics, personal computing, and mobility. Last year, for example, the United States installed 10.6 gigawatts of solar power,⁴ the capacity of five Hoover Dams,⁵ built in just one-fifth of the time.

Industry still has work to do in developing solutions that are resilient, modular, decentralized, and privately funded. Beyond simple awareness of the alternatives, operators are looking for proof of concept—and these examples abound. Recent projects in California alone include the installation of solar panels on thousands of schools⁶ and a burgeoning fleet of electric buses at the University of California.⁷ Both efforts have resulted in lower maintenance and service costs for operators and customers alike. As examples continue to

proliferate, industry players that bury their heads in the sand will fall behind.

Capital markets must be reshaped to support innovative, smaller-scale projects

Even if we can't predict the future, one conclusion is clear: more change is imminent, and we must adapt to that change with more flexibility. Big, monolithic, centralized infrastructure represents the precise opposite of what is required. Designing, planning, permitting, funding, constructing, and commissioning a new large-scale infrastructure project takes at least five years, if not ten. It is therefore extremely difficult for conventional projects to take advantage of emerging technologies and capabilities. Many conventional projects in development today will be obsolete before an opening-ceremony ribbon is even cut.

We need entrepreneurs and innovators to develop projects that create compelling economic benefits for their users—but to do so, we need to reshape capital markets so that these projects can attract the necessary financing. Two primary parties are crucial here: financiers and regulators. Banks need to underwrite a more diverse, albeit aggregated, set of customer credits, much as we've seen done in real estate. And regulators need to facilitate a faster time to market so new solutions can benefit users more quickly. Setting such policies will require careful consideration of the current obstacles—such as environmental regulations that delay development—and a thoughtful approach to ensure that relaxed regulations accelerate the development of sustainable projects rather than the traditional, large-scale, dirtier projects that prompted the environmental regulations in the first place.

Create incentives that reward long-term thinking

Finally, we must confront the unabated momentum across industry, capital markets, and government toward short-term incentives. Some politicians

may favor large, centralized infrastructure projects because they serve as tangible, highly visible signs of progress or achievement in an election year. In the private sector, quarterly or even annual earnings obscure the key performance indicators of long-term assets, which accumulate value and revenue over the course of decades.

Government leaders need to step back and focus on strategic, multidecade planning. Citizens and the media must demand more accountability for the long-term decisions these leaders are elected to make. And investors need to be able to put money at risk today to reap returns over many years, not just mark-to-market every day. If you value a bridge that's under construction, it's not worth very much; you're testing its value before it even connects in the middle.

Incentives need to build trust—with capital markets, regulators, industry players, and, ultimately, the consumers and businesses that use the infrastructure systems. Those who are setting incentives and those who are accepting them have a role to play, and we can be more thoughtful and holistic than conventions currently suggest.



Like most industries, infrastructure will increasingly focus on the customer. Technology costs are down, and the efficiency and resilience of sustainable solutions are proven. The minimum efficient scale to power a home, office building, or factory is dramatically smaller than in the past.

A new era of infrastructure is upon us, and customers are increasingly demanding cheaper resources, more reliable systems, less pollution, improved health outcomes, more choice among vendors and approaches, and freedom from a monolithic regime. To meet those demands, we

need different go-to-market strategies, different partnerships, different economic models, and different time horizons—in short, an infrastructure transition.

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¹ Ray Chen, "Natural gas and renewables make up most of 2018 electric capacity additions," U.S. Energy Information Administration, May 7, 2018, eia.gov.

² "Water reuse and recycling: Community and environmental benefits," US Environmental Protection Agency, Water Division Region 9, last updated April 20, 2018, epa.gov.

³ "Local food: 5 benefits of farm-to-table eating," *San Diego Union-Tribune*, April 21, 2015, sandiegouniontribune.com.

⁴ "U.S. solar installations down in 2017," Institute for Energy Research, March 21, 2018, instituteforenergyresearch.org.

⁵ "Hoover Dam: Frequently asked questions and answers," US Department of the Interior Bureau of Reclamation, last updated March 18, 2015, usbr.gov.

⁶ Jake Richardson, "More than 5,000 US schools have solar-power installations," *CleanTechnica*, June 15, 2018, cleantechnica.com.

⁷ Cody Kitaura, "Electric bus service will connect UC Davis with Sacramento," University of California, Davis, June 19, 2018, ucdavis.edu.

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