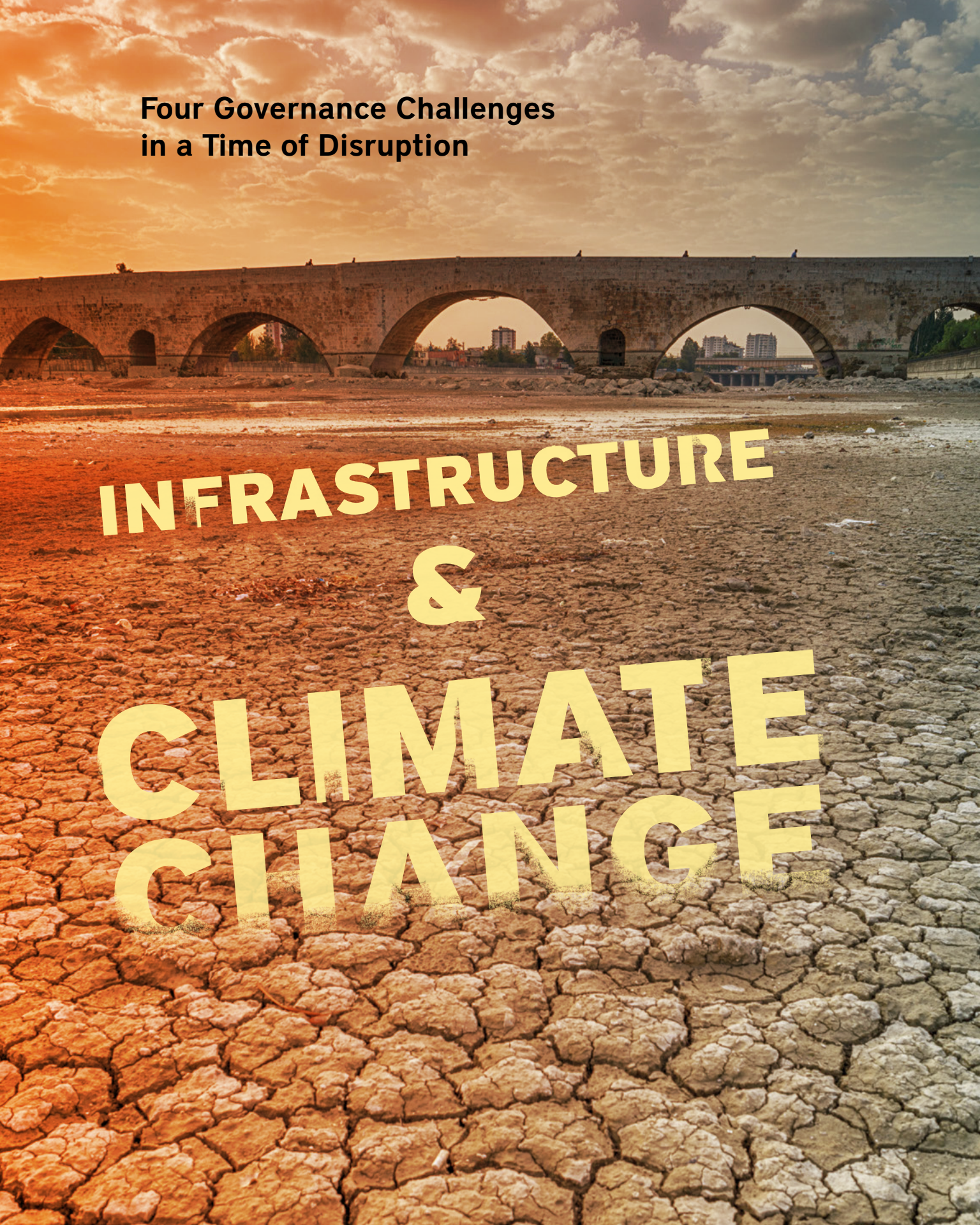
Four Governance Challenges
in a Time of Disruption



INFRASTRUCTURE & CLIMATE CHANGE

The following is an excerpt from a chapter in the forthcoming Lincoln Institute book *Infrastructure Economics and Policy: International Perspectives*, which includes contributions from leading international academics and practitioners addressing the latest approaches to infrastructure policy, implementation, and finance. Edited by José Gómez-Ibáñez of Harvard University and Zhi Liu of the Peking University–Lincoln Institute Center for Urban Development and Land Policy, the book is available for preorder at **www.lincolninst.edu/publications/books/infrastructure-economics-policy.**

By Henry Lee

AS THE WORLD FOCUSES on the COVID-19 pandemic, the disruptive reality of global climate change looms on the horizon. Its implications for public infrastructure could be immense. Forest fires in Australia, Siberia, and California, record cold in Texas, droughts in southern India and South Africa, intense hurricanes and floods in the United States and the Philippines, and the melting of the Arctic ice sheet are all harbingers of what a changing climate has in store.

As pointed out by Martin Weitzman and Gernot Wagner in their book *Climate Shock*, "Climate change is unlike . . . any other public policy problem. It's almost uniquely *global*, uniquely *long-term*, uniquely *irreversible*, and uniquely *uncertain*—certainly unique in the combination of all four" (2015).

The impact of climate change on infrastructure services will be integral to the world's economy. How we power our factories, buildings, and homes; allocate and treat our water; and transport people and goods may look very different 30 years from now. Uncertainty surrounds both the impacts of and responses to climate change, but the direction is clear. The effects will be more disruptive in 2050 than today. More floods, droughts, fires, and heat waves will occur. While countries may struggle to transition their economies, escalating climate impacts may force them to accelerate their efforts.

The biggest challenges to meeting national and local climate goals through infrastructure investments will not be in the realms of engineering or technology, but rather in the areas of governance and public policy. Key institutional issues include the broad governance issues that prevent governments at all levels from working together effectively; infrastructure siting; stranded economic and social assets; and the need for greater public investment in preventing damages as opposed to investing only in relief and recovery.

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Seyhan River, Turkey. Credit: tunart via Getty Images.

Structural Inefficiency

Governments consist of multiple agencies, each with a defined portfolio of responsibilities. The water resources department provides water to consumers. Another department might provide sewerage services, while still another addresses water pollution. In many jurisdictions, irrigation is within the purview of the agriculture department, while the public health agency sets quality standards for drinking water. In many countries there are agencies that develop plans for coastal areas, while another agency has a similar responsibility for rivers and lakes. If the country requires desalination technologies to meet the demand for potable water, it must work with the agencies responsible for electricity, since such facilities consume substantial amounts of power. When these agencies want to make investments in new infrastructure, they must seek permits from a variety of other agencies. Finally, yet another group provides support services such as budget oversight, procurement, and human resources. This description is simply the governance structure for water infrastructure. The same complex map of complementary responsibilities exists for transport or energy.

In most cases, these water departments were established at different times to meet different public policy problems. Establishing a new department, as opposed to expanding an existing one, allowed public officials to demonstrate responsiveness to the public concern of the moment. In some countries, the existence of multiple agencies gives elected officials the ability to make more appointments, which is a key currency for elected officials. The result, however, is a balkanized system that does not effectively manage problems that cross departmental responsibilities. Interagency coordination and cooperation will be growing concerns for presidents, prime ministers, governors, and mayors as they address the underlying interconnections inherent in climate policy.

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The governance structure for issues related to water, energy, and transportation is typically complex and can be inefficient. Credit: Paul Sableman via Flickr CC BY 2.0.

Horizontal coordination challenges are replicated at the vertical level. What responsibilities should lie with national or central governments, and which should be given to mayors? Highways, transmission lines, pipelines, and possibly water lines are important to realizing national goals and priorities; however, their construction and management often require substantial cooperation between national and subnational governments. Permitting electric generating facilities is essential to meeting national targets for adequate power, yet this responsibility is usually allocated to subregional governments.

Climate change does not recognize jurisdictional boundaries. Most countries contain states or provinces, each with its own government, its own bureaucracies, and, in many cases, its own priorities. Many of these states or provinces contain metropolitan areas, each consisting of a large city surrounded by smaller cities and towns whose economies are closely linked, but whose governments are independent of each other. The challenge of managing climate change becomes very difficult when these jurisdictions do not share common goals and when their ability to cooperate is derailed by financial and political rivalries. The ability to develop new

and innovative intergovernmental structures will determine whether subregional governments can ensure the continuing operation of infrastructure services in a climate-constrained world.

Climate is the ultimate interagency issue, and it will impact a vast majority of the existing governance structures. To meet this challenge, governments will have to organize themselves so that responsibilities for responding to the threat and damages from climate disruptions are better assigned. Which climate-related activities are best handled by local governments, and which should be tackled by higher levels of governance? To what extent should the national government be able to overrule subnational governments when an infrastructure decision or climate investment falls within the jurisdiction of the subnational government but is deemed to be of national importance?

How can governments design and implement greater interagency coordination, both horizontally among agencies at the same level of government and vertically across those at different levels? To meet this need, some governments have established major decision-making bodies at their highest levels. For example, China has a State Council, and the United States has expanded the roles of the Domestic Policy Council and the National Security Council. However, only issues of highest priority reach these bodies. Climate change will require thousands of decisions made by thousands of officials at all levels.

Finally, subnational governments have access to only certain revenues, while national governments almost always have access to a larger portfolio of revenue sources. Climate change will dramatically increase the fiscal burden on local, state, and provincial governments. It may do so in scenarios in which local fiscal revenues are decreasing, as investors move their money to regions less vulnerable to climate disruption.

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The construction and management of major infrastructure projects like highways, such as this interchange in Albuquerque, New Mexico, requires cooperation between federal and state governments. Credit: Mlenny via iStock/ Getty Images Plus.

As discussed earlier, subnational jurisdictions will face substantial infrastructure costs. They will look to national governments for financial assistance, but what will be the political and structural cost demanded in exchange for those funds? For example, if the federal government provides substantial assistance, should it take on greater responsibility for the provision of local services? Will local governments voluntarily allow national governments to micromanage services that heretofore were their exclusive responsibility? Or will national governments provide substantial incremental assistance with no strings attached? Will national governments be willing to experiment with creative pilots that encourage effective coordination at the subregional level? How the institutions of governance are structured and operate will have a major impact on the provision of more resilient infrastructure services.

Infrastructure Siting

In the first half of the 20th century, western countries embarked on ambitious infrastructure programs. Intercity highways were constructed. Impressive boulevards and parkways were built as dilapidated neighborhoods were demolished to be replaced by modern downtown areas. Many countries initiated efforts to develop power-generation complexes and transmission grids to move electricity. Airports and seaports were built, and global trade was expanded. While these achievements were impressive, they often happened without much consultation with the people affected by these investments. Environmental considerations were ignored. Too often, the infrastructure seemed to be built because it could be built. Bigger and more modern projects crowded out smaller and more appropriately scaled facilities. Alternative options were not considered.

The backlash that ensued resulted in the establishment of rigorous siting procedures to ensure that critical externalities and social concerns would no longer be ignored. Stakeholders with a wide spectrum of interests were given multiple opportunities to raise their concerns. Often developers not only had to demonstrate a regional need for a project, but also had to show that it met the specific needs of each jurisdiction affected by the proposed project. A power line moving electricity from point A to point B that crossed region C had to demonstrate a benefit to the populations of all three jurisdictions.

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In many instances, this process became very expensive and time-consuming. Developers (and their lenders) became reluctant to invest the time and money needed to guide a project through the labyrinthine permitting process, obtain support from multiple stakeholders, and survive legal challenges. While siting may be more difficult in democracies, even authoritarian governments such as China have encountered strong public opposition to certain infrastructure projects, forcing them to forgo or amend those investments.

It would be hard to argue against stakeholder involvement or the merits of greater sensitivity to the environmental and social consequences of large infrastructure projects. No one is suggesting that governments return to the first half of the 20th century, when officials imposed large public works projects on an uninformed, and sometimes skeptical, public. However, the infrastructure requirements to transition to a decarbonized economy will be huge. In 2019, global electricity generation consisted of 9,824.1 terawatt-hours (TWh) of coal, 825.3 TWh of oil, and 6,297.9 TWh of natural gas (BP Statistical Review of World Energy 2020). In a decarbonized world, a significant proportion of this fossil fuel capacity will be replaced by renewables that have approximately half the capacity of an equally sized fossil fuel facility, which means

The forces behind major infrastructure projects have often overlooked the concerns of those most affected by them, as evidenced by protests against urban renewal in mid-20th-century Boston (left) and against the recently constructed Dakota Access Pipeline (right). Credits (l–r): Boston City Archives via Flickr CC BY 2.0, Victoria Pickering via Flickr CC BY-NC-ND 2.0.

nations will need to build many more generating stations than they have today. Further, renewable systems will require substantially more land and significantly expanded transmission and distribution systems.

In the United States alone, an analysis by Wu (2020) found that achieving net-zero greenhouse gas emissions by 2050 would require about the land area of New Mexico for new onshore wind capacity and about the land area of Vermont for new solar photovoltaic capacity. The probability that these investments can be successful under today's siting regimes is, unfortunately, low. The consequences of not making these investments will be to fail to transition public infrastructure to meet national climate goals and to suffer ever greater climate disruption.

Transitioning water and sewerage infrastructure (to manage ever more droughts and floods) and transportation infrastructure (to meet the realities of climate disruption) may require less investment in the siting process than energy infrastructure. However, over the next 30 years, significant infrastructure siting will be needed across all three of these sectors. Identifying this problem is easier than solving it. Many reform policies and programs have been suggested, but most have failed to improve the siting process. Any meaningful reforms must have several characteristics.

First, reforms will require a renewed trust in the public sector. The magnitude and scope of infrastructure investments required will not happen without significant government involvement. Second, the number of government agencies involved in permitting and siting will need to be compressed, which means that existing siting laws will have to be amended. A comprehensive one-stop siting shop may be too difficult to achieve, but narrowing down the fifteen to twenty involved agencies to four to five could significantly expedite the process for new infrastructure.

The biggest and most important step will be to establish siting institutions across different levels of government while incentivizing officials from the national and subregional governments to conduct joint assessments with a prior agreement that both will abide by the joint decision. For example, in the United States, offshore wind projects require permits from the federal, state, and, in some situations, local governments. Under the present system, opponents can strive to sequence the three siting processes until the developer runs out of money and leaves. Identifying processes to encourage the three levels of government to review siting in a collaborative process could significantly reduce the cost and timeline.

Third, the entire siting process for a project must be concluded in a reasonable time frame. Drawing the process out for years is a luxury that societies could afford in a non-climate-constrained world, but it will not be feasible if

countries desire to effectively respond to the looming climate threat. Stakeholders need to be listened to, and environmental concerns need to be assessed; at some point, however, infrastructure decisions must be made, and appeals to the courts limited. One idea is to establish a compressed review process for only a subset of projects that meet certain criteria, such as zero greenhouse gas emissions. The challenge will be reaching agreement on the appropriate criteria.

Fourth, societies must accept that this process will produce a few bad projects and a few projects in which new facts and problems will emerge after decisions have been made. The present system minimizes the number of such projects. The siting process described above could increase that number, but the trade-off may be necessary for countries to benefit from being better prepared to manage emerging climate disruptions.

Block Island Wind Farm, the first commercial offshore wind farm in the United States, began operating in 2016. Credit: Chris Bentley via Flickr BY-NC-ND 2.0.

Stranded Assets

Investments to decarbonize the energy sector and adapt to climate change will result in human dislocations (for example, climate refugees, workers who lose their jobs, and communities that lose their sources of employment) and economic dislocations (for example, unamortized physical assets). These problems may be less urgent in the cases of transportation and water infrastructure, since the existing assets are unlikely to be replaced by an entirely new system. Energy, however, will be a different case, as countries replace the existing fossil fuel system with one that relies heavily on renewables, storage, and possibly sequestration.

Past efforts to deregulate portions of the vertically integrated electric industry give us a sneak preview of the importance of managing the stranded asset problem. High-cost generating facilities were not competitive in the new deregulated market. The utilities that owned these assets would not accept the proposed deregulation policies unless regulators allowed them the opportunity to recover the cost of their previous investments, approved by past regulatory bodies.

If countries intend to decarbonize their electricity sectors, the magnitude and cost of the stranded assets will be much larger than those in recent history, as will the pressure on regulators to compensate the owners of fossil-fueled generating assets. This problem will be larger in countries such as China and India, where a significant portion of their coal-fired generation was built in the last 20 years and will not be fully amortized until 2040 to 2055.

The labor-force dislocation associated with climate mitigation and infrastructure adaptation may prove to be even more challenging to manage. Millions of men and women are employed in the fossil-fuel-intensive electricity sector, and their prospects for finding work in another industry may be limited because of age or geography. Some countries have no social security net for retired workers, who are instead simply retained on their company's payroll. If the

A worker from the U.K.–based energy company Petrofac on a gas and oil rig in the North Sea. Credit: Lee Ramsden/ Alamy Stock Photo.

plant is closed, their pensions evaporate. There will be understandable political opposition to retiring these facilities without a funded plan to take care of these employees. Simply retraining them to install solar collectors or build transmission lines will not be politically sufficient or practically feasible at a meaningful scale. One creative approach is an effort championed by the Evergreen climate group, inspired by Washington State Governor Jay Inslee and established in 2020, which advocates a GI Bill of sorts to assist fossil fuel workers and communities through pensions, health care, and other training and financial support. While the governance solution to these stranded communities and workers may not be quite so drastic, equity considerations demand that they be addressed in any national climate-infrastructure policy.

Invest in Disaster Relief or Prevention?

Historically, governments have placed significantly more emphasis on responding to disasters than on disaster preparation and resilience. In the United States, the Federal Emergency Management Agency (FEMA) spends billions on disaster relief and recovery while spending negligible amounts on avoiding or minimizing those damages in the first place. Why do governments so rarely prioritize climate disaster prevention?

Some state and local governments, often in partnership with nonprofit organizations, purchase coastal barriers or create artificial wetlands or mangrove swamps; these investments are often driven by the cobenefits (in the form of habitat protection, biodiversity, or parklands) as opposed to climate adaptation. Governments in some earthquake-prone regions have inserted requirements for more resilient building practices into city zoning regulation, but those cities are frequently the ones that have repeatedly experienced severe earthquake damage, making the public more enthusiastic about investments in greater resilience. Research has shown some cases in which the government bought up land to reduce the costs of damages (both human and economic) from a future earthquake; these cases are the exceptions, not the rule.

Governments are concerned that tax revenues be spent on activities for which the benefits can be documented and the public can be assured that their tax dollars have not been misused. If FEMA were to spend millions buying private properties in areas vulnerable to significant flooding, but no floods occurred for

the next 15 years, the agency would be accused of having wasted taxpayer money. But if FEMA were to spend nothing on resilience and a flood were to occur a few years later, FEMA would be judged on its response to the victims of that flood and its willingness to help that community recover. Few would point out after a disaster that the recovery costs would have been far less if FEMA had bought out the most vulnerable of the buildings prior to the disaster. The incentives are clearly skewed toward investing in recovery rather than in preparation or resilience.

To put this dilemma in perspective, southern Australia has experienced forest and bushfires that were especially severe because of years of droughts and unusually hot weather. After the 2009 Black Saturday fires, the government of Victoria implemented a housing buyback program. Its offer received considerable publicity at the time, since here was an example of a government trying to get ahead of a future problem. However, it took a year to get the program passed because of bureaucratic delays, and few homeowners were interested in pursuing the government's offer thereafter (Herscher and Rizzo 2020). In 2019 and 2020, the same areas experienced even more severe bushfires. Interestingly, few criticized the government for its inability to implement the buyback program, and there has been no clamor from the public to develop a new program. Some experts suggest measures such as more stringent building codes, expanded voluntary buyback programs, and enhanced early warning systems; thus far, these policies have not been pursued (Henriques-Gomes 2020; Hill and Martinez-Diaz 2020).

Will this dilemma change? It is unlikely, without a significant push from the public. Admittedly, the financial costs of relief and recovery efforts are skyrocketing as disaster intensity increases. The Wharton Risk Management and Decision Processes team at the University of Pennsylvania found that postdisaster spending in response to 2017 events in the United States was more than $130 billion—a record high (Lingle, Kousky, and Shabman 2018). Perhaps

The Federal Emergency Management Agency opened several disaster recovery centers in Harris County, Texas, after Hurricane Harvey hit in 2017. Credit: michelmond via iStock Editorial/Getty Images Plus.

as this number increases, pressure will increase for greater national governmental investment in climate preparation.

Most future investments in preparation and resilience will be made by property owners who will do their own cost-benefit analyses, realizing that government assistance in the best of circumstances will be inconsistent and difficult to predict. This outcome is not necessarily bad, but it ignores lower-income communities and households, many of which are located in the most vulnerable locations. It might be more effective to direct incremental government adaptation funds to these lower-income neighborhoods than to attempt to convince the major public and private relief organizations to fund large-scale infrastructure adaptation and resilience. Perhaps those agencies responsible for housing and urban development should lead the national government's efforts to promote preparation in concert with their sister institutions at the subnational level.

Conclusions

The climate problem is real, and its impacts will be severe. These impacts will be neither homogeneous nor temporally or spatially predictable. In light of these uncertainties, many governments will hesitate to invest in low-carbon infrastructure without economic and financial assistance at scales that exceed normal political comfort.

What can be done to address these challenges? First, rational pricing for infrastructure services such as electricity and water will become substantially more important in a world dependent on renewable energy, electric vehicles, and water from distant aquifers or capital-intensive desalination facilities. Pricing that reflects the true social cost of these services is essential but by itself will not be enough. In addition, governments at all levels must develop interagency and intergovernmental institutions and processes to address adaptation and mitigation investments. These initiatives should be accompanied by a commitment to transfer funds to where they are needed. Traditional political rigidities must be superseded by a willingness to be creative and to take political risks based more on vision and less on historical stakeholder loyalties. Finally, this new sense of innovation must focus on governance reforms in areas such as siting, stranded assets, interagency coordination, and preventive investments. These reforms will occur only when key stakeholders become more aware of the looming risks of climate change and demand that their elected officials respond to these threats with considerably more urgency than shown to date.

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