

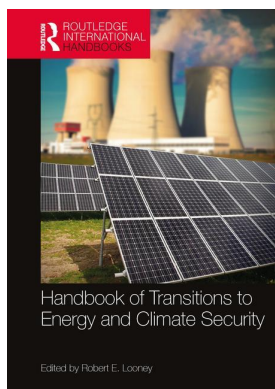
This article was downloaded by: 10.3.97.143

On: 11 Dec 2023

Access details: *subscription number*

Publisher: *Routledge*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: 5 Howick Place, London SW1P 1WG, UK



Handbook of Transitions to Energy and Climate Security

Robert E. Looney

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Publication details

<https://www.routledgehandbooks.com/doi/10.4324/9781315723617-21>

Michael Kugelman

Published online on: 29 Nov 2016

How to cite :- Michael Kugelman. 29 Nov 2016, *Managing energy and climate policy challenges in Pakistan from:* Handbook of Transitions to Energy and Climate Security Routledge

Accessed on: 11 Dec 2023

<https://www.routledgehandbooks.com/doi/10.4324/9781315723617-21>

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Managing energy and climate policy challenges in Pakistan

Modest progress, major problems

Michael Kugelman

Pakistan faces a conundrum. It is mired in an acute energy crisis, and at the same time it is highly vulnerable to the effects of climate change. And yet in its efforts to ease its energy woes, the country risks worsening its climate vulnerability in a big way.

The good news is that Pakistan recognizes the links between energy and climate change. It has taken some small but promising steps, both in its energy and climate change policies, to mitigate the effects of global warming. Ultimately, however, Pakistan faces tremendous obstacles in its efforts to get relief from an all-encompassing energy crisis, and from the increasingly alarming effects of climate change. For policymakers, the challenges are daunting.

The stakes are high. In volatile, nuclear-armed Pakistan, the security implications of failing to properly address these immense energy and climate challenges are immense.

A deep and destabilizing energy crisis¹

Over the course of 2014 and 2015, Pakistan experienced energy deficits of 4,500 to 5,000 megawatts, or MW (they sometimes soared to 8,500 MW – more than 40% of national demand). These figures approximate those of similarly energy-insecure India, which saw shortfalls between 3,000 and 7,500 MW over the same period of time.² Pakistan's urban areas regularly experience several hours of daily outages, while in some rural regions residents are lucky to receive four hours of electricity per day. Consumption levels of Pakistan's two most heavily utilized sources of energy, oil and gas, are so high that Pakistan's national oil and gas company has predicted that indigenous oil reserves will be exhausted by 2025, and domestic natural gas reserves by 2030.

Pakistan's energy problems, however, are arguably rooted more in shortages of governance than of pure supply. The energy sector suffers from widespread inefficiencies, including transmission and distribution losses that exceed 20%, as well as from several billion dollars of debt. The losses are caused by bad equipment, poor maintenance, and energy theft. The debt is a consequence of cash flow problems: energy generators, distributors, and transmitters lack funds. This is due in part to a flawed pricing policy: the Pakistani government charges a pittance for

energy, and yet few customers pay their bills. As a result, revenue is scarce, and the sector literally cannot afford to provide energy.

Pakistan's energy crisis has troubling implications for its fragile economy and volatile security situation. In recent years, power shortages have cost the country up to 4% of gross domestic product (GDP). Hundreds of factories (including more than 500 in the industrial hub city of Faisalabad alone) have been forced to close. According to the World Bank's 2016 Doing Business rankings, businesses in Pakistan have estimated losses from power outages at up to a whopping 34% of annual revenue.³

Meanwhile, the energy crisis has sparked demonstrations that sometimes turn violent. Additionally, militants are happy to exploit Pakistan's energy insecurity. In recent years, separatists in the insurgency-riven province of Baluchistan have targeted dozens of gas lines. In January 2015, insurgents in Baluchistan blew up two key towers near a major power station, tripping the national grid and plunging 80% of the country into darkness. In 2013, the Pakistani Taliban attacked a power station that cut off electricity throughout the city of Peshawar, which has a population nearly as large as Los Angeles.

Wide expanses of Pakistan's population are affected by this energy crisis. Shortages not only prevent people from working, but also from cooking and receiving proper medical care (in some hospitals, services have been curtailed). Not surprisingly, public opinion polls in Pakistan identify electricity shortages as one of the country's top problems.

Severe climate change vulnerability⁴

The low-lying, lower-riparian, flood-prone nation of Bangladesh is often held up as the poster child for climate change vulnerability in South Asia. In fact, Pakistan is right up there with it – and by some measures it actually qualifies as one of the most climate vulnerable nations in the world. Germanwatch's Global Climate Risk Index measures the extent to which nations are impacted by weather-related disasters (mainly using the criteria of death tolls and financial losses). The 2015 index ranks Pakistan as the 10th most impacted country in the world during the 1994–2013 period – though it was number three in 2012 and number six in 2013.⁵ A comprehensive United Nations Development Programme study from 2015 reaches a similar conclusion: Pakistan, it contends, “is assessed to be one of the most vulnerable countries in the world to climate change.” The study continues:

Pakistan's extreme vulnerability ... is understandable owing to its geographic, demographic and diverse climatic conditions. Of particular concern are the CC [climate change] threats to water, energy and food security due to the inherent arid climate coupled with the high degree of reliance on water from glacial snowmelt.⁶

Pakistan's severe climate vulnerability is amplified by the staggering scale and array of natural disasters and extreme weather events that have hit the country in recent years. In the summer of 2015, a searing heat wave killed more than 1,200 people (most of them in the megacity of Karachi) over a one-week period – a death toll that some observers attributed in part to stifling homes suffering through hours-long power outages.⁷ In 2014, severe drought in the bone-dry Thar desert region of Sindh province claimed the lives of dozens of people (many of them children) over a three-month period. A sobering UN assessment found that the drought “devastated” crops and livestock, and displaced hundreds of thousands of people.⁸

These scorching temperatures and drought conditions exacerbate Pakistan's already-severe water insecurity.⁹ According to a 2015 International Monetary Fund report, Pakistan is the

third-most water stressed country in the world, and its per capita annual water availability has plunged perilously close to the 1,000 cubic meter scarcity threshold.¹⁰ In the coming years, Pakistan's water shortages could be further intensified by glacial melt. Pakistani officials have claimed that glacial recession on the country's mountains has increased by nearly 25% in recent years. This is all the more significant given that the Indus River Basin – Pakistan's chief water source – obtains its water stocks from the snows and rains of the western Himalayas. This majestic mountain region has experienced glacial thinning of up to a meter per year.

Pakistan also experiences torrential rains and damaging floods. In 2010, climatologists judged that the catastrophic deluge that convulsed Pakistan that year – submerging a fifth of the country and displacing millions – constituted “the worst natural disaster to date attributable to climate change.” The next year brought record-setting monsoon rains; monsoon amounts were a staggering 1,170% above normal in the country's south. The destructiveness of Pakistan's floods is exacerbated by rampant deforestation. The country suffers from the highest annual rate of deforestation in Asia (it lost a full third of its forest cover between 1990 and 2010), with barely 2% of its total area remaining forested today. One reason for this state of affairs is the illicit logging trade of the Pakistani Taliban. In 2009, when it briefly controlled the northern region of Swat, its timber business eliminated up to 15% of Swat's forest cover.

The uptake is troubling. Experts estimate that roughly a quarter of Pakistan's land area and half of its population of nearly 200 million are vulnerable to climate change-related disasters. Environmental officials have warned that in the southern province of Sindh alone, “millions of people” face “acute environmental threats.” It is easy to understand why. A 2015 study of coastal communities in Sindh found that strong fluctuations in air temperatures, along with dry weather and warm surface sea temperatures, contributed to reductions in mangrove tree growth; decreases in agricultural growth; habitat losses for numerous types of species; and human displacement and migration.¹¹ Meanwhile, Baluchistan – a poor and dry, though resource-rich, province – is also highly vulnerable to climate change. A 2012 assessment concluded that climate change poses multi-dimensional risks to many critical sectors, including water, agriculture, horticulture, forestry, and livestock. “If unmanaged,” the study warns, climate impacts could pose “a severe development hazard.”¹²

Environmentally damaging energy fixes

There is reason to fear that in its zeal to tackle the energy crisis, Pakistan could worsen its climate vulnerability. The national government, led by Prime Minister Nawaz Sharif, has announced its intention to revamp the country's energy mix by making a big push for coal. (Pakistan's energy mix has been dominated by oil and gas in recent years, with coal making a more modest contribution.) Islamabad vows to exploit vast untapped coal reserves in Thar, and to develop coal projects in Baluchistan (the government also hopes to ramp up imports of coal while these indigenous extractive endeavors are underway). The Thar reserves are estimated to hold a total of 175 million tons of coal, and Pakistan hopes to use them to generate 100,000 MW of power.¹³

Proponents of this policy contend that coal boasts three key qualities in Pakistan that other energy sources, including renewables, do not: immediate availability, low cost, and capacity to provide uninterrupted power supply. Top energy officials in Pakistan acknowledge coal's harmful climate impacts, but they contend that economic considerations must trump environmental ones. “We are a poor country,” Sharif's energy adviser said in 2014. “We have to create a portfolio that is affordable.”¹⁴ In effect, Pakistan intends to ease its energy crisis by embracing one of the world's dirtiest fuels.

To be sure, Pakistan's coal policy is fraught with challenges. The country lacks much of the capital and technology necessary for intensive mining, and its roads and railways are poorly equipped to transport extracted coal across the country. Help is on the way, however, thanks to a mammoth Chinese infrastructure investment, announced in 2015, that will bring an estimated \$35 billion worth of energy projects to Pakistan. These include, notably, several coal-fired power plants.

In addition, renewables are given relatively short shrift in the country's National Power Policy of 2013 (one of Pakistan's most recent, and only, comprehensive energy policies). The policy contains only a few mentions of wind and solar projects, most of which are described as aspirational more than operational (there is also a vague reference to subsidizing low-cost renewable energy for consumers). The term "climate change" is not mentioned at all.¹⁵

Furthermore, Pakistan's 2015–16 annual budget allocated very few resources to climate-related issues. In fact, of the 40 federal ministries or divisions awarded funds from Pakistan's Public Sector Development Program, the Ministry of Climate Change received the fourth-lowest allotment – an infinitesimal 0.016%. The ministry's allotment of 40 million rupees, roughly \$380,000, was actually higher than the 25 million rupees awarded to it in the previous two budgets.¹⁶ On the whole, federal climate-related expenditures have totaled about 6 to 8% of all federal expenditures in recent years.¹⁷

Small but encouraging steps for climate change mitigation

All of the above suggests that Pakistan does not accord much if any priority to climate change mitigation, and strengthens the assertion that corrective measures for its energy crisis are doomed to exacerbate climate vulnerability instead of ease it.

This assertion, however, is belied by the reality on the ground. Pakistan has in fact expressed considerable concern about its climate vulnerability and taken concrete measures to address it. As far back as 2002, the country formed a Global Change Impact Study Center to conduct climate change research and to advise policymakers and planners about climate issues. In 2005, the government established a Committee on Climate Change, overseen by the prime minister. In 2010, Pakistan's Planning Commission – a government research and advising body – published a report on climate change impacts in Pakistan. This report inspired the Ministry of National Disaster Management to develop a National Climate Change Policy and Action Plan.

New policies

Three years later, in 2013, Pakistan's Ministry of Climate Change launched a formal National Climate Change Policy (NCCP) (it was drafted in 2012).¹⁸ The policy acknowledges that Pakistan's energy sector is the country's largest source of greenhouse gas emissions, and highlights the need for an integration of climate change and energy policy. While admitting that Pakistan's future embrace of coal is all but inevitable, it makes a strong pitch for the acquisition of clean coal technologies and for coal production techniques that minimize environmental damage. The policy also encourages the development of renewable energy resources, and advocates for new building designs that incorporate solar panels and other earth-friendly measures (when the NCCP was launched, there were already plans for some buildings in Karachi to use stormwater harvesting for plant-watering, and wastewater for fountains, fire control, and restrooms). Additionally, the NCCP proposes the imposition of a carbon tax to discourage environmentally damaging energy generation; the development of indigenous technologies for carbon dioxide capture and storage; and the slow introduction of "green fiscal reforms" in different sectors (including water and energy) to reduce carbon emissions.

Significantly, the NCCP also links environmentally friendly energy policies to broader national benefits. More energy efficiency and conservation, it argues, constitute “excellent and cost-effective ways” to ensure sufficient energy supplies and the achievement of economic development goals.

Later in 2013, an implementing framework was published for the NCCP. It outlines climate change adaptation actions across a variety of sectors, including energy, water, and agriculture, and assigns explicit timeframes for the completion of such actions.¹⁹

Pakistani officials have remained acutely aware of this matter in the few years since the NCCP was launched. In late 2014, the Pakistan Agricultural Research Council urged agricultural scientists, policymakers, and environmental experts to develop comprehensive policies to mitigate climate change impacts on the agricultural sector (which is the largest contributor to Pakistan’s economy).²⁰ In August 2015, Pakistan’s Senate Standing Committee on Climate Change described climate change as a “big threat” and called on all government ministries to help mitigate it – in ways that include launching public awareness campaigns and reducing the amount of illegally held forestland.²¹ Several weeks later, top authorities at the Ministry of Climate Change and the Parliamentary Task Force on Millennium Development Goals joined forces to announce the need for a greater focus on climate change and its threats.²²

Meanwhile, the donor community is doing its part to help. After a meeting between U.S. President Barack Obama and Prime Minister Sharif in October 2015, their two countries announced the formation of a U.S.–Pakistan Clean Energy Partnership to help attract investment for renewable energy projects.²³ Earlier in 2015, Pakistan agreed to arrangements with two European companies (Vestas of Denmark and PROPARCO of France) to develop wind energy projects with a combined capacity of 350 MW.²⁴ Additionally, the aforementioned \$35 billion Chinese investment package for Pakistan’s energy sector does involve several renewable projects, including a solar energy park. In May 2015, Pakistan launched its first solar power plant – a project funded by the Chinese – which initially had a modest 100-MW generation capacity but was expected to ramp up to 1,000 MW in 2016.²⁵

Producer and consumer incentives

Pakistan is also taking concrete steps to incentivize producers and consumers to embrace renewable energy – a smart move in a country with plenty of sunshine and wind. On the producer side, Pakistan in 2015 announced generous upfront tariffs – fixed costs paid out as a lump sum – to solar and small hydro power producers (this encouraging development, however, was somewhat dampened by the announcement several months later that upfront tariffs would be reduced for wind energy producers).²⁶

Meanwhile, on the consumer side, government authorities have approved new measures that facilitate the installation of rooftop solar panels for private use, and enable solar-powered homeowners to receive credits on future energy bills if they allow their excess solar power to be supplied to the national grid. In early 2015, the State Bank of Pakistan and the Alternative Energy Development Board announced a new mortgage financing option that enables homeowners to borrow up to \$50,000 against their mortgage to pay for the installation of rooftop solar panels.²⁷ The provincial government of Khyber–Pakhtunkhwa has gone even further. In February 2015, it announced that it would provide solar power to nearly 6,000 off-grid households in 200 villages. Provincial authorities agreed to foot 90% of the bill – leaving only 10% to be paid by households in one of Pakistan’s poorest regions.²⁸

Climate change justice: a case study

Perhaps the most striking illustration of the seriousness with which Pakistan regards climate change comes not from the government, but from the courts – and specifically the High Court of Lahore, the capital of Pakistan’s most populous province of Punjab. In September 2015, in a ruling with few precedents anywhere in the world, Judge Syed Mansoor Ali Shah ordered that the Pakistani government do more to enforce the climate change adaptation measures articulated in the NCCP several years earlier. The ruling not only obliges the government to carry out its climate change commitments, but also establishes a new climate change commission – and names 21 officials that must sit on it – to oversee the process. Judge Shah’s ruling came after a farmer filed a public interest litigation case against the government, alleging that climate change effects were causing him undue hardship and that officials’ inaction had violated his “fundamental rights.”²⁹

In a country where justice often moves at a glacial pace, the alacrity with which the court’s ruling took effect is remarkable. On October 1, 2015, just days after the verdict, the new climate change commission held its first meeting. Members have been asked to identify achievable items from the NCCP’s implementing framework, and to discuss the process for implementation at future meetings. Subsequent orders issued by Judge Shah have laid out a detailed timetable for meetings of the climate change commission and its expected deliverables.

Environmental lawyers around the world were stunned by the case; one admitted that “Pakistan was nowhere in the list of my countries where I would have expected to see this kind of a ruling.”³⁰ This is because, in the blunt words of one Pakistani environmental specialist, “Pakistan is one of the countries most vulnerable to climate change but, despite having a national climate policy, no one appears to care.”³¹

The fact that the case did occur in Pakistan can perhaps be attributed to Judge Shah himself, a fervent advocate for more robust climate change mitigation policies. He saw firsthand the extent of Pakistan’s climate vulnerability when he served on a commission that surveyed flood damage. That experience served as a “rude awakening,” and helped crystallize what he describes as the “grave risk” posed to Pakistan by climate change. He soon discovered that federal and provincial government officials, including senior-level government ministers, did not appreciate the gravity of the situation and did not even know what was meant by climate change. All of this helped inspire his ruling.³²

In the days after the ruling, Judge Shah expressed confidence that his orders would be carried out successfully, even though several key members of the climate change commission did not show up for initial meetings. He pointed to several early successes, including a request from forestry department officials for training and assistance.³³ Parvez Hassan, an environmental lawyer serving as the commission chair, was similarly sanguine. He said that the commission’s work was “progressing rapidly and effectively,” and that the government was “fully cooperating and supporting” the commission.³⁴

Major obstacles to overcome

Unfortunately, impressive as these efforts have been to enhance resilience to climate change through clean energy projects and other mitigation measures, Pakistan faces a long and hard road ahead. Progress, while impressive, could ultimately prove limited. Seven factors help explain why.

Competing priorities

Every government faces multiple demands and lacks the resources and capacity to tackle each one equally. Policy planners tend to emphasize issues that they perceive as the most pressing at the present moment. Despite evidence that climate change has become a real and current threat, many countries continue to shrug it off as an abstraction – a notable yet far-off threat that can be saved for another day.

This is particularly the case in Pakistan, where the government faces so many immediate challenges. These range from terrorism and malnutrition to out-of-school children and water-borne disease. Additionally, given the volatility of Pakistani politics, governments are often preoccupied with political survival issues. The current government, for example, nearly did not survive an anti-government protest campaign spearheaded by the political opposition in the summer of 2014. Renewable energy and climate change mitigation simply do not stack up with these immediate issues in terms of priority; government officials do not have the luxury of steadfastly pursuing the implementation and enforcement of climate-related policies – despite the best efforts of individuals such as Judge Shah.

Energy in general, however, is very much a top priority for the government. It figured prominently in Sharif's 2013 election campaign (energy took up more pages than any other issue in his party's election manifesto document), and he took office that year with a strong mandate to fix the crisis. Still, for political reasons, Pakistani officials are constantly under pressure to boost generation on a broad scale, and fast, in order to narrow large supply-demand gaps. Renewables currently do not enjoy sufficient scale to be very helpful in this regard. Importing more foreign hydrocarbons – particularly in an era of relatively cheap global oil prices – can address demand more widely and rapidly, and is therefore a politically safer move.

The military

Pakistan's military has ruled the country for nearly half its existence, and even at times when it has not – such as the current era – it has exerted heavy influence over the policy sphere. Defense spending habitually hogs the annual budget, which helps explain why areas such as education and healthcare have historically received such small allocations – and why subjects perceived as peripheral, such as climate change, receive even smaller allotments. The Pakistani security establishment is not known for taking an interest in climate change issues. The military enjoys a vast economic empire, valued at about \$20 billion, with assets that range from farms to construction facilities and cereal companies.³⁵ One can comfortably assume that this empire leaves a deep carbon footprint and does not embrace earth-friendly tactics and technologies.

One can also reasonably argue that in the interest of national stability, the military has an interest in resolving the energy crisis in the fastest way possible. However, this entails a preference for rapid-generation, hydrocarbon-focused, supply-side-centered policies implemented during past eras of military rule (and in the current era of civilian rule), and not for renewables or other greener options, or for energy efficiency or other demand-side policies. The military, for example, strongly supports China's \$35 billion energy investments – several of which are focused on clean energy, but most of which are focused on coal. Without strong levels of buy-in from the all-powerful Pakistani military, it is unrealistic to believe that the government can make a case for climate policy to become a front-burner issue anytime soon.

High costs

It is perhaps no coincidence that Pakistan's recent renewable power generation success stories – such as the launch of its first solar power plant – have largely been one-off projects that enjoy the largesse of foreign donors. Pakistan, quite simply, cannot afford the sky-high costs necessary to support renewable energy projects on a wide scale, and in a way that meets baseline demand.

This is not to say that renewable energy is simply too expensive to touch. On the contrary, costs have fallen in recent years. Additionally, Pakistan's annual budget for 2015–16 features a number of cost-friendly measures for producers and consumers. These include tax exemptions for solar imports and solar- and wind-energy producing industries; government financing of mark-ups on loans for solar-based tubewells; and interest-free loans for small farmers using solar tubewells.

Nevertheless, solar and wind energy costs – particularly for technology, storage, and overall production – are quite high for producers. This can be attributed in part to Pakistan's paucity of energy infrastructure. If potential solar and wind producers want to build grid-connected power plants, then they need to work the steep costs of building transmission lines into their financial calculations – because these transmission lines are lacking in Pakistan.

Renewable energy costs are also high for consumers. A major reason why is the unregulated market for renewable energy, and particularly for solar. Islamabad has offered tax exemptions and other discounts on imported solar panels and related products, but the positive benefits of such policies are negated by middle men who sell solar materials (often subpar ones) at jacked-up prices.

The cost of renewable energy is also high for Pakistan's government. This is because of project financing plans that must offer generous returns to investors, in order to ease concerns about risk in an unstable country where the renewable energy portfolio remains an unproven frontier.³⁶ In effect, the government must absorb high capital and start-up costs to attract nervous investors. Ultimately, with the energy sector already handicapped by crippling levels of debt that have approached \$5 billion, it is unrealistic to believe that the high costs associated with solar and wind power can easily be absorbed or overcome.

Decentralization

In 2010, Pakistan passed its 18th constitutional amendment, which reduced the power of the presidency and devolved many federal-level government functions, resources, and responsibilities to the provinces. Theoretically, this was a policy of democratization in that it empowered provincial governments, which have traditionally had to defer to often-abused central power sources such as the presidency and military. In practice, however, the 18th amendment has overburdened already capacity-constrained and frequently corrupt provincial authorities.³⁷ This has troubling implications for policy development and implementation.

Climate issues have been directly and deleteriously affected by the 18th amendment. Pakistan's environment ministry was one of the 17 that were eliminated after the amendment's passage, meaning that key policy areas such as environmental pollution and ecology became the full responsibility of the provinces – even though, as the environmental expert Ahmad Rafay Alam has written, provinces had little experience with environmental regulation. Even today, he says, climate change, mitigation, and adaptation “all remain foreign terms to the provinces.”³⁸ There is also no longer a clear national-level coordination framework for environment and climate change policy. Additionally, the devolution process for environmental management has been implemented in a disorganized and inconsistent fashion. A 2015 World

Bank study found that these responsibilities have been devolved more fully in the province of Punjab than in the province of Sindh.³⁹

Furthermore, the 18th amendment has also obliged beleaguered climate-focused provincial authorities to operate against a confusing and chaotic institutional backdrop. The abolished environment ministry was replaced with a federal climate change ministry, though in 2014 the latter was downgraded to a division due to budget cuts – before once again being restored to a ministry in 2015 (curiously, however, in announcing its 2015–16 budget allocations, Pakistan still refers to it as a division, not a ministry). Critics describe the current climate ministry as ineffective and cash-starved. Alam has quipped that its current budget is “less than the cost of a Toyota.”⁴⁰

In effect, well-intentioned political decentralization has produced a regrettable result for climate policy: the onus has been put on overwhelmed provincial governments to manage climate portfolios with which they have little if any prior experience, while federal-level climate authorities lack the resources to provide meaningful support.

Institutional dysfunction

It is not just climate change-focused institutions that are troubled in Pakistan; those associated with energy are as well. This bodes ill for the country’s efforts to successfully manage policy for these two interrelated sectors. Pakistan has no overarching energy ministry; rather, over a dozen different entities are charged with energy-related functions. Different government units manage different energy resources – and in the case of biomass, different units manage the same resource. Additionally, each major energy resource has its own regulating entity. There is little to no coordination (though plenty of competition) between these various energy-focused actors.⁴¹

Such a chaotic institutional structure constrains effective policy planning, development, and implementation. It also complicates any potential effort to fashion a revised energy mix that draws more on renewables – a major policy shift that would need to win over key stakeholders in the vast energy bureaucracy and in state-owned hydrocarbon companies. It is hard to imagine that such a chaotic institutional environment – and the rivalries and turf wars that it engenders – could support such delicate exchanges and negotiations, much less the development and execution of a more renewables-focused energy policy on the whole.

Urbanization

Like many developing countries, Pakistan is experiencing rapid urbanization – and its 3% annual urbanization rate is the fastest in South Asia. Karachi’s population grew 80% between 2000 and 2010 – the largest increase of any city in the world. Most estimates contend that Pakistan’s urban-based denizens, presently a third of the total population, will be about 50% by 2025. However, according to density-based definitions of urbanization – which classify urban space as any area with 1,000 people per square mile, regardless of whether these areas are administratively classified as cities – Pakistan’s population could already be up to 65% urban today.⁴²

Many manifestations of urbanization – including heavy industrialization and exhaust-belching automobiles – drive up carbon emissions. Pakistani cities do not do much on a large scale to mitigate environmental damage. For example, there are few wastewater treatment facilities in Pakistani cities, despite the widespread contamination of urban water supplies due to largely unregulated industrialization.

To be sure, some small-scale pro-environment measures are in place. A number of urban buildings, for example, have incorporated stormwater harvesting into their water usage plans. Additionally, some would argue that bringing more people on to the electricity grid (which happens when people settle in urban spaces) can reduce climate change effects, because more people on the grid means fewer people using traditional, off-grid – and heavily polluting – energy sources such as firewood and biomass. This may be true to an extent, but ultimately such an argument is flawed. Many poor urban residents refuse to go on the grid because they much prefer to keep using cheap or free (and polluting) off-grid options instead of opting for more expensive (and cleaner) on-grid options. Additionally, many of those who go on the grid in Pakistani cities use dirty fuels. This will certainly continue to be the case if Pakistan succeeds in integrating coal more fully into the country's energy mix. The country intends to serve urban demand not only through Thar-based coal reserves, but also by converting furnace-oil based power plants to coal.

In sum, urbanization deepens environmental risks more than it mitigates them. It also complicates the ability of Pakistani officials to fashion a greener and more sustainable energy mix. The financial and public health consequences are quite serious: environmental degradation damages in cities are estimated at several billion dollars per year, and air pollution kills nearly 25,000 urban residents annually.⁴³

Lack of policy implementation

This is arguably the most significant factor of all, and one that ails Pakistan's broader policy environment. Many promising policies across the board are conceptualized and developed – but never implemented, much less enforced. There are numerous reasons why. One is technical. In Pakistan, policy documents are often written in a way that precludes any chance of implementation. There is often little explicit information or instructions as to how a particular policy is to be carried out. Another reason is purely political: a lack of political will to push through major reforms or policies, even if they could have long-term positive effects for the country. Pakistan – along with many other countries, to be sure – tends to have leaders who focus more on their political fortunes than on the broader needs of their country.

Another reason that may help explain Pakistan's implementation problems is one of political economy. One may argue that a rentier state mentality compels Pakistan's political class and other powerbrokers (especially the military) to assume that the outside world will provide assistance to help keep the country afloat, including measures to keep the energy situation from spiraling out of control. The fact that Pakistan has placed so much hope in China's \$35 billion energy investment package is illustrative. When a state can assume that it will get bailed out by external support, then it has fewer incentives to take ownership of policy challenges and hunker down to address them. To this end, while recent European, American, and Asian investments in Pakistan's fledgling renewable energy sector are encouraging, they may also exacerbate the complacency that prevents Pakistan from taking bigger steps on its own.

The stakes of inaction: trigger for destabilization

The potential consequences of failing to take sufficient action to mitigate climate change effects have been well chronicled. These include the destruction of agriculture and ecosystems, widespread water scarcity, and waves of climate refugees. Sadly, these are all very real possibilities for Pakistan in the coming decades. The steep price tag of climate change is another frequently discussed consequence. In Pakistan, a former environmental minister has projected an eventual

figure of \$14 billion per year – even as current annual climate change needs in the country cost anywhere from \$13 billion to \$32 billion. These are expenses that the country is presently unable to finance.⁴⁴

Equally important, though less discussed, are the stability implications of an angry and abused environment unleashing its full wrath, and particularly on a nation such as Pakistan that is deeply fractured, militancy-riven, and nuclear-armed. On a general level, there is the possibility of intensified privation – spawned by livelihoods losses, acute water and food insecurity, mass displacements, and other climate change effects – heightening the risks of radicalization. Pakistan’s young masses – about two-thirds of the country’s population is under the age of 30 – could be more likely to succumb to the blandishments of militants, particularly given the state’s repeated failure to meet the general population’s basic needs even under ordinary circumstances.

More specifically, there are three troubling climate-change-related scenarios that could imperil Pakistan’s fragile stability.⁴⁵

First, climate change effects could inflame relations with India, which in 2015 were already suffering from one of their most difficult periods in years. Pakistani hardliners, including the Lashkar-e-Taiba terror group, routinely accuse upper riparian India of contributing to, if not outright precipitating, Pakistan’s floods and droughts. India, they allege, manipulates Indus Basin river flows so that water either gushes downstream or is diverted upstream (there is little evidence that India does either, at least not intentionally). They contend that “liberating” India-held Kashmir, the point of origin for many of the rivers and tributaries flowing into Pakistan, is the only way to stop India’s hydro machinations.

Increasingly hot temperatures, glacial melt, and other climate events could exacerbate Pakistan’s flooding and droughts – thereby supplying Pakistani militants with further ammunition for their accusations and even pretexts for attacks on India. New Delhi, meanwhile, suffers from its own dry spells and water shortages. It could well decide, for the sake of the national interest, to do the very thing that Pakistani militants falsely accuse it of doing now: diverting river flows to provide more water and hydro power for Indians. The Indus Waters Treaty, which has helped keep India and Pakistan from fighting a war over water, could be put to the test – and so could the bilateral relationship itself.

Second, environmental stress could deepen Pakistan’s urban violence. Karachi is often convulsed by such strife, and much of it arises from fierce competition over precious land. Yet Karachi – a coastal, low-lying metropolis – is vulnerable to flooding, cyclones, and other climate-related phenomena that could easily wipe out vast swaths of the city’s heavily contested real estate. This means the land that remains could become even more precious, thereby raising the stakes for the city’s fighting factions and likely increasing violence.

Third, and perhaps most troubling, Pakistan’s environmental insecurity imperils nuclear security. The concern here is not of militants seizing nuclear weapons, but of the country experiencing a catastrophic nuclear accident similar to that of Japan’s Fukushima nuclear plant in 2011. A key Pakistani nuclear facility, the Karachi Nuclear Power Plant (KANUPP), sits not only in a flood- and storm-prone area, but also in one of the most densely populated parts of the country. Back in 2012, a study released jointly by the journal *Nature* and Columbia University found that more than 8 million people live within 30 kilometers of KANUPP – the largest figure for any nuclear facility in the world.⁴⁶ KANUPP, which is nearly 45 years old, has been described by Pervez Hoodbhoy, a prominent Pakistani nuclear physicist, as a “chronically incontinent” reactor that frequently leaks heavy water. Given the combination of a fragile old plant, a large nearby population, and Pakistan’s poor emergency-response capabilities, the consequences of a tsunami or cyclone strike on or near KANUPP could be truly catastrophic. According to Hoodbhoy, the release of deadly radioactivity would be only one of several

threats. Others would include clogged roads, a collapse of vital services, and Karachi (the country's largest city and financial capital) succumbing to the predations of looters, criminals, and, perhaps, militants.⁴⁷

Over the last few years, China has committed to constructing several new nuclear reactors in Pakistan. However, this has not led to the shuttering of KANUPP. On the contrary, it remains operational. Even more concerning is that the Chinese are building two new reactors on the very grounds of KANUPP. One of these new reactors was inaugurated in 2015. Pakistani officials have defended these new investments and their locations, contending that the integrity of KANUPP's structure is sound and that it has proper safety measures in place – thereby ruling out doomsday scenarios.⁴⁸ Nonetheless, given KANUPP's rickety state, the construction of two new reactors right next to it is quite worrisome.

Recommendations and conclusions

Pakistan faces a conundrum of serious energy problems coupled with severe climate vulnerability. The government is aware of each dilemma and has taken encouraging steps to address both of them. However, the challenges are daunting. Fortunately, Pakistan, with assistance from international donors, can execute several policy interventions that would better equip the country to overcome them, or at least to manage them.

First, to help get climate change off the policy back burner, Pakistan's vibrant civil society should lead awareness-building campaigns about the imminent threat it poses. These campaigns should target Pakistan's influential and far-reaching mass media – specifically radio in rural areas and private television channels in urban areas. The spokespersons for such campaigns should include prominent personalities who can shape public sentiment. These might include television news anchors, religious leaders, and Bollywood and athletic stars. If civil society can build awareness in this way, and put pressure on the government to act, then policymakers are likely to take climate issues more seriously.

Second, the powerful Pakistani military, which exerts strong influence over the policy environment but has little awareness of or understanding of climate change, must better understand the connections between environmental security and national security. Specifically, efforts should be made to impress upon the security establishment the links between climate change effects and stability.

Third, to help bring the costs of renewable energy down to more reasonable levels, Pakistan's government should formulate policies that encourage the most cost-efficient production of as much energy as possible in order to bring down the per unit price as low as possible. Quite simply, policymakers should strive for policies that encourage investment in energy generation at a price that the country can afford.⁴⁹ In all reality, for costs to come down in this way, major correctives will be necessary. These include the construction of more transmission lines and other infrastructure, more regulation of renewable energy markets, and across-the-board anti-militancy and anti-extremism measures that usher in a calmer long-term security situation.

Fourth, with decentralization reforms saddling overburdened provincial governments with difficult new climate change responsibilities, international donors should sponsor capacity-building training programs to help these officials better learn how to manage their resources and to carry out their mandates.

Fifth, Pakistan should take steps to bring some order to a chaotic energy sector. This should entail scaling back the number of government entities charged with energy responsibilities, and above all establishing an overarching body – such as a new energy ministry – to coordinate energy policy. This would admittedly be a hard sell, given the deep inertia of Pakistan's energy bureaucracy and the strong resistance of various vested interests within the energy sector. And

yet the benefits would be great. More institutional coherence would facilitate a more effective and organized process of energy planning, development, and execution.

Sixth, Pakistan should acknowledge that while it – like any country – is in no position to halt climate change outright, it can nonetheless institute a number of correctives to blunt its effects and reduce the scope of potential damage. These measures include passing stringent laws against Pakistan’s deforestation, which happens at alarming rates, and establishing more robust disaster risk reduction mechanisms.

To be sure, even if all these recommendations were to be successfully implemented – and that is a mammoth “if” – Pakistan would still face major energy challenges and climate change vulnerability. In the coming years, Pakistani policymakers will need to confront these problems, whether or not they are ready to do so. Even if Pakistan’s more well-known and immediate challenges were to disappear – if militancy were to be completely stamped out, if the military were to permanently withdraw to the barracks and usher in a golden age of civilian democracy, if the economy were to enjoy spectacular growth – then energy and environmental matters will still loom large.

This is a reality that cannot be wished away. Devising more effective – and, in time, integrated – energy and climate policies is a worthwhile way to start preparing for this future and inevitable state of affairs.⁵⁰

Notes

- 1 This section is drawn in part from Michael Kugelman, ed., *Pakistan’s Interminable Energy Crisis: Is There Any Way Out?* (Washington, DC: Woodrow Wilson Center, 2015), www.wilsoncenter.org/sites/default/files/ASIA_150521_Pakistan’s%20Interminable%20Energy%20Crisis%20rpt_0629.pdf. See also Wendy Culp, “Pakistan’s Energy Insecurity: Anatomy of a Crisis and How to Move Forward – An Interview with Michael Kugelman,” National Bureau of Asian Research, July 22, 2015, www.nbr.org/downloads/pdfs/eta/kugelman_interview_072215.pdf; Michael Kugelman, “Could Pakistan’s Energy Crisis Bring Down the Government?” *War on the Rocks*, February 10, 2015, <http://warontherocks.com/2015/02/could-pakistans-energy-crisis-bring-down-the-government/>.
- 2 Michael Kugelman, “Powerless in Pakistan,” *Foreign Policy*, June 30, 2015, <http://foreignpolicy.com/2015/06/30/powerless-in-pakistan/>.
- 3 World Bank Group, *Doing Business 2016: Measuring Regulatory Quality and Efficiency* (Washington, DC: World Bank Group, 2015), www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf, 70.
- 4 This section is drawn in part from Michael Kugelman, “Pakistan’s Climate Change Challenge,” *Foreign Policy*, May 9, 2012, <http://foreignpolicy.com/2012/05/09/pakistans-climate-change-challenge/>.
- 5 Sonke Kref, David Eckstein, Lisa Junghans et al., *Global Climate Risk Index 2015* (Germanwatch, 2014), <https://germanwatch.org/en/download/10333.pdf>.
- 6 United Nations Development Programme (UNDP) in Pakistan, *Pakistan: Climate Public Expenditure and Institutional Review (CPEIR)* (United Nations Development Programme in Pakistan, 2015), www.pk.undp.org/content/dam/pakistan/docs/Environment%20&%20Climate%20Change/UNDP%20Climate%20Report%20V10.pdf, 11.
- 7 Michael Kugelman, “Powerless in Pakistan.” *Foreign Policy*, June 30, 2015. <http://foreignpolicy.com/2015/06/30/powerless-in-pakistan/>.
- 8 Michael Kugelman, “Pakistan’s Impending Famine,” *The Diplomat*, March 14, 2014, <http://thediplomat.com/2014/03/famine-threatens-pakistan/>; United Nations International Children’s Emergency Fund, “Drought Disasters: Asia” (United Nations International Children’s Emergency Fund, 2014), www.unicef.org/drought/asia.htm.
- 9 For background on Pakistan’s water crisis, see Michael Kugelman, ed., *Running on Empty: Pakistan’s Water Crisis* (Washington, DC: Woodrow Wilson Center, 2009), www.wilsoncenter.org/sites/default/files/ASIA_090422_Running%20on%20Empty_web.pdf.
- 10 Kalpana Kochhar, Catherine Pattillo, Yan Sun et al., *Is the Glass Half Empty or Full? Issues in Managing Water Challenges and Policy Instruments*, International Monetary Fund, June 2015, www.imf.org/external/pubs/ft/sdn/2015/sdn1511.pdf.

- 11 Kashif Majeed Salik, Sehrish Jahangar, Waheed ul Zafar Zahdi, et al., "Climate Change Vulnerability and Adaptation Options for the Coastal Communities of Pakistan," *Ocean & Coastal Management* 112 (2015): 61–73. www.sdpi.org/publications/externalpublications/climate-change-vulnerability-and-adaptation-options-for-the-coastal-communities-of-pakistan.pdf.
- 12 Saadullah Ayaz, *Climate Change and Coastal Districts of Baluchistan Communities – Situation Analysis, Implications, and Recommendations* (International Union for the Conservation of Nature–Pakistan, Embassy of the Netherlands, and Government of Baluchistan, 2012), https://cmsdata.iucn.org/downloads/cc_and_coastal_districts_analysis_study.pdf. While much of the literature on Pakistan's climate risks focuses on Sindh and Baluchistan, the provinces of Khyber-Pakhtunkhwa and Punjab are quite vulnerable as well. In fact, some studies rank Punjab as Pakistan's second-most vulnerable province after Baluchistan. See Sadia Mariam Malik, Haroon Awan, and Nizullah Khan, "Mapping Vulnerability to Climate Change and its Repercussions on Human Health in Pakistan," *Globalization and Health* 8, no. 31 (2012), www.globalizationandhealth.com/content/pdf/1744-8603-8-31.pdf.
- 13 Khalid Mansoor, "How Coal Can Help Address Pakistan's Energy Crisis," in *Pakistan's Interminable Energy Crisis*, ed. Michael Kugelman (Washington, DC: Woodrow Wilson Center, 2015), 40–52.
- 14 Musadik Malik, "Pakistan's Energy Crisis: Challenges, Principles, and Strategies," in *Pakistan's Interminable Energy Crisis*, ed. Michael Kugelman (Washington, DC: Woodrow Wilson Center, 2015), 23–39.
- 15 Ministry of Water and Power (Pakistan), *National Power Policy 2013* (Ministry of Water and Power (Pakistan), 2013), www.ppib.gov.pk/National%20Power%20Policy%202013.pdf.
- 16 Finance Division (Pakistan), *Federal Budget 2015–16: Budget in Brief* (Finance Division (Pakistan), 2015), www.finance.gov.pk/budget/Budget_in_Brief_2015_16.pdf.
- 17 UNDP in Pakistan, *Pakistan*.
- 18 Ministry of Climate Change (Pakistan), *National Climate Change Policy* (Ministry of Climate Change (Pakistan), 2012), www.mocc.gov.pk/gop/index.php?q=aHR0cDovLzE5M14xNjguNzAuMTM2L21vY2xjL3VzZXJmaWxlcEvZmIsZS9Nb2N5Yy9Qb2xpY3kvTmF0aW9uYWw1MjBDbGltYXRJTlIwQ2hhbmdlJTlIwUG9saWN5JTlwb2YIMjBQYWtpc3RlbiUyMCGyKS5wZGY%3D.
- 19 Climate Change Division (Pakistan), *Framework for Implementation of Climate Change Policy (2014–2030)*, Climate Change Division (Pakistan), 2013, www.pk.undp.org/content/dam/pakistan/docs/Environment%20&%20Climate%20Change/Framework%20for%20Implementation%20of%20CC%20Policy.pdf.
- 20 "Pakistan Faces Major Risks from Climate Change: PARC," *Daily Times*, November 11, 2014, www.dailytimes.com.pk/islamabad/11-Nov-2014/pakistan-faces-major-risks-from-climate-change-parc.
- 21 Associated Press of Pakistan, "Senate Body Wants Solid Steps to Mitigate Climate Change Threats," *Daily Times*, August 19, 2015, www.dailytimes.com.pk/national/19-Aug-2015/senate-body-wants-solid-steps-to-mitigate-climate-change-threats.
- 22 Associated Press of Pakistan, "Need for Climate Change Awareness Plan Stressed," *Daily Times*, September 15, 2015, www.dailytimes.com.pk/islamabad/15-Sep-2015/need-for-climate-change-awareness-plan-stressed.
- 23 White House, Office of the Press Secretary, "2015 Joint Statement by President Barack Obama and Prime Minister Nawaz Sharif," White House, Office of the Press Secretary, October 22, 2015, www.whitehouse.gov/the-press-office/2015/10/22/2015-joint-statement-president-barack-obama-and-prime-minister-nawaz.
- 24 Greentech Lead, "Vestas Signs MOU to Develop Pilot Wind Projects in Pakistan," Greentech Lead, February 20, 2015, www.greentechlead.com/wind/vestas-wind-signs-mou-develop-pilot-wind-projects-pakistan-21833; "France PROPARCO Invests 20m to Support Pakistan Wind Energy Projects," *Daily Times*, March 11, 2015, www.dailytimes.com.pk/business/11-Mar-2015/france-proparco-invests-20m-to-support-pak-wind-energy-projects.
- 25 Anam Zehra, "Pakistan Opens First Solar Power Plant, Built with Chinese Investment," Reuters, May 5, 2015, <http://in.reuters.com/article/2015/05/05/pakistan-solar-idINL4N0XW2VP20150505>.
- 26 "Discovering New Resources: NEPRA Approves Upfront Tariff for Solar Power," Associated Press of Pakistan, January 29, 2015, <http://tribune.com.pk/story/829221/discovering-new-resources-nepa-approves-upfront-tariff-for-solar-power/>; Khaleeq Kiani, "Upfront Tariff for Small Hydro Plants Okayed," *Dawn*, April 3, 2015, www.dawn.com/news/1173562; Mushtaq Ghumman, "Wind Power Projects: Upfront Tariff of Rs. 10.6048/kwh," *Business Recorder*, June 26, 2015, www.brecorder.com/fuel-a-energy/193/1199787/.
- 27 Ian Clover, "Pakistan Overhauls its Solar Industry for the Better," *PV Magazine*, January 2015, www.pv-magazine.com/news/details/beitrag/pakistan-overhauls-its-solar-industry-for-the-better_100017687/#axzz3n9bpnDEG.

- 28 Amir Saeed, "Solar to Power Thousands of Off-Grid Homes in North Pakistan," Reuters, February 18, 2015, www.reuters.com/article/2015/02/18/us-pakistan-energy-solar-idUSKBN0LM0OR20150218.
- 29 Ahmed Rafay Alam, "Pakistan Court Orders Government to Enforce Climate Law," *The Third Pole*, September 24, 2015, www.thethirdpole.net/2015/09/24/pakistan-court-orders-government-to-enforce-climate-law/; Natasha Geiling, "Pakistan Now has a 21-Person 'Climate Council,' Thanks to a Judge's Ruling," *Think Progress*, October 7, 2015, <http://thinkprogress.org/climate/2015/10/07/3710023/pakistan-court-climate-change/>.
- 30 Raveena Aulakh, "Pakistan Orders State to Enforce Climate Policies," *The Star*, October 3, 2015, www.thestar.com/news/world/2015/10/03/pakistan-judge-orders-state-to-enforce-climate-policies.html.
- 31 Alam, "Pakistan Court Orders Government to Enforce Climate Law."
- 32 Judge Syed Mansoor Ali Shah, phone interview with the author, October 7, 2015.
- 33 Ibid.
- 34 Parvez Hassan, email interview with the author, October 31, 2015.
- 35 Very little work has been done on this opaque subject, though the most definitive account is Ayesha Siddiq, *Military Inc.: Inside Pakistan's Military Economy* (Karachi, Pakistan: Oxford University Press, 2007).
- 36 For a more detailed discussion, see Musa Khan Durrani, "Is Solar Power Really the Best Solution for Pakistan?" *Dawn*, October 2, 2015, www.dawn.com/news/1209933.
- 37 See Michael Kugelman, *Decentralization in Pakistan: The Lost Opportunity of the 18th Amendment* (Norwegian Peacebuilding Resource Center, 2012), www.peacebuilding.no/var/ezflow_site/storage/original/application/fcfee16739837e8125703a4ae5e750df.pdf; Colin Cookman, "The 18th Amendment and Pakistan's Political Transitions," Center for American Progress, April 19, 2010, www.americanprogress.org/issues/security/news/2010/04/19/7587/the-18th-amendment-and-pakistan-political-transitions/.
- 38 Alam, Ahmed Rafay, "Pakistan Court Orders Government to Enforce Climate Law," *The Third Pole*, September 24, 2015. www.thethirdpole.net/2015/09/24/pakistan-court-orders-government-to-enforce-climate-law/.
- 39 Ernesto Sanchez-Triana, Santiago Enriquez, Bjorn Larsen, et al., *Sustainability and Poverty Alleviation: Confronting Environmental Threats in Sindh, Pakistan* (Washington, DC: World Bank Group, 2015), 132.
- 40 Zofeen T. Ebrahim, "Pakistan's New Climate Change Ministry Merely 'Cosmetic,'" *Dawn*, February 6, 2015, www.dawn.com/news/1161895.
- 41 For a more detailed discussion of the institutional dysfunction within Pakistan's energy sector, see Ziad Alahdad, "Pakistan's Energy Sector: Putting It All Together," in *Pakistan's Interminable Energy Crisis*, ed. Michael Kugelman (Washington, DC: Woodrow Wilson Center, 2015), 134–151.
- 42 Michael Kugelman, ed., *Pakistan's Runaway Urbanization: What Can Be Done?* (Washington, DC: Woodrow Wilson Center, 2014), www.wilsoncenter.org/sites/default/files/ASIA_140502_Pakistan's%20Runaway%20Urbanization%20rpt_0530.pdf.
- 43 Sania Nishtar, Farrukh Chishtie, and Jawad Chishtie, "Pakistan's Urbanization Challenges: Health," in *Pakistan's Runaway Urbanization*, ed. Michael Kugelman (Washington, DC: Woodrow Wilson Center, 2014), www.wilsoncenter.org/sites/default/files/ASIA_140502_Pakistan's%20Runaway%20Urbanization%20rpt_0530.pdf, 107–125.
- 44 Lisa Friedman, "Can Pakistan Survive Climate Change?" *E&E News*, May 28, 2013, www.eenews.net/stories/1059981842.
- 45 These three scenarios are adapted from Kugelman, "Pakistan's Climate Change Challenge."
- 46 Declan Butler, "Reactors, Residents, and Risk," *Nature*, April 21, 2011, www.nature.com/news/2011/110421/full/472400a.html.
- 47 Pervez Hoodbhoy, "Some Learned from Fukushima. Did We?" *Express Tribune*, March 11, 2012, <http://tribune.com.pk/story/348572/some-learned-from-fukushima-did-we/>.
- 48 Imtiaz Ali, and Shahid Ghazali, "PM Nawaz Inaugurates K-2 Powerplant at Kanupp," *Dawn*, August 21, 2015, www.dawn.com/news/1201662; Abdul Hafeez, "Kanupp Defends its Ambitions, Rules out Domsday Scenario," *Geo*, May 25, 2015, www.geo.tv/article-185958-Kanupp-defends-its-ambitions-rules-out-doomsday-scenario.
- 49 For a detailed discussion of appropriate pricing policies, see Shannon Grewer, "How to Incentivize Energy Innovation and Efficiency, and Encourage the Rapid Deployment of Affordable Solutions," in *Pakistan's Interminable Energy Crisis*, ed. Michael Kugelman (Washington, DC: Woodrow Wilson Center, 2015), 102–119.
- 50 Michael Kugelman is grateful for the invaluable research assistance provided by Aleena Ali and Nausheen Rajan.