Pakistan's Interminable Energy Crisis:

IS THERE ANY WAY OUT?

Wilson Center

EDITED BY Michael Kugelman

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Jane Harman, Director, President and CEO

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Easing an Energy Crisis That Won't End

MICHAEL KUGELMAN

In April 2015, China did something extraordinary: it gifted a $46 billion investment package to Pakistan.

That figure is more than six times the $7.5 billion in development assistance that the United States authorized to Pakistan between 2009 and 2014. It is also significantly more than the $31 billion in total assistance (security and economic) that Washington provided to Islamabad between 2002 and 2014. And it equates to 20 percent of Pakistan's annual budget.[1]

A majority of the $46 billion—approximately $35 billion—will be allocated to energy projects. These include coal-fired power plants, a dam, a solar power park, and a gas pipeline to Iran (Islamabad has pursued the latter project for years, but a lack of financing has been a major obstacle). Together, these projects are expected to create about 17,000 megawatts (MW) of power.[2]

Not surprisingly, Chinese and Pakistani authorities boasted of the benefits these investments will bring to Pakistan's energy security. A former Chinese ambassador to Pakistan expressed hope that they would "help curb Pakistan's crippling energy crisis." Pakistani Prime Minister Nawaz Sharif went much further, boldly predicting that Pakistan "would soon be rid of its electricity and gas crisis." The media got in on the act as well, with one Pakistani newspaper giddily predicting that China's investments could "pave the way for the end of decade-long power outages."[3]

If only it were that simple.

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The mere acts of building new energy infrastructure and adding more generation capacity will not make Pakistan's energy crisis go away—no matter how much money the Chinese may make available. The crisis is simply too complex.

DEEP AND DESTABILIZING[4]

To be sure, supply shortages are one component of the crisis. Even in the present era of cheaper global oil, Pakistan faces energy deficits of 4,500 to 5,000 MW (in recent years, these shortfalls have sometimes soared to 8,500 MW—more than 40 percent of national demand). 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. In the case of Pakistan's two most heavily utilized sources of energy (oil and gas), consumption levels are so high that Pakistan's national oil and gas company, Oil and Gas Development Company Limited (OGDCL), predicts that indigenous oil reserves will be exhausted by 2025, and that Pakistan will run out of domestic sources of natural gas by 2030.

Nevertheless, Pakistan's energy problems are arguably rooted more in shortages of governance than of pure supply. The energy sector suffers from widespread inefficiencies, including transmission and distribution (T&D) losses that exceed 20 percent, as well as from several billion dollars of debt. The losses are caused by bad equipment, poor maintenance, and energy theft. The debt—often described as "circular" in nature—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 percent 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. Some Western companies, citing electricity deficits, have suspended operations in Pakistan.

In January 2015, the Moody's ratings group warned that energy shortages will damage Pakistan's credit worthiness.

Meanwhile, the energy crisis has sparked demonstrations that sometimes turn violent. Protestors, angered by unscheduled outages, have blocked roads and attacked the homes and offices of members of major political parties. Additionally, militants are happy to exploit Pakistan's energy insecurity. Over the last four years, separatists in the insurgency-riven province of Baluchistan have targeted more than 100 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 percent of the country into darkness. Just a few days later, a similar assault reduced gas supplies to the provinces of Punjab and Khyber-Pakhtunkhwa by 25 million cubic feet. It is not just Baluch insurgents wreaking havoc on Pakistan's electricity infrastructure. Back in April 2013, the Pakistani Taliban blew up the largest power station in Khyber-Pakhtunkhwa province. Half of Peshawar, the provincial capital with a population nearly as large as that of Los Angeles, lost power.

Wide expanses of Pakistan's population are affected by the 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.

In short, the energy crisis threatens Pakistan's economy and its precarious security situation, while also deleteriously affecting the lives of everyday residents across the board. In July 2014, recognizing the significance of this story, the Woodrow Wilson Center's Asia Program and the Fellowship Fund for Pakistan hosted an all-day conference on Pakistan's energy crisis. The papers presented at this Washington, D.C. conference appear in edited form in this volume. Three conference presenters also produced policy briefs. These briefs were published soon after the 2014 conference and are available online.[5]

THE VIEW FROM ISLAMABAD

By no means has Pakistan's current government downplayed or neglected the energy crisis; on the contrary, it has focused laser-like on it

since taking office in May 2013. Even back on the campaign trail, the now-ruling Pakistan Muslim League-Nawaz (PML-N) party accorded extensive attention to energy. The PML-N's election manifesto dedicated an entire section to energy, which constituted one of the longest in the entire document.[6]

In this volume's opening essay, **Musadik Malik**, the prime minister's energy adviser at the time of the Washington conference, lays out Islamabad's vision for addressing the energy crisis. He proposes new "organizing principles" to guide the government's response. Above all, he argues, Pakistan must engineer three changes in its power market structure. First, there must be less bureaucracy and more efficiency—a shift that will entail more meritocracy, transparency, and accountability. Second, heavy regulation needs to give way to more competition. This requires Pakistan to demonstrate a genuine commitment to resolving its energy crisis: "With this kind of commitment, and if we are able to put resources behind this commitment," Malik declares, "people will begin to have a little bit of confidence in Pakistan, and they will begin to invest in Pakistan." Once investors express interest, the government should "do competitive bidding, let the best bidder win, and then get out of the way." Third and finally, Pakistan needs to craft a more balanced and cheaper energy mix—one that does away with the current heavy dependence on expensive imported oil. These three changes, Malik concludes, will transform a "red tape" market into a "red carpet" one.

The government's short-term priorities include generating more power capacity; reducing the supply-demand gap and bringing it down to zero within the next five years; and lowering T&D losses to 16 percent (and to 10 percent "over a reasonable period of time"). In Malik's view, bringing down T&D losses will be much easier now that Pakistan has started using smart meters—devices that record energy consumption rates at rapid intervals and allow for efficient monitoring. This technology, he writes, enables Pakistani energy policymakers to engage in more "evidence-based decision making." Officials are developing "dashboards" for Prime Minister Sharif that capture the performance of thousands of grid station feeders, and that depict load-shedding rates across the country on a monthly or yearly basis. Already, useful discoveries have been made: the length of a feeder is directly associated with T&D loss levels (longer feeders have higher losses), and there is no relationship

between losses and load shedding (feeders with low losses often experience more load-shedding than those with higher losses).

COAL VS. GAS

This book's contributors are largely in accord with Malik's broader assessment. There is some disagreement, however, on what constitutes a proper energy mix. Malik makes a strong push for coal, which currently plays a negligible role in Pakistan's energy picture. Islamabad has signaled its intention to exploit the vast coal reserves of Thar, a desert region of Sindh province, and to develop several coal projects in Baluchistan—including one that the government hopes will one day generate more than 6,000 MW of power. Malik envisions coal as part of a new "sensible and balanced portfolio" that also includes hydro and other resources. He acknowledges the environmental and public health risks of heavy coal production, but insists that "we are a poor country, and we have to create a portfolio that is affordable."

Khalid Mansoor wholeheartedly agrees. Mansoor, chief executive of The Hub Power Company Limited (HUBCO), Pakistan's first and largest independent power project, describes coal as "the only solution" to the country's unworkable energy mix. Coal, he argues, meets three key criteria for a sustainable energy source: it is immediately available, it is low-cost, and it can provide an uninterrupted power supply. By contrast, hydro is not always available because riverwater is only available seasonally. Solar and wind, though they should "ideally form a part" of the overall energy mix, cannot support "baseload demand" without the introduction of prohibitively expensive measures. Meanwhile, liquefied natural gas (LNG), which can address baseload demand, generates levelized costs that are double those of coal.

According to Mansoor, the Thar coal project is well underway. An environmental and social impact assessment has been conducted, some international competitive bidding has been completed, and "all requisite infrastructure" for a mine and power plant are "in an advanced stage of implementation." Eventually, Thar's reserves, which total 175 billion tons, will be able to generate 100,000 MW of power. Mansoor admits, however, that even with current progress, indigenous coal exploitation

is not an immediate option. For now, Pakistan should turn to imported coal—which in terms of energy content is a third the cost of imported oil. He also calls on Pakistan to convert its furnace oil-fired power plants to coal. Tariffs associated with furnace oil approach 22 cents per kilowatt hour (kWh). However, after a conversion to coal, Mansoor writes, these rates would come down to 10 cents per kWh. The lower tariffs associated with coal, he contends, would go a long way toward easing Pakistan's energy sector debt.

There is, however, another side to this story. Pakistan has not proved that it boasts the vast technical capacity, not to mention the financing, to undertake such large-scale coal exploitation. It also lacks the advanced infrastructure required to transport this coal around the country. In fact, in late 2014, China withdrew its support for several coal plants in Baluchistan, citing insufficient infrastructure.[7] Mansoor acknowledges these deficiencies, citing an absence of transmission lines to connect coastal power plants to load centers and also "the failure" of Pakistan's national rail service to convey coal from ports to inland areas. Pakistan Railways, he admits, suffers from severe shortages of locomotives and money.

Predictably, several contributors champion natural gas. Unlike coal, gas is a major component of Pakistan's energy picture today—it constitutes about half of the overall mix—and it has provided fuel to urban Pakistani homes since the 1970s. "In the short and intermediate term," writes World Bank senior natural gas consultant **Robert M. Lesnick**, "natural gas is the most viable choice for alleviation of Pakistan's growing energy gap." Even after decades of indigenous exploitation, he adds, Pakistan continues to enjoy "a bountiful supply" of gas sources that can sustain the country into the future. However, the sector has suffered in recent years, with proven reserves having declined by 25 percent over the last decade. Investor interest has cooled significantly as well. Lesnick attributes this to low natural gas prices, gas field sizes that investors deem too small, heavy taxation, a lack of security and modern telecommunications services in gas-rich regions, overregulation, and the issue of unaccounted for gas (UFG)—which in recent years has totaled 11 percent of all gas produced.

Lesnick proposes a variety of short-term correctives for these problems. Pakistan should fast-track development proposals to quicken the pace of

drilling activities. The Ministry of Petroleum and Natural Resources (MPNR) should "identify and value" concessions deemed technically noncompliant or in need of remedial work. The UFG problem should "be owned at a high government level," independent of the MPNR. Lesnick calls for a diagnostic study to determine where the losses are within the gas sector. He also suggests that a realistic plan be established to reduce UFG rates to "industry-recognized allowable levels."

Energy consultant **Akhtar Ali** agrees with Lesnick that Pakistan should embrace natural gas, and offers his own set of recommendations for overcoming the gas sector's many challenges—including a current shortfall of 2 billion cubic feet per day. He argues that Pakistan should target new gas prices of $8 to $10 per one million British thermal units, or MMBtu (the current wholesale cost in Europe), and proposes that the industrial gas tariff be raised from the present $5.60 per MMBtu to about $10. He also recommends that Pakistan explore indigenous natural gas alternatives such as tight and shale, along with biogas, more robustly. "The promise of cheap and abundant gas is too important to be taken lightly, forgotten, or soft-pedalled," he declares.

THE PROMISE—AND PERILS—OF PRIVATIZATION

Ali, like Malik and other contributors, also calls for more market-friendly conditions. Price controls should be lifted for large consumers, he writes, and gas producers should be able to sell directly to large consumers at mutually negotiated prices. He stops short, however, of calling for outright privatization of the gas sector, a process that he argues would be "protracted and controversial." Talk of privatization, he says, "tends to create unnecessary uncertainty and paralyzes decision making." Ali believes that Pakistan's major opposition political parties are opposed to privatization, and that courts have "opposed and reversed" privatization deals. Accordingly, he argues that gas companies should be divided and reorganized—the transmission functions of Pakistan's two state-owned gas companies should be merged, and about 8 to 10 new gas distribution companies should be established.

Unsurprisingly, Ali also opposes full-scale privatization of Pakistan's electricity sector. He suggests that distribution companies be divided

into smaller local companies or distribution franchises. Going small would promote greater efficiency: theft would not be as easy to ignore or deny, given that the practice would impact smaller companies particularly strongly. Additionally, smaller companies would have jurisdiction over smaller areas, thereby facilitating the ability to identify thieves. Ali, however, does argue for the privatization of generation companies. He contends that since they are smaller and employ fewer workers than do distribution companies, privatization is easier to pull off.

Javed Akbar, chief executive of Javed Akbar Associates (Private) Limited, an energy consulting firm, is more bullish on energy sector privatization. He believes it should be implemented across the board. The lesson of recent history, he writes, is that public sector efforts to address energy challenges have produced unsatisfactory policies (such as bad pricing regimes) and infrastructure (such as capacity-constrained thermal power plants), or become bogged down in bureaucratic recalcitrance and political squabbling. He calls for the privatization of public sector thermal power units and distribution companies. He highlights the chief success story of energy sector privatization: in the five years after Abraaj Capital took over the generation, transmission, and distribution aspects of the Karachi Electric Supply Company, or K-Electric, generation capacity increased by nearly 40 percent; fuel efficiency in power generation rose by nearly 25 percent; and T&D losses fell from 36 to 28 percent (these numbers, admittedly, are disputed within these pages; Ali claims that K-Electric's losses still register at 34 percent).

Akbar, like Ali, writes about the strong potential of indigenous tight and shale gas. He cites official Pakistani estimates that current reserves of these gas alternatives are quadruple those of conventional natural gas. If they are properly exploited, Pakistan could conceivably double its natural gas production within 20 years. To reap this vast potential, Akbar calls for the state-owned Pakistan Petroleum Limited (PPL) to sell 26 percent of its equity to an overseas company with the capacity to explore and rapidly develop these promising hydrocarbon reserves. Akbar believes that if this PPL experiment is successful, then Pakistan should consider a similar divestment with OGDCL, the larger of Pakistan's two public sector hydrocarbon companies.

A key question, however, is whether the private sector is truly committed to investing in Pakistan's energy sector. Many of this volume's

contributors—including Malik, a high-ranking government official—admit that the sector lacks sufficient competition. Lesnick says that no new international oil companies have entered Pakistan over the last decade. However, it has not always been this way. In fact, as the essay of **Shannon Grewer** chronicles in detail, several decades ago investors—impelled by ultra-attractive financing incentives that included generous tax exemptions—poured capital into Pakistan's energy sector. In the 1990s, writes Grewer, managing director at EMI Advisers LLC, a firm that provides advice on energy sector investment, Pakistan attracted $5 billion in investment and added nearly 4,500 MW of generation to the grid—and in record time. Pakistan enjoyed a power surplus, and was "hailed as a model" for power sector growth projects in the developing world.

And yet Pakistan's energy security soon deteriorated. Grewer explains that this was because Islamabad had guaranteed private investors a set return on their invested capital regardless of the performance level of their projects (which were mainly power plants). Since investors knew they would be paid handsomely regardless of how their projects turned out, they had no incentive to prioritize keeping down costs—or using technology that would maximize plant efficiency to generate large amounts of energy at low costs. Consequently, investors opted for expensive and shoddily constructed facilities that produced energy at higher-than-average costs. Eventually, energy costs rose—triggering new hardships for the Pakistani masses even while the independent power producers (IPPs) enjoyed high returns. A popular backlash ensued, prompting Islamabad to revise its investor policies. Today, Pakistan has gone to another extreme: it has capped the amount of money investors can make off of their projects. This means that investors now favor cheap and inefficient technology—with less energy produced altogether. Project developers are now rewarded for using the lowest-cost solutions, laments Grewer, "even if there are alternatives that would produce less expensive energy on a per kilowatt basis." She recommends that the Pakistani government, instead of obsessing about how much money investors will make, should design policies that incentivize the most cost-efficient production of as much energy as possible to bring down the per unit price as low as possible. Policymakers, she concludes, should "focus on developing policies that encourage investment in energy generation at a price that the country can afford."

COORDINATION AND CONSOLIDATION

Several of this book's contributors argue that major institutional reforms within Pakistan's energy sector are needed to attract more private investment—and to produce more effective and sustainable policies on the whole. It is a view embraced even by those holding leadership positions within the sector. **Nargis Sethi**, who at the time of the 2014 conference was secretary for water and power, contends that "organizational and institutional weaknesses" have spawned bad management and corruption. Several years ago, eight distribution and three generation companies emerged from the unbundling of the Water and Power Development Authority—and yet today they still find themselves under the administrative control of the Ministry of Water and Power. This latter ministry, where Sethi was secretary, "is totally preoccupied with operational and development matters" and therefore has no time for policy formation and policymaking.

Sethi recommends that the water and power ministry's largely administrative role become more policy-focused. The ministry, she contends, should become a "nerve center." It must "coordinate, lead, and be a watchdog so that public complaints are redressed and energy policies and plans are fully implemented without any bottlenecks and unnecessary bureaucratic hurdles." She also calls for reforming the structural aspects of Pakistan's energy sector regulatory bodies so that they are more autonomous and effective. Additionally, she recommends the establishment of a new mechanism to address disputes that arise between one of these regulatory entities, the National Electric Power Regulatory Authority (NEPRA), and the government.

Ziad Alahdad, a former director of operations at the World Bank, advocates for institutional reform throughout Pakistan's energy sector, and not just within its individual entities. His essay calls for a better coordinated energy sector with more integrated and focused planning—a concept that he defines as Integrated Energy Planning and Policy Formulation (IEP). What Pakistan needs, he declares, is "the ability to bring together the various subsectors of the broader energy sector through a robust mechanism." IEP has both analytical and institutional dimensions. The former entails the smooth integration of energy subsector plans and policies to support national objectives. Alahdad believes

that Pakistan already enjoys the capacity to build this analytical dimension, thanks to the Hydrocarbon Development Institute of Pakistan, a well-regarded research outfit connected to the Ministry of Petroleum and Natural Resources. The institutional dimension of IEP—which entails the establishment of a separate ministry or other entity with overarching responsibility for the energy sector—will be more difficult to develop. With over 15 agencies and ministries involved in energy policy, coordination today is "well-nigh impossible," Alahdad writes. Different entities manage different energy resources—and in the case of biomass, different entities manage the same energy resource. Additionally, each major energy resource has its own regulating entity.

Energy sectors across the world have adopted IEP, Alahdad writes, and the World Bank's current energy strategy accords top priority to sector-wide planning. Pakistan itself has flirted with the concept, which was partially introduced in the 1980s with the establishment of an Energy Policy Board to facilitate the integration of sector-wide plans and policies. However, the experiment was short-lived and ultimately failed—thanks in great part to "the power of vested interests" and to bureaucratic inertia that stubbornly resists institutional change involving authority shifts. And yet, according to Alahdad, the benefits of IEP are immense. For example, in Pakistan, it can alleviate crippling sectoral debt by helping craft an affordable energy balance (Pakistan's current oil-dominated annual energy import bill will soon reach a whopping $38 billion, Alahdad estimates), and by emphasizing cheaper ways to ensure power availability—for instance, better managing existing resources instead of building expensive new power plants.

SUSTAINABLE SOLUTIONS, NOT SHORT-TERM FIXES

Given the acute nature of Pakistan's energy crisis, this book emphasizes short-term correctives. At the same time, contributors readily acknowledge that the crisis is too complex to be solved overnight. For this reason, they offer recommendations for both the short and long term. These measures are meant to go beyond short-term fixes, and to avoid Pakistan's tendency to restrict its policy responses to what Alahdad describes as short-term "continuous crisis management."

The following recommendations represent a sample of those proposed by the book's contributors. They are listed here not for the sake of endorsement, but rather to spark debate about how best to respond to a crisis that refuses to go away.

Thinking About Energy

1. **Emphasize demand-side solutions as much as supply-side measures**. Establishing more generation capacity and tapping into indigenous hydrocarbon reserves will do little to ease the energy crisis if resources continue to be used inefficiently and wastefully. Energy can be created not only by increasing supply, but also by repairing poorly maintained generation plants and dysfunctional T&D systems.

2. **Underscore the critical role of data collection and technology**. Credible data collection—drawing on information provided by knowledgeable and reputable sources—can help inform more effective energy policies. It can provide a detailed picture of why and where T&D losses are occurring, and enable policymakers to respond accordingly. It can also help officials determine appropriate cost structures for new energy projects. Technology, meanwhile, can contribute to more efficient energy production and management. Pakistan should deploy equipment and machinery that is cost-efficient, and it should utilize smart meters and other devices that enable authorities to constantly monitor patterns of energy consumption.

3. **Do not overlook noncommercial energy**. Pakistani policymakers focus heavily on commercial energy, a key ingredient of national growth. However, biomass—firewood, dung, and crop residues—constitutes a significant proportion of total energy consumption in Pakistan, and is the chief household fuel in rural areas. In fact, noncommercial energy accounts for half of overall demand. Neglecting noncommercial energy consumers constrains growth in the long term. Pakistan should incorporate noncommercial energy into plans and policies, and recruit more policymakers with expertise in this area.

4. **Take the experiences of other countries—both good and bad—into account**. Turkey and Kazakhstan have effectively managed critical energy challenges by prioritizing coordinated planning and full implementation. In India, authorities have brought high T&D losses down in some regions through more modern forms of management, useful technologies such as smart distribution transformers, and a new anti-theft law. At the same time, Germany has struggled to build a sustainable renewable energy program, which observers attribute to an overly politicized reform process. Additionally, franchising models for distribution companies have experienced varying degrees of success in India and Australia.

Energy Mix

1. **Achieve a more affordable energy balance**. Move away from expensive hydrocarbon (and oil-dominated) imports and more toward the exploitation of untouched domestic reserves. To the extent that importation must continue in the short term, target more coal and less oil.

2. **Embrace coal**. In the short term, convert furnace oil-fired plants to coal, and redouble efforts to develop new coal-fired power plants with the understanding that many functions will be passed on to third parties and that the plants will eventually become IPPs. To mitigate environmental risks, introduce coal briquettes as furnace fuel. Briquettes are cleaner than ordinary coal when burned, and do not leave dust and debris.

   In the longer term, pursue the Thar coal project, which has already made some progress in the areas of infrastructure and financing. Initial objectives for Thar should be the development of a mine of 7.6 million tons per annum and 1,200 MW of generation capacity, along with the construction of infrastructure—especially a rail network—to transfer coal around the country. Pakistan should target investors through the use of competitive international bidding.

3. **Capitalize on opportunities for natural gas and renewables**. Pakistan should take advantage of its large reserves of unexploited

natural gas alternatives such as tight, shale, and biogas, and turn to the private sector to kickstart tight and shale gas development. In the immediate term, Pakistan should pursue the natural gas pipeline project with Iran—an initiative that could bring Pakistan up to a billion cubic feet per day of additional gas. Pakistan should start constructing 750 kilometers of the pipeline now, and build the small remaining portion (stretching from the Gwadar port into Iran) if sanctions are lifted on Iran. The gas pipeline with Iran would bring not just energy relief, but also financial relief: gas coming via pipeline from Iran would be significantly cheaper than the cost of LNG.

Meanwhile, photovoltaic solar cell prices have fallen significantly in recent years. Accordingly, Pakistan should develop utility company-sized solar power sites (larger than 50 MW) nationwide, and connect them to the power transmission grid to support daytime peak power demand. The Pakistani government should also encourage, through duty-free imports, the installation of solar panels on homes and buildings to serve increasing demand in residential and commercial sectors. Furthermore, distribution companies should develop the capacity to take surplus solar power from homes and buildings to help meet their peak power demand. Additionally, NEPRA should court solar and wind power investors by offering reasonably priced tariffs. Solar and wind power costs are falling, and new plants could conceivably be brought online following a timeline of less than a year. In Pakistan, these renewables have the potential to be rapidly deployable and cost-competitive with other fuel sources.

Energy Markets and Pricing

1. **Make Pakistan's energy sector more attractive for investors**. Introduce more meritocracy, transparency, and accountability. Reduce the level of government involvement. Scale back subsidies, but retain support for the poor. Limit price controls. Additionally, do not let geopolitical considerations trump economic opportunities. Pakistan's aggressive courtship of Chinese companies makes investors from other countries fear the lack of a level playing field. At the same time, do not let the pursuit of investors eclipse national energy policy imperatives. Accordingly, when crafting investment packages,

policymakers should be motivated above all by what will produce energy plentifully and efficiently—and not by how much (or little) money will accrue to investors.

2. **Adjust gas prices**. The cost of gas should be aligned more closely with wholesale prices in Europe, where they run from $8 to $10 per MMBtu. The gap in prices between compressed natural gas and diesel/gasoline should be narrowed. Gas prices should not be indexed with those of oil, a more expensive resource. Additionally, gas tariff policies should be adjusted so that industry consumers bear a larger brunt than residential ones. Finally, the industrial gas tariff should be doubled.

3. **Implement energy tax policies that bring more energy efficiency and assist the poor**. Pakistan should abolish the petroleum development levy (PDL), a tax slapped on petrol, diesel, and kerosene—three fuels that are more expensive than gas, and that are used disproportionally by the poor for cooking and transport. For these reasons, Pakistan's poor are hit particularly hard by the PDL, and would enjoy immediate relief if it were eliminated. At the same time, Pakistan should continue to apply the gas infrastructure development cess (GIDC, a tax placed on gas infrastructure development), because it can help reduce price disparities between natural gas and petroleum. The GIDC has increased natural gas prices in Pakistan, and can therefore contribute to more judicious gas use. Higher prices may encourage less wasteful consumption.

Energy Governance

1. **Reduce T&D losses immediately**. Pakistan's initial target should be reducing the current loss rate—more than 20 percent—to around 16 percent, and then eventually to 10 percent. Given the political obstacles associated with raising tariffs, T&D loss reduction may be the most realistic way to reduce circular debt in the energy sector. Energy officials should introduce technologies that allow them to better identify where the problems lie, and official studies should be commissioned. When these studies are published, poorly performing

distribution companies should prepare action plans to reduce their losses by half within five years.

2. **Take energy theft more seriously**. The government should better enforce existing laws (and pass new ones) against the practice, and institute more punitive measures—such as denying bail. Influential groups—including media personalities and religious leaders—should educate people about the irresponsibility of theft. Local communities should form electricity user associations that monitor energy use, conduct audits, and identify and report electricity thieves. At the same time, officials should focus more on the core motivations for theft. In the case of poor consumers, these include an inability to pay for energy.

3. **Be more responsible about managing energy infrastructure and finances**. Pakistan should adopt more robust maintenance regimes to ensure that power plants, transmission lines, and other key infrastructure do not fall into serious disrepair. Boost collections rates by having budget adjusters help recover arrears in the provinces. Improve bill collection by issuing credible threats to disconnect those who refuse to pay. Additionally, monthly financial planning in the power sector should be strengthened.

4. **Ramp up Pakistan's capacity to explore and develop indigenous hydrocarbon resources**. Pakistan's oil, gas, and coal reserves are vastly underexploited. Less than 4 percent of probable oil reserves and 19 percent of gas reserves have been confirmed, while just 1 percent of coal reserves have been proven. Pakistan should invest in the technology and infrastructure to tap into these reserves. Additionally, Pakistan's most resource-rich areas tend to also be its most insecure, and some local communities respond violently to what they perceive as inequitable exploitation of their resources. Accordingly, Pakistan should forge deeper partnerships between hydrocarbon industries, the government (federal and provincial), and civil society to promote greater hydrocarbon development.

5. **Intensify energy conservation efforts**. According to data in this book, Pakistan's energy savings potential is estimated at 2,250 MW—

about half of the country's total power shortfall. Pakistan should enact an energy conservation law, establish economic incentives for consumers to use less energy, and institute stricter building codes that promote more efficient energy use. Manufacturers should list energy consumption data on product labels, which can incentivize companies to produce more energy-efficient equipment. The importation of inefficient electrical appliances should be discouraged. The media and educational institutions should highlight the importance of conservation, and provide guidance on how to use energy more efficiently.

Institutional Reform

1. **Bring more coordination and order to the energy sector**. Streamline the decision-making process so that policies no longer need approvals and buy-in from so many entities. Develop a mechanism that integrates all energy subsector plans and policies to support national goals. Establish a new energy ministry or department with overarching responsibility, and with full access to top policy levels. It should be established through a gradual process, though the decision to form it should be announced upfront. If such changes are deemed too disruptive or infeasible, Pakistan should create a chief energy adviser's office with multi-ministry jurisdiction.

2. **Privatize, but slowly and in phases**. Privatization can make energy institutions more effective, because when they are untethered to the state they will have more incentive to strengthen their technical capacities and foster accountability. However, privatization is controversial and does not always enjoy bipartisan political support. While generation companies should be privatized, it may be more prudent for distribution companies—which tend to be larger and employ more people than generators—to be reorganized into smaller firms and restructured through the use of franchising. This latter model transfers operational responsibilities to private actors while the government maintains ownership over assets.

3. **Focus on making two key energy regulators—NEPRA and the Oil and Gas Regulatory Authority—more effective**. One

option is to integrate them into one institution. A less drastic option is to find ways to allow them to enjoy more regulatory autonomy. Efforts should also be made to reduce disputes that arise between NEPRA and the government, and between NEPRA and its licensees.

TROUBLE ON THE HORIZON

In early 2015, Pakistan's sputtering economy began to show signs of life, with international lending agencies forecasting growth at around 4.5 percent—compared to a five-year average of 3.6 percent.[8] Macroeconomic stabilization, even if modest, could bode well for a debt-burdened energy sector. Also in early 2015, electricity subsidies, previously equivalent to about 2 percent of GDP, fell to 0.7 percent of GDP.[9] Meanwhile, in May 2015, Pakistan inaugurated its first-ever solar power plant, which was expected to produce 1,000 MW of power by 2016.[10]

Such hopeful signs, however, are limited. Events in late 2014 and early 2015 have underscored how Pakistan's energy crisis remains deeply entrenched, with troubling manifestations and implications. Fuel shortages left filling stations dry and motorists stranded. Forced outages at four separate power plants took 2,000 MW off the grid.[11] Textile industry leaders—who run the country's largest export-oriented sector—announced massive layoffs. This is because many factories, forced to operate expensive generators that they could not afford, had to shut down.[12] Meanwhile, the International Monetary Fund's latest estimates (in April 2015) pegged circular debt at around $5.3 billion—significantly higher than the $3 billion figure frequently cited in 2014.[13] And a government effort to sell shares of its largest energy company, OGDCL, was cancelled due to political unrest and falling oil prices.[14] "It is fair to say," concluded Pakistan's influential *Dawn* newspaper in an April 2015 editorial, "that by now the government has lost the initiative in tackling the power crisis, and appears to be muddling through like all previous administrations."[15]

And yet it could get worse. Pakistan is in the midst of rapid urbanization—a major societal shift that could worsen the effects of its energy problems in the years ahead. Estimates suggest that at least 50 percent of Pakistan's population could be concentrated in urban areas by the 2020s.

However, according to density-based definitions of urbanization—which classify urban space as any area with 1,000 people per square mile—Pakistan is actually about 60 to 65 percent urban today.[16] Demand for electricity is particularly high in cities, because urban industries and homes tend to be more dependent than those in the hinterland on grid-connected energy sources. With droves of Pakistanis entering cities and becoming dependent on grids, supply pressures will deepen exponentially.[17]

THE COSTS OF INACTION

The stakes have never been higher. Demand for energy will rise dramatically in the coming years, and if the crisis is not overcome soon, Pakistan could face unprecedented shortages. A quick glance at the data provided in this book captures the seriousness of all this.

Back in 1947, Pakistan's total power generation capacity was 60 MW. Today, installed electricity capacity is about 23,000 MW—though actual production stands at just 12,000 MW. Malik, in his essay, describes how the government added 2,000 MW over a year-long period—though only about 1,500 MW of it is online.

Over a period stretching from 2014 into 2015, peak demand was 20,800 MW—and this figure is expected to rise to nearly 32,000 MW by 2019. In effect, in just a few years, national demand will exceed, by nearly 10,000 MW, current installed capacity (the gap is even larger when taking into account actual production). According to Ali's essay, Pakistan may need to install as much electrical capacity in the current decade as it did over the last 60 years. And yet beyond the current decade, meeting demand will grow even more difficult. Energy demand will nearly double in the next 10 years, Ali projects, and it will quadruple in the next 20. This all suggests that Pakistan will be placing tremendous amounts of hope in that $35 billion in energy investments pledged by China in April 2015—and the 17,000 MW of new generation capacity that the investments are supposed to produce. And yet, especially at this early point, there is no guarantee that these investments will produce their expected outcomes—despite the assurances given by Chinese and Pakistani officialdom. Additionally, as this volume repeatedly makes clear, supply increases alone will not solve energy problems.

In effect, if Pakistan does not move with alacrity to address its energy woes, the challenges that the crisis presents today will seem insignificant compared to what could be in store for the country in the years ahead.

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Finally, this book is dedicated to Adam and Jun. Unlike Pakistan, these two little boys always have plenty of energy.

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Pakistan's Energy Crisis: Challenges, Principles, and Strategies

MUSADIK MALIK

This essay examines the energy challenges in Pakistan, the salient features of our new organizing principles, and the short to medium term corrective measures that we are trying to take—and the challenges that may be encountered along the way.

ASPIRATIONS AND TARGETS

We live in a world of about 8 to 12 hours of load shedding. Last year it was 10 to 14 hours. We would like to build a country where we have enough power that basically gives comfort and a life of integrity to our people, and that also allows us to do development and to continue on the trajectory of economic growth. That is what we would like to see.

We are in a country where the cost of power to the end consumer is very high, and we would like to basically create a framework through which we can provide not just electricity but electricity that people can afford comfortably.

We live in a region, South Asia, which is one of the most inefficient power markets in the world, and in a country, Pakistan, which is one of the most inefficient power markets within South Asia. Our aspiration, if

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nothing else, is within the next four to five years to be the most efficient power market or power economy in South Asia.

And finally, we constantly run into this issue of circular debt within our energy sector, which basically means that we do not have a viable or sustainable power economy. We would like to build a power economy that is sustainable and affordable, and that gives confidence to our investors that if they come to Pakistan, in real terms they would be making at least a 20 percent return on equities, with federal government guarantees.

Broadly speaking, this is the world that we are trying to construct in the power economy in Pakistan. We have come up with some very specific targets. As of 2013, on average we had about a 5,000 megawatt shortfall between demand and supply. We would like to bring this down to zero within the next five years. Right now we are providing electricity at 14.6 cents or 14.7 cents to the end consumer per unit. To provide a sense of comparison, in the wholesale market in India, power is getting

Figure 1: Strategic Thrusts and Aspirations

STRATEGIC THRUST	FROM…	…TO
Diminish Supply-Demand Gap	A widening supply demand gap leading to 8–12 hours of load shedding daily	A power generation capacity that can meet Pakistan's energy needs in the long-term
Create Affordable Electricity	An expensive electricity generation system	Inexpensively generated electricity universally available at affordable rates
Build Operational Efficiency	A highly inefficient generation, transmission, and distribution system	Highest levels of generation, transmission, and distribution efficiency in South Asia
Create Sustainable Sector	An unsustainable economic model that discourages investment and creates circular debt	A profitable and bankable power economy that invites investment and protects public interest

traded at around seven cents. So there is an enormous cost differential. The economic burden of electricity that falls on our end consumers, and also on our commercial and industrial enterprises, compromises competitiveness. We would like to make sure that over a period of time—within reason—we bring down the cost to the end consumer to close to 12 cents, and the cost of production down to the single digits.

We currently have transmission and distribution losses close to 22 percent. Most of this is distribution losses, much of it theft. Over a short period of time we would like to bring this rate of losses down to around 16 percent, and then over a reasonable period of time we would like to not have transmission and distribution losses of more than 10 percent.

Finally, our collections right now average 87 percent. We'd like to increase our collections rate to 95 percent, and eventually to 98 to 99 percent. These are the targets that we are chasing in our new reform agenda.

THREE TOP ENERGY CHALLENGES

There are three major issues. Number one is the big supply/demand gap, number two is affordability to and for the end consumer, and number three is inefficiencies—in Pakistan, a code word for pilferage. These are three major hurdles that we are trying to overcome.

Demand/Supply Gap

In 2012, we had an average gap between supply and demand of about 5,000 megawatts, which was lending itself at any given point in time to about 10 to 12 hours of load shedding. Load shedding is not equally distributed on an everyday basis, so this load shedding peaked at around 6,000 megawatts that year. This has led to 14 hours of load shedding. This is exactly what was happening in 2013 as well, when we held our national elections. It was a really, really bad year for us energy-wise.

Affordability

When an audit was done in 2013, the average cost of production of electricity (generation cost) was about nine cents and change. As noted

earlier, in India this figure has been about seven cents. Why this differential? The answer lies in the energy mix that we have.

If you look at our energy mix, you will find that about 44 percent of our energy is coming from either diesel or residual fuel oil (RFO), furnace oil, or mixed fuel. Because of this burden, and because of the high cost of oil, our cost of production has gone up quite significantly. This is compromising our competitiveness and putting a burden of electricity or energy on the end consumer.

Inefficiencies

As if the cost of production were not bad enough, we also have challenges of distribution. Recall the transmission and distribution losses in Pakistan; a 21 to 22 percent loss rate is very high. The biggest chunk in this is the distribution losses, although we can stand to improve transmission losses as well. This is where all of the theft and pilferage and corruption are hidden, and where all of the inefficiencies are. It's also where all of the mismanagement is. This is the focus of our attention now.

And if all this were not bad enough, we also do not collect money very well. One hundred units of electricity are produced at a very high cost, which is problem number one. In transmission and distribution we lose about 22 of those units, which is really, really bad. With 22 units lost, you are left with about 78 units. And of those 78 units delivered, we are only collecting about 32 or 33 percent of those 78 units. When you have a power economy like this, you may as well begin to give out electricity for free—because at least you would get some political mileage out of it.

This is not a sustainable framework, and we need to change these problems that we are encountering in our power economy. In 2013, when our regulator assessed the cost of delivering electricity to the end consumer, it turned out to be 14.67 cents. We were selling electricity at that point in time at 8.8 Pakistani rupees, or 8.8 cents per unit. So there was a gap of about six cents per unit. Every time we produced a unit of electricity we were losing six cents, and this six cents was culminating in 5 billion dollars' worth of circular debt that you hear about over and over again.

Meanwhile, the tariff that we are now charging—the effective tariff that we are charging to the end consumer—has gone up. However, we are protecting the poor. We have protected people who are using

less than 200 to 300 units. Primarily we have protected people who are using less than 200 units. And we have protected people marginally between 200 and 300 units. What does 200 units mean? 200 units equates to having two or three light bulbs and one fan, perhaps two fans, and one power charger. That is it. This is the level of poverty that we are talking about. If you have ever seen a Pakistani whose clothes are ironed, or if you have ever seen a Pakistani who has a refrigerator and can basically buy milk in the morning and save it in the evening for his children, then he is not among the 68 percent of people of Pakistan who are consuming electricity at that very modest level.

So when we are asked to basically pass the real cost of electricity to the end consumer, I just want to set the context so that you can begin to understand whom are we trying to protect. We had about 6 to 7 billion dollars' worth of predicted subsidy or circular debt built into our power economy, but with the tariff rationalization that we carried out in 2014, it has dropped now to a subsidy of about 2.8 billion or 3 billion dollars. And this subsidy is going only to those aforementioned 68 percent of consumers.

If we are able to bring our transmission and distribution losses down to 10 percent or less, then even with the government taxes on power we can still bring the cost of delivery down from 14 cents to about 11.7 cents. This will not be easy, given that right now these losses are north of 22 percent. However, if we succeed in doing so, then our power economy becomes sustainable and viable.

ORGANIZING PRINCIPLES

It is important to understand that we reflected on our energy challenges and concluded that the problem is not just tactical—it is not just a matter of transmission losses or high costs of production. We sought deeper, root causes, and this is what we found.

New Power Market Structure: From Red Tape to Red Carpet

We found, first of all, flaws in the current structure of Pakistan's power market. We call it the red tape market—one driven by regulations and

opportunistic types of transactions and bureaucracy. We want to move from a red tape to a red carpet market—one that is laid out not just for our investors, which is what comes naturally to mind, but also for end consumers and employees. If we're not laying out this red carpet for everyone, our power economy is not going to transform.

Changing the structure of Pakistan's power market will require moving from bureaucracy to efficiency, from regulation to competition, and from opportunistic transactions to a sustainable strategy for our power economy. If we can change the founding and organizational principles of the power economy of Pakistan, then the rest shall follow.

From Bureaucracy to Efficiency

There are three pillars associated with bringing efficiency into our power market structure. The first is merit order—whether in the context of dispatch orders, payments, or prioritizing who gets fuel, everything must be based upon merit. We believe that if we have a system of merit in generation, transmission, and distribution, then we would be moving toward efficiency.

One cannot have a merit order without transparency. Without transparency, a merit order would create a client/patron relationship and a black market—in effect, it would simply create another way for transacting in this black market. The most important thing in making this market structure transition is to create transparency—where there is equal information for and to all. If we are able to have this merit order and make it visible through transparency, then we would have efficiency.

What would then naturally come out of all of this is accountability. We need to have competent leaders in various positions from within and outside the market. They need to come and run Pakistan's power market as a business—because it's not being run as a business right now. And in the wake of this merit order, and in the wake of this transparency, we would need to hold these people accountable. We believe that if we are able to create a merit order, and if we are able to create transparency around this merit, and if we are able to hold people accountable, then we'd be able to move our power market more and more toward efficiency.

From Regulation to Competition

How are we going to create competition? Our framework is a little bit of mimicry of what Singapore has done, or what Dubai has more recently done, or what has partly been tried by Ireland. The idea is that we will build, and they will come. Pakistan's brand is down for both unfounded and very well-founded reasons. Therefore if we want people from outside to come and commit to Pakistan, then first we Pakistanis have to commit to Pakistan. The current government of Pakistan is committed to building the essential infrastructure. Whether it be Gadani, Dasu, or Bhasha, in the case of all these power projects the government of Pakistan is saying: "We are by God going to do this because we are doing it for our own children. If other investors come along and help us we will be able to do it in four years, but if they don't come along we will do it in seven. But by God, we are going to do it."

With this kind of commitment, and if we are able to put resources behind this commitment, people will begin to have a little bit of confidence in Pakistan, and they will begin to invest in Pakistan. We basically are creating energy cities, energy corridors, and public/private partnerships—such as in Gadani, where we are developing a port, a corridor, and utilities infrastructure, and building up 6,600 megawatts of energy. In all of these areas, we are partnering with the private sector. We are working very closely with multilateral donors to come and join hands with us to build the large hydro project at Dasu, and we are right now trying to find financing for a dam at Bhasha. We are moving forward on hydel, coal, and a number of other accounts, and we are hopeful that if we continue to put our money where our mouth is, then others will also begin to participate in the development of the energy sector in Pakistan.

Now, once we start to build this and we invite the private sector, then how are we going to transact? We believe that we should work through fees and tariffs rather than through cost-plus models. This is because cost-plus models create black markets: If someone wants to invest, a bureaucrat has to sit and go line-by-line and allow for one cost while rejecting the other cost. This creates all kinds of suboptimal transactions and black markets. We believe that we should do our analysis up front and figure out what a fair return on a fair kind of reasonable investment should be—and then provide an upfront tariff, which would give very

aggressive returns to investors. We should then do competitive bidding, let the best bidder win, and then get out of the way of the private sector and let it do its job. Our job is to do the analysis up front, and then let the competition come in and drive costs down.

In essence, first we build the infrastructure, second we give the up-front tariff and let people bid and compete on the tariff, and third—the more important part, and the part where we have not quite succeeded as much—is the real red carpet aspect of this story. This will involve a change of mindset. An initial idea has been to introduce what we call key client managers—just like in banks—so that the job of our secretaries, deputy secretaries, joint secretaries, and so on would not be to basically pull out a pen and say what is wrong, but instead to make our investors and consumers successful and to run with them to the finish line, and with integrity. This is the mechanism through which we believe we are going to bring about competition.

From Opportunistic Transactions to a Sustainable Strategy

This is a simpler equation. As was noted earlier, our power mix is lopsided and is characterized by very high-cost power. We need to move to a low-cost power mix. We are trying to create a balanced portfolio, so that we are not hedging on a single power source. We have received some slaps on our wrists because of our focus on coal. In fact, we are currently producing zero percent of our electricity from coal, and I believe the United States is producing about 44 percent and India about 60-something percent, and China is producing even more. We are not thinking about having 100 percent of our energy come from coal. We just want to have a balanced portfolio so that our cost of production comes down.

And we have to come to coal reluctantly and grudgingly, because we know that it is a dirty fuel. We know that it places a burden on the environment, and we know that it places a burden on health. But we are a poor country, and we have to create a portfolio that is affordable. We are mixing it up with hydel, we are mixing it up with some renewables, and we are mixing it up with other sources so that we have a sensible and balanced portfolio in which the coal component does not become 90 percent or even 70 percent, but rather a reasonable percentage as in other countries. A fair mix is what we are trying to do.

We are also trying to have a level playing field; we have to protect the poor. So we will protect the poor, and at some point in time we may have to cross-subsidize and charge commercial enterprises or industrial enterprises a bit more. But for now, we are not at that point. We will cross that bridge when we get there. Our principle is that we will continue to protect the poorest of the poor in Pakistan even in our desire to get rid of these subsidies.

And finally, if we are going to think about sustainability we cannot just look at the supply side because supply is just one part of the equation. The other is the demand side. We are going to have a focus on demand management. We currently have a bill, which is I believe with the cabinet, that if approved would allow us to do all of the things that we have been thinking about: Time-of-day metering, technology standards, Greenstar compliance standards, building standards, and so forth. With this combination, we would be able to build these three anchors of efficiency, competition, and sustainability. And if we are able to do so, we believe that we would have a reformed, viable, competitive, and affordable power market—and hopefully provide relief to the people of Pakistan.

STRATEGIES AND PLANS

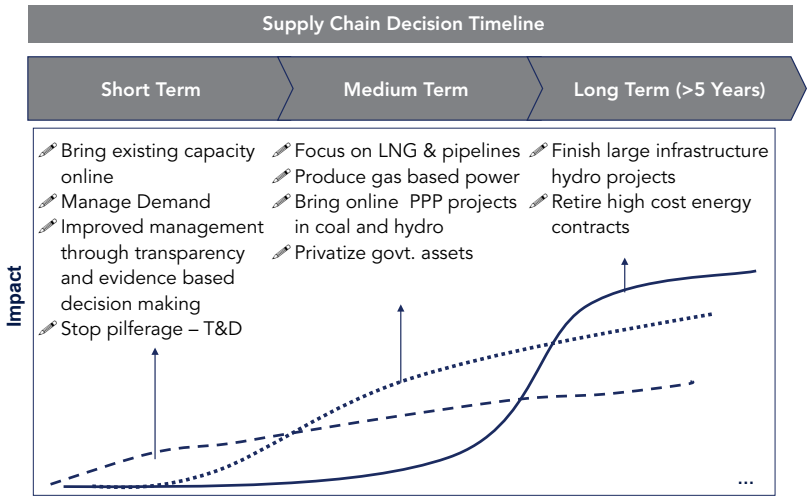
This section highlights specific short- to medium-term measures that we are taking to address the energy crisis.

The shortest run thing that we are going to do is bring existing capacity online. We will also better manage demand, improve management, and stop pilferage and broader losses in transmission and especially in distribution.

For the medium run we are going to focus on our large projects. We are going to focus on Gadani, which is our 6,600-megawatts-worth-of-coal power generation corridor. We are going to focus on Thar, which has its own complications of mining. Nevertheless, we are committed and we are focused on it. We are also working on Dasu. The first stage of Dasu will take three or four years. Gadani would take four or five years, Thar may take four to six years. But these are medium-term things that have to happen for Pakistan to move forward.

Figure 2: Supply Chain Decision Table

We will improve efficiency in the short run; build mega low cost PPP projects (coal and hydro) in the medium run; and finish the large infrastructure projects in the long run



Note: PPP=public-private partnerships.

We are also setting up liquefied natural gas (LNG) terminals that would allow us to import gas. Right now we hear a lot about gas, gas, gas—but we do not have gas. And because we do not have gas, we cannot produce electricity through gas. If we do eventually produce electricity through LNG, it is not going to be as affordable as it is right now. However, it is clean, and if it falls within our target of under 10 cents per cost of production per unit, then gas it is.

In the long run, we have large hydel infrastructure—the Bhashas and Dasus of the world. These are large infrastructure projects that will take anywhere from five to eight years to build. This is what needs to be done for the country. We have to do the right thing because we have been doing all sorts of wrong things for too long, and if these things have to happen in seven years then they happen in seven years and so be it.

Generation and Supply Management

Over the past year, we have added about 2,100 to 2,220 megawatts of power to the grid by fixing some of the available capacity and putting in a little bit of new capacity. Some of the wind capacity is new, and some of the gas and furnace oil capacities are old—so it is a good mix. However, due to technical problems, not all of this is online. Out of this 2,100 megawatts, about 1,500 to 1,600 megawatts are online. However, no matter how you slice it, we have added about 1,500 to 1,600 megawatts last year. The actual capacity that we brought online, not the operational capacity, is about 2,100 megawatts.

So that is what we have done. We need to continue along this trajectory to bring existing capacities online, and we are committed to doing that.

Demand Management

We have a very bizarre marketplace, where the markets stay open until 11 p.m. If you go to Europe, most of the commercial enterprises are closed around six or seven o'clock. For a country that is energy starved, I think it would make sense to use the sunlight and do our commercial transactions in the sunlight—and then at a reasonable point in time, whatever that point in time is, shut down the commercial enterprises and shave off the peak load.

Additionally, the hope is that our industries will begin to use more efficient kinds of energy and more efficient equipment. I was shocked when I realized that there are 22 million energy-reading meters in Pakistan, of which 350,000 are industrial ones. These 350,000 industrial meters were drawing 24 percent of the total power subsidy. It is unfair, in a country where people cannot store milk for their children, for people who are making money from consuming electricity to get 24 percent of the total subsidy. We are going to pass the real cost of electricity to people who are using electricity for commercial and industrial purposes.

Transparency and Evidence-Based Decision Making

We're very grateful to USAID, which has installed smart meters in Pakistan. These devices record energy consumption in real time, in

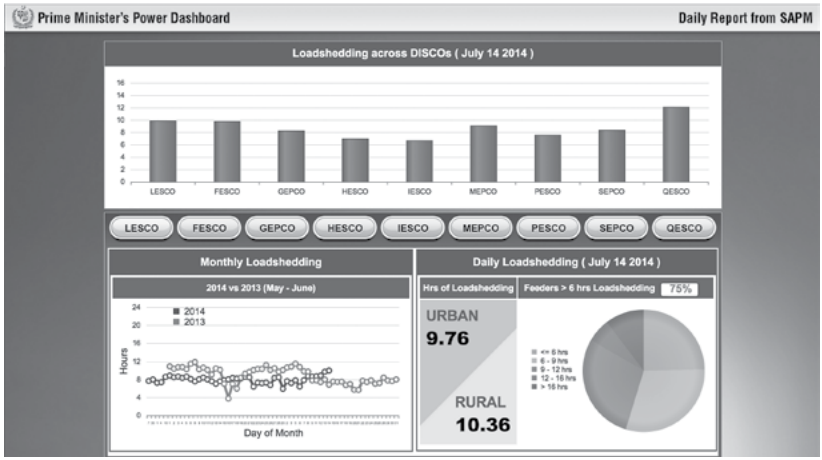
intervals of an hour or less, and transmit the data back to the utility for monitoring and billing. This has allowed us to do evidenced-based decision making on energy, to know where we are bleeding and how much we are bleeding, and to help us understand what we need to do in response. At 15-minute intervals, we are getting approximately 9,000 feeders. At 15-minute intervals, we are getting how much energy comes in, and how much energy goes out. There are engineers involved, and each one is responsible for about five to seven of these feeders. We are going to hold these engineers accountable. Every engineer will have to give a profit and loss statement for his feeders.

Figure 3 depicts one of the dashboards that we are building for the prime minister. It depicts exactly how much load shedding is going to be occurring on a particular day. It shows this year's load shedding as compared to last year's. It breaks things down in an urban and rural context. The pie chart tells what percentage of feeders had less than six hours of load shedding, between seven and nine hours of load shedding, nine and twelve hours of load shedding, and so forth, so that we know specifically what is happening to end consumers and what is the magnitude of pain being inflicted upon them by mismanagement.

With this dashboard, you will also be able to pull up all of the feeders in a particular grid station and ask a fundamental question: Why is there so much variance? Why is this area getting four hours or six hours, and this area getting twelve hours? This is where the bootlegging takes place; this is where the load shedding is sold and bought and traded in a suboptimal manner. Fortunately, we have now been given a very clear visibility of what is happening in the country, we can curb the problems, and we can have an equitable kind of framework for load shedding distribution.

The prime minister's dashboard also allows us to look at how load shedding has evolved over the course of a month or year. We can track whether it is increasing or decreasing, and how it is moving (see Figure 4). Once this becomes public information—because we are now piloting and beta testing it—everyone will be able to see what is happening and how it compares to people's neighbors and to people living in the jurisdiction of other distribution companies. They will be able to ask a fundamental question: Why? This is what I call transparency. In the absence of this transparency, the merit order mentioned earlier is not very realistic.

Figure 3: Prime Minister's Dashboard



Furthermore, this dashboard system allows us to look at breakdowns over the course of a day (see Figure 5). We can basically see where the breakdown has taken place, and why a whole grid station is out—which means 10 to 12 feeders and maybe half a million people. We can ascertain why there is no access to power, and what has happened at the grid station.

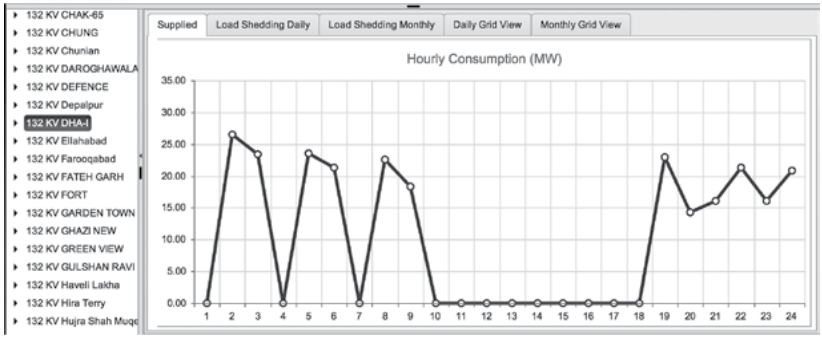
This all represents a level of transparency that can allow us to reform our distribution. This represents the evidence and infrastructure essential for policy-making and decision-making—and yet previously, we did not have access to it. Every single time we asked for a number, we got a different number depending on the time of the day and the mood of the guy who was giving the information. Now we have credible information.

Distribution Improvements

Here we have taken three views. One is a customer view on distribution, which revolves around load shedding—because that is what people are affected by and what they are invested in. How much load shedding

Figure 4: Load Shedding at Nisar Colony Feeder (July 2014)

Figure 5: Load Shedding at DHA-I Grid Station: Anomalies and Breakdowns (May 27, 2014)



am I getting, it is fair, is it equitable, how does it compare with someone else, and why do I get more or someone else gets less? The second view is the operational view. This revolves around transmission and distribution losses—a code word for theft. We have to kill this theft, and we are committed to doing so. The third view is financial, which revolves around receivables and collections.

Customer view

Load shedding varies from 12 hours in some distribution companies to seven hours in others. Similarly, within a grid station, it varies from three hours of load shedding at one distribution company to 23 hours at another. This kind of inequity is absolutely not sustainable, and we are committed to removing it.

Interestingly, we have found no relationship between load shedding and losses. Consider the Lahore Electric Supply Company (LESCO). Low-loss feeders experience more than 10 hours of load shedding, while high-loss feeders experience less than six hours of load shedding. We are going to use this data to make sure that we have reasonable equity from the consumer perspective. Load shedding is causing up to 3 percent gross domestic product (GDP) losses every year. The losses were about 630 billion Pakistani rupees in 2013–14.

We believe that with the evidence that we now have, and with the infrastructure that took us one year to build, we will now be able to bring these losses down and bring theft down, and hopefully have a viable market.

Operational view

The distribution company for Islamabad has 6.1 percent distribution losses, while the one for Quetta has 20 percent distribution losses. Six and 20 is a very wide range. We need to figure out why this is so wide, and decrease this standard deviation or variance across different distribution companies.

We looked at LESCO, the distribution company in Lahore, regarded as one of the most efficient in Pakistan. When we went to them, they said that their distribution losses were 10.8 percent. However, this figure is misleading. Their industrial feeders had very low losses up to only 2 or 3 percent, but the mixed feeders—residential and small commercial

Figure 6: Targets for LESCO Feeders Under "Band-It" Strategy

Targets for LESCO Feeders under "Band-it" Strategy					
Gold Band 	Load-Shed 2 hours	< 13 km feeder length	5.3% losses	30-80 km feeder length	15.7% losses
		13-30 km feeder length	9.5% losses	> 80 km feeder length	15% losses
Green Band 	Load-Shed 4 hours	< 13 km feeder length	11.5% losses	30-80 km feeder length	21.7% losses
		13-30 km feeder length	15.5% losses	> 80 km feeder length	20.6% losses
Yellow Band 	Load-Shed 8 hours	< 13 km feeder length	17.4% losses	30-80 km feeder length	28.6% losses
		13-30 km feeder length	19.5% losses	> 80 km feeder length	27% losses
Red Band 	Load-Shed 14 hours	< 13 km feeder length	> 17.4% losses	30-80 km feeder length	> 28.6% losses
		13-30 km feeder length	> 19.5% losses	> 80 km feeder length	> 27% losses

and small industry feeders—were running at a 22 percent loss. How can a feeder belonging to the most efficient distribution company in Pakistan run on an average of a 22 percent loss?

As if that was not bad enough, we looked at these mixed feeders and found that about 90 percent of them were being underbuilt and parked at rural and remote feeders. In effect, the equivalent of billions of rupees were underbuilt. Whether this was due to incompetency or corruption was unclear. Whatever the reason, it was costing the system an enormous amount of money.

By being parked at remote feeders, those in charge knew that no one would raise any voice over this issue. And yet this has compromised the viability of the power sector.

Even worse, we looked at those 3 percent loss industrial feeders and found that roughly the top 30 feeders accounted for 64 percent of underbilling. So about 30 different industries were being underbilled, and 64 percent of that underbilling was parked within 30 different companies or 30 different feeders. And additionally, exactly 30 companies were being

overbilled—exactly the same amount that was underbilled. Some people were being underbilled and some were being overbilled. We are confident that with the added transparency and visibility and easier availability of data, we will now be able to solve these problems.

Additionally, working with the engineers, we figured out that transmission distribution losses have something to do with the length of a feeder: The longer the feeder, the higher the losses. So, within LESCO, we have segmented feeders by length, and established loss targets for each feeder length (see Figure 6). In terms of categorization, feeders with the largest amount of load-shedding are grouped into the red band. Those with the least amount of load-shedding are grouped into the gold band. Those in the middle are grouped into green and yellow bands.

This is the system that we are proposing: If you are associated with the bottom red band, you are going to be out or you move up. And if you are on the top, in the gold band, you get salary rewards. So there is a reward and punishment regime. Additionally, the model is dynamic because as your performance improves, the band for gold changes and the band for red changes. So as people move, the band also begins to move up to optimal or high performance. This is our strategy for improving distribution. We believe, speaking conservatively, that this system could bring benefits of roughly 41 billion rupees per year.

Financial view

We have set targets for collection rates. We are going to pick up all of our receivables and we are going to improve our collection rates. And we have linked all of this—the collection rates, the distribution losses, and receivables—with load shedding.

So if you have high distribution losses, poor collections, and high receivables, you are going to get 10 hours of load shedding. But if you have low distribution losses and receivables and fantastic collections rates, then you are going to get just two hours of load shedding. So on the one hand, we are creating individualized incentives. On the other hand, we are establishing links with load shedding. We are hoping that if we succeed at doing all of this, we will basically be able to collect about 3 billion dollars within a year. This would bring our circular debt to zero, make our market a viable market, and hopefully help us achieve or move toward the goal that we have set for ourselves.

How Coal Can Help Address Pakistan's Energy Crisis

KHALID MANSOOR

In Pakistan, coal and hydro are the only two reliable sources of energy. Coal in particular is advantageous—and arguably more desire than hydro—because coal-fired power plants can be put together with relatively short development and execution times. Also, hydro cannot provide electricity year-round because of the seasonal availability of river water.

When it comes to coal, both coal imports and the coal-rich region of Thar have a key role to play. Thar's role will increase with the passage of time. As Pakistan pursues coal, it has to align itself with China geopolitically as it is the only country that can help arrange financing for coal-fired power plants. Islamabad must also be cautious about the environment, and must comply with strict environmental quality standards to reduce the negative impact of carbon dioxide emissions.

Islamabad has chosen coal and hydro as the main drivers of its effort to address the country's power crisis. While Islamabad is absolutely right in this choice of fuels, it needs to adjust the ways it implements this choice. Conventional independent power producers (IPPs) have a long gestation period, particularly in the context of current infrastructure constraints. Meanwhile, conventional generation companies (GENCOs, the power companies owned by the government of Pakistan) can be developed quickly—but they have failed miserably in the past to provide sustainable and efficient supplies of electricity. Unfortunately, these are the only two institutional models Islamabad is currently using.

KHALID MANSOOR is chief executive of The Hub Power Company Limited (HUBCO), Pakistan's first and largest independent power project.

IS AN EMPHASIS ON COAL A REALISTIC SOLUTION?

Yes. In fact, it is the only solution.

For an energy source to be sustainable, it must meet three key criteria: It must be immediately available, it must be low cost, and it must allow for an uninterrupted power supply.

While solar and wind can be developed immediately, they are unable to support the baseload demand of the country without resorting to expensive measures such as battery storage. However, they should ideally form a part of the overall energy mix strategy, and the Pakistani government's intention to secure around 15 percent of electricity from these renewable sources makes logical sense. Still, they cannot resolve the energy crisis because they cannot provide baseload operations.

Additionally, coal and hydro have levelized costs equal to around 10 cents per kilowatt hour.[1] Other baseload fuels such as liquefied natural gas (LNG) and residual fuel oil (RFO) would yield levelized costs double those of coal. Efforts should be expedited to convert RFO-based power plants to coal.

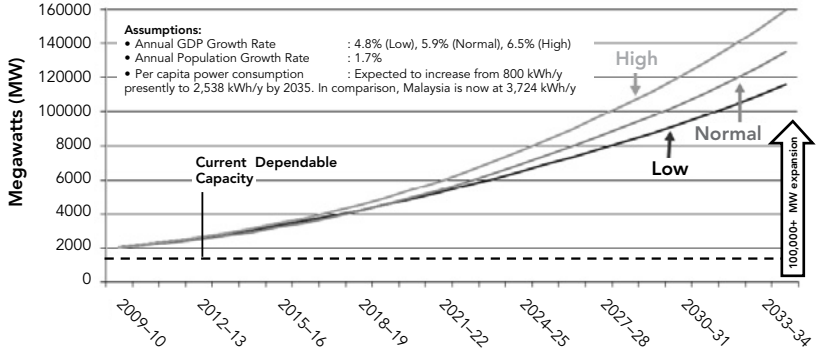
Imported coal should be a medium-term solution until indigenous coal is available. To achieve long-term energy security in an unstable geopolitical region, Pakistan must plan to develop indigenous fuel sources for all long-term projects.

CAN THE THAR COALFIELDS BE ADEQUATELY TAPPED ANYTIME SOON?

Currently, 44 percent of Pakistan's energy supply is imported, and the annual oil import bill is at an unsustainable level of around $15 billion.

And yet there are clear opportunities for indigenous exploitation. The Thar coalfields in Sindh province have the potential to mine good-quality lignite—on a level that can compare with anywhere else in the world. To this point, it has not been exploited—and this is only because developers in Pakistan have always wanted easier solutions. The total reserves of Thar coalfields are 175 billion tons, and the quality of lignite at Thar is suitable for power generation. In total, three blocks of around 2 billion tons of exploitable coal reserves each have been granted leases.

Figure 1: Country Power Demand Projection



Source: National Transmission & Distribution Co. (NTDC), Pakistan.
Note: GDP=gross domestic product, kWH/y=kilowatt hours per year.

Figure 1 shows the demand-supply situation projected for Pakistan in the medium to long term. The country has to grow from a meager 16,000 megawatt (MW) sustainable supply source to higher than 60,000 MW by 2025. Among indigenous energy options, Thar offers the most reliable choice of fuel, and it can be developed as quickly as other alternatives. Thar is in fact the only long-term solution to bridge Pakistan's supply-demand gap, and to enable the country to achieve true energy security. While shorter term needs will be fulfilled through imported coal, only Thar can provide a sustainable solution for generating 100,000 MWs for 200 years.

Currently, all stakeholders are watching the development of Thar Block-II with high hopes. This block is moving through a process to develop a mine capable of generating 1,200 MWs with potential to be scaled up to around 5,000 MWs.

The Pakistani government's initiative of providing sovereign guarantees to secure financing for a coal mining project of Sindh Engro Coal Mining Company (SECMC) is a step in the right direction. The National Electric Power Regulatory Authority (NEPRA) has also announced an attractive tariff for Thar IPPs.

With a recently formed consortium of Engro, Hubco, and House of Habib to implement a Thar mining project, there is reason to be optimistic. Indeed, in an otherwise fraught political environment, the two biggest political parties—the Pakistan Muslim League-Nawaz (which leads the central government) and Pakistan People's Party (which leads the Sindh provincial government) have joined hands and set aside their political differences to support Thar. However, in order to achieve expeditious development, strong support from the Pakistani government will be required.

A quick update on the Thar project is as follows:

- A bankable feasibility study has been completed by a team of renowned international consultants in compliance with international standards.
- An environmental and social impact assessment for both mining and power projects has been done, and the Sindh Environmental Protection Authority (SEPA) has given the go-ahead for this project.
- International competitive bidding has been completed. A letter of intent has been issued to a renowned Chinese contractor for mining and power projects.
- For an initial power plant, Circulating Fluidized Bed Combustion Technology is being adopted for reasons of flexibility and ease of operations.
- NEPRA has approved the Thar coal-based upfront tariff.
- Coal tariff approval is underway by the Thar Coal & Energy Board (a regulatory authority).
- The mining project will be completed 42 months after financial close. Two involved IPPs will come online 38 and 42 months after financial close. Efforts are underway to expedite and achieve financial close by the end of 2015.

All requisite infrastructure for a mine and power plant is in an advanced stage of implementation:

- It has been determined that the primary source of water for the power plant will be a Left Bank Outfall Drainage scheme. As a back-up, groundwater will be available. Availability has been confirmed of a 100 percent water supply for the life of the plant.
- A transmission line has been approved.
- Work has started on three out of six segments for road rehabilitation from the cities of Thatta to Islamkot, with expected completion (as of this writing) in mid-2015.

A comprehensive bankable feasibility study has been conducted by SECMC (see Figure 2).

WHAT IS THE BEST WAY TO DEVELOP THE THAR COALFIELDS?

An ideal two-pronged approach is as follows:

- Develop an initial 7.6 million tons per annum (MTPA) mine along with 1200 MW of generation capacity.
- Develop infrastructure, especially a rail network, which can help transport coal to other parts of the country as and when the Thar mine is sufficiently scaled up.

With the greater provincial autonomy put into place by Pakistan's 18th constitutional amendment of 2010, each province is compelled to have a reliable baseload power-generation capacity to meet its needs. This requires that appropriate-capacity power plants are constructed near load centers. Thar needs to be developed as an effective low-cost choice of fuel for all upcoming power plants that will be constructed around the country.

Additionally, Thar is one of the most underprivileged regions of the country. SECMC plans to spend significant amounts on a regular basis for the uplift of the local community in the areas of health and education.

Figure 3 offers the pricing projection of Thar coal at different capacities of the mine, from first phase to full scale-up. For the first phase of the current project (involving a 3.8 MTPA mine), the following is an update on the financing:

Figure 2: Banking Feasibility Study for Thar

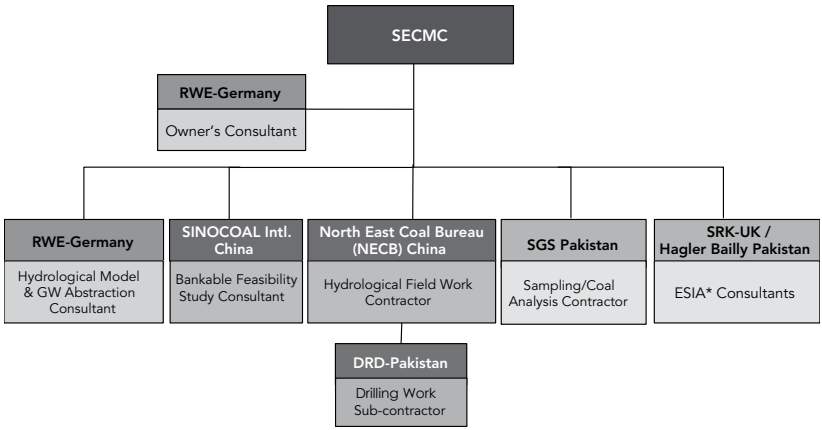
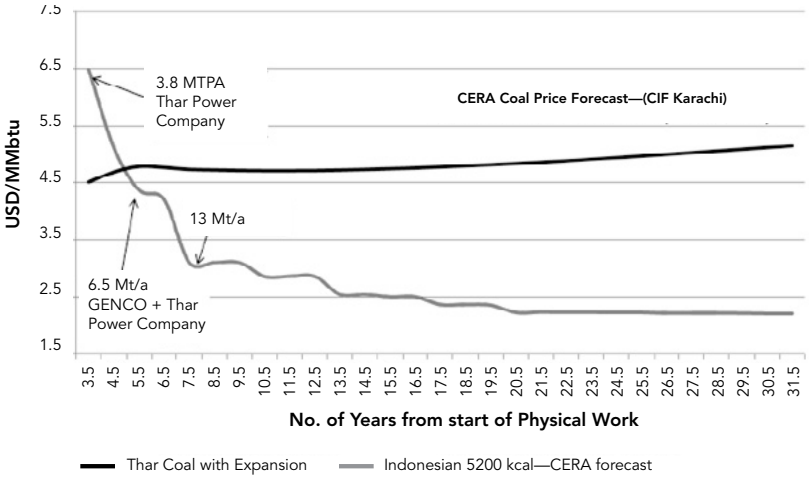


Figure 3: Pricing Projection for Thar Coal



Source: SECMC.
Note: CERA=Cambridge Energy Research Associates. CIF=cost, insurance, and freight. MMbtu=million British thermal units. Mt/a=millions tons a year. MTPA=million tons per annum. kcal=kilo calories.

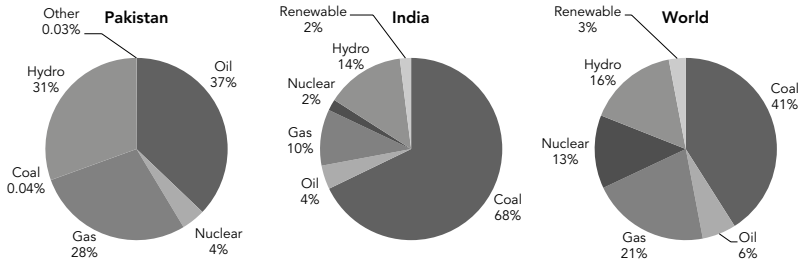
- Financing will be arranged through a mix of local and foreign financing—primarily from China as export credit.
- The Pakistani government has listed this project under the Pakistan-China economic corridor priority projects list, and both mining and power projects have been categorized as "early harvest projects."
- The Council of Common Interest recently ratified a sovereign guarantee of $700 million for SECMC's Thar coal mining project.
- Financiers in China are willing to fund the mining project, based on the sovereign guarantee.
- For the power project, financing will be provided by Chinese banks on a project finance/commercial risk basis against a power purchase agreement & implementation agreement. A mandate has been awarded to a consortium of the Industrial and Commerical Bank of China and the Pakistani bank HBL.
- Equity for both projects has been arranged.

WHAT ARE THE ENVIRONMENTAL TRADEOFFS FOR PAKISTAN OF A GREATER RELIANCE ON COAL?

Pakistan is cognizant of the environmental concerns associated with coal. Coal projects are being designed and implemented responsibly, and with as little negative impacts as possible. Also, as Figure 4 shows, coal based generation is currently just 0.04 percent in Pakistan (as against 68 percent in India and a world average of 41 percent). Coal-based generation in Pakistan is a worthwhile initiative to help Pakistan attain a more level playing field with its regional peers.

It is evident from Figure 4 that Pakistan is, overall, a non-polluting country when compared to its regional peer India (the same holds true when Pakistan is compared to China). But this does not mean that Pakistan should be allowed to pollute the environment unnecessarily. Coal development must be accompanied by an appropriate scheme of emission controls by incorporating appropriate technological interventions.

Figure 4: Coal-Based Generation



Source: Pakistan Energy Yearbook*, Hydrocarbon Development Institute of Pakistan; Ministry of Petroleum and Natural Resources, government of Pakistan; and* World Energy Outlook*, International Energy Agency.*

WHERE DOES PAKISTAN PLAN TO GET ITS IMPORTED COAL FROM?

Fortunately, Pakistan is in a region housing two of the world's biggest coal-importing countries: China and India. This has made importing coal into Pakistan so much easier, because trade routes are already established for the import of coal from South Africa and Indonesia. With low freight costs over the last two to three years, importing sub-bituminous coal has become a reality and, under current pricing regimes, coal of about 4,000 kilo calories per kilogram offers the best bargain in terms of landed CIF costs. With flexible technologies, a higher proportion of Thar coal can also be used in power plants that are designed on low-to-mid calorific value coal.

Should Coal Be Imported?

Importing coal at the cost of Thar is a bad idea. However, unfortunately, in the short term imported coal remains a necessity. Currently, Pakistan spends billions of dollars on importing furnace oil, so why not import coal? It is a third of the cost of oil in terms of energy content.

As Thar mines are being developed, and as infrastructure is being developed to transport coal or electricity from Thar to other parts of the country, imported coal presents a viable short- term solution. The following is recommended to allow for a gradual transition from imported coal to the use of Thar-based coal:

- Develop the infrastructure to transport coal from Thar to other parts of the country on a fast-track basis.
- Design upcoming coal-based power plants with the flexibility to use Thar coal.

CAN ISLAMABAD SUCCESSFULLY CONVERT ITS OIL-BASED PLANTS TO COAL?

Yes—but unfortunately this is currently not a priority for the government. Islamabad can initiate this conversion only if there is a policy to support it. Above all, oil-to-coal conversions require two major initiatives: A policy approved by the Pakistani government and project financing.

The benefits of a conversion are compelling. Pakistan's $15 billion annual oil import bill is unsustainable; conversion would reduce this bill significantly. Additionally, the current RFO-based tariff ranges from 19 to 22 U.S. cents per kilowatt hour (kWh). By contrast, this tariff after a conversion to coal would be an estimated 10 U.S. cents per kWh.

IPPs have in fact pursued coal conversion projects. Four MoUs were signed with the Pakistani government in June 2013 for coal conversion within two years after financial close. In pursuit of the same, policy guidelines for coal conversions have been drafted with the concurrence of relevant stakeholders, but the government's Economic Coordination Committee did not approve them. The projects were then halted.

Pakistan's government would be the primary beneficiary of those four coal conversion projects, as there is potential for $1.5 billion worth of foreign exchange and fiscal savings per year. The conversions would also contribute toward resolving the circular debt issue. And yet oil-to-coal conversions are not a current government priority.

PAKISTAN'S GOVERNMENT IS RIGHT IN ITS CHOICE OF ENERGY—BUT MUST FINETUNE ITS ACTION PLAN

The Pakistani government is rightly focusing on coal-based power generation and the exploitation of Thar mines through IPPs. But there are some problems in terms of how it plans to achieve these objectives—and particularly its intention of moving promptly, and of having a security structure in place that can quickly bring private investment.

Under current circumstances, no initiative will lead to electricity supply before 2019—regardless of what the government may claim. All projects are at early stages of development cycles that run from three to four years. Historically, we have witnessed that IPPs take a long time for materialization and GENCOs have failed to perform sustainably.

The core points in this regard are that any new venture in the private power sector, especially pertaining to new technologies, takes much longer than what we anticipate, and that resorting to traditional GENCO models for new expansion is not reliable—especially considering that the Pakistani government has no professional experience in coal-fired generation.

LIMITING FACTORS

We operate in an environment where there are more limitations than enablers. The following factors limit the options available to Islamabad in terms of viable solutions.

- The conflict between power sector stakeholders and the bureaucracy, which has a risk-averse attitude.
- The limited capability of institutions that are negotiating security packages on coal.
- The absence of urgency on all levels other than within the country's top leadership.

The policy environment can be improved through the following solutions:

- The more complicated the security package is, the more time it will take to negotiate a bankable security package. We need simpler security packages.
- We must have tariff rules that are applicable to all investors without discrimination. No IPP should seem to be receiving special treatment. This calls for any recommendation to be based on either upfront tariffs or international competitive bidding.
- The decision-making process should be streamlined. Much time is wasted, for example, when policies require decisions and buy-ins from so many places—from the Private Power & Infrastructure Board and NEPRA to the National Transmission and Dispatch Company.

Infrastructure Constraints

These are numerous. They range from an absence of transmission lines to connect coastal power plants to load centers (which can be 1,400 kilometers away) to the failure of Pakistan Railways to transport coal from ports to inland areas. Given these constraints, it is practically impossible to have fast-track IPP development.

As things stand today, no coastal power plant can be connected to load centers if a transmission line is not laid. This is a long-term project requiring private sector investment under a policy that is currently only in draft form. Also, Pakistan Railways has no money and no locomotives. It can hypothetically be revived in three to four years, but this would require robust action from the government.

These constraints suggest a timeframe of at least three to four years to make a bankable security package for conventional IPPs. In fact, even 2020 appears to be an ambitious target; 2022 may be more realistic. While this may be a practical timeframe, it is not an acceptable one—given the fragile condition of our nuclear-armed state. We need solutions and we need creativity—and we need them urgently.

HOW CAN COAL HELP PAKISTAN ADDRESS ITS ENERGY CRISIS IN THE IMMEDIATE TERM?

Taking into account the infrastructure constraints, the troubled history of GENCOs, and the limiting factors afflicting the energy policy environment, here are two immediate and actionable recommendations:

- Establish coal-based tolling plants in areas close to railway lines in Gadani and at load centers. Tolling plants are facilities where coal-handling, coal supply, and coal-related payment risks are handled by the offtaker (that is, the buyer of production). IPPs are only there to convert the Pakistani government's coal into the Pakistani government's electricity, and are paid an upfront tariff.
- Develop new coal-fired GENCOs under a structure in which development, operations and maintenance, and ownership is passed on to third parties that become IPPs in due course.

Pakistan's Biggest Energy Challenge—and How Coal Can Help Resolve It

The basis of all power sector development rests on the timely resolution of circular debt. Investors and lenders are hesitant to be a part of an industry that cannot afford to pay its legitimate dues. Pakistan will never get out of the quagmire of circular debt unless the root cause is addressed. This can be done by bringing down the cost of power generation through a three-step process that directly involves coal.

- Channel subsidies or increase tariffs.
- Reduce the cost of electricity (and reduce tariffs or subsidies as applicable) by inducing Thar coal and linking Thar to the country through a reliable railway network. Creative structures of coal IPPs need to be in place for quick execution. Pursue coal conversions to reduce the cost of power generation.
- Improve governance in terms of theft and collection by DISCOs (government-owned electricity distribution companies) to alleviate the circular debt problem. This will ensure the sustainable

development of the power sector, which is supposed to grow three-fold in the next decade.

NOTE

1. Figures and statistics provided in this essay come from sources within the Pakistani public and private sectors, and also from the author's own estimates and projections.

The Role of Indigenous Natural Gas in Meeting Pakistan's Primary Energy Needs

ROBERT M. LESNICK

Pakistan's primary energy demand has grown by 47 percent in the past decade, while its energy production has remained flat. It is generally accepted by government officials and industry experts that under current energy policies, the cost to cover Pakistan's primary energy gap is on a trajectory to become economically unsustainable within the next two decades.

Currently, Pakistan imports approximately one-third of its primary energy needs, principally through the external purchase of over 400,000 barrels per day of petroleum products, at a cost of approximately $15 billion per annum (nearly 90 percent of the import is used to fuel the power sector, which previously ran on natural gas). In 2011, the Pakistan Institute of Petroleum forecast that energy imports would grow to $50 billion or more by 2025.[1]

The irony is that Pakistan is blessed with significant amounts of indigenous coal, natural gas, and water resources which could be harvested to keep the nation nearly energy independent. Pakistan has significant coal reserves in the Thar Desert in Sindh province. However, these reserves are remote to any demand and are technically and environmentally difficult to mine and use. Several development concepts have been proposed, but it is unlikely that the resource will be utilized within the next decade.

The World Bank recently approved a combination of loans and grants to support the development of the Dasu Hydroelectric Project. The first

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phase of this project will add 2,160 megawatts (MW) of important new capacity to Pakistan's grid. Ground-breaking activities took place in June 2014, and the project is planned for completion by the end of the decade. However, project complexity, significant opposition to population relocation planning, and environmental concerns associated with the project will challenge this target date.

In the short and intermediate term, natural gas is the most viable choice for alleviation of Pakistan's growing energy gap. The natural gas industry has a long and successful history of supplying most of Pakistan's energy. Natural gas supplied 54 percent of Pakistan's primary energy in 2012, and about 50 percent in 2013. The sector continues to hold promise, as it is believed that there remains a bountiful supply of conventional and unconventional sources of gas to continue to supply the country far into the future. Unfortunately, poor policy formulation and implementation as well as lawlessness in resource-rich provinces have reduced global investment interest in the sector. As a result, proven natural gas reserves have declined by 25 percent over the past decade.[2]

The relative attractiveness of Pakistan's natural gas industry is summarized in Figure 1. During the last decade, no new international oil companies have entered the country, and incumbent companies have shown minimal interest in petroleum licensing activities. Industry believes the risks associated with exploration and development activities (weaknesses and threats) have outweighed the potential rewards for success (strengths and opportunities) when compared to other international opportunities for investment.

BARRIERS TO RAPID NATURAL GAS DEVELOPMENT

The major factors leading to low participation in gas development in Pakistan have been generally small field sizes, unfavorable petroleum policies and fiscal terms, and lawlessness in areas of high geologic potential. Recently, a lack of consensus regarding the implementation of provincial rights—resulting from the passage of the 18th constitutional amendment in 2010—has added additional regulation and tax uncertainty to the investment climate within the sector.

Figure 1: Pakistan's Natural Gas Industry

FUTURE PRODUCTION: SWOT ANALYSIS	
Strengths • long, successful development history • extensive pipeline infrastructure • variety of end use • solid policy and regulatory capacity • natural gas regulatory authority	**Weaknesses** • mean reserve size is relatively low • controlled, capped prices • limited drilling E&P service industry • circular debt • over-regulated/understaffed
Opportunities • ample unexplored areas • shale gas and oil • market growth • downstream participation	**Threats** • federal/provincial jurisdiction issues • SOE's hold 70% reserves • law and order situation • aging infrastructure, high UFG

Note: SWOT=Strengths/Weaknesses/Opportunities/Threats.

Limited Materiality

Experts on the sector within Pakistan often cite an above-average drilling success ratio. However, gas fields in the country tend to be modest in size, limiting the number of international oil companies that might show interest in the sector. As Figure 2 indicates, the reserve size of a conventional natural gas field in Pakistan often ranges from just 10 to 50 billion cubic feet.

By comparison, the average natural gas field is less than 10 million barrels of oil equivalent on an energy basis, and less than 2 million barrels on a revenue basis. Although these fields can be developed for profit, their contribution would be very minor to the balance sheet of a mid-size, or larger, energy company. As a result, Pakistan is often screened out as a possible country for new entry in favor of other areas offering higher geologic potential.

Poor Petroleum Policy

Many market analysts will suggest that low natural gas prices are the biggest factor contributing to Pakistan's current natural gas shortfall. Currently, gas from 44 producing fields is priced in accordance with 33

unique pricing formulas, from 10 or more previous natural gas policies. These formulas all track crude oil at prices between $25 to $35 barrels of oil (bbl), but deviate dramatically lower and are capped as crude oil values rise. The most recent policy, approved in 2012, raises the base price of gas by about 50 percent for qualifying production, but still sets arbitrarily low escalation as crude oil values rise above $30/bbl and caps all increases at $110/bbl. As illustrated in Figure 3, which is derived from Pakistan's 2012 Petroleum Policy, natural gas is priced significantly below crude oil (and liquid petroleum products) in the current market environment.

In addition to pricing, there are other elements of Pakistan's petroleum policies which reduce investment attractiveness in the petroleum sector. These include taxes and the treatment of imported goods, currency conversions, and a variety of accounting and technical issues associated with the exploration and production of hydrocarbons.

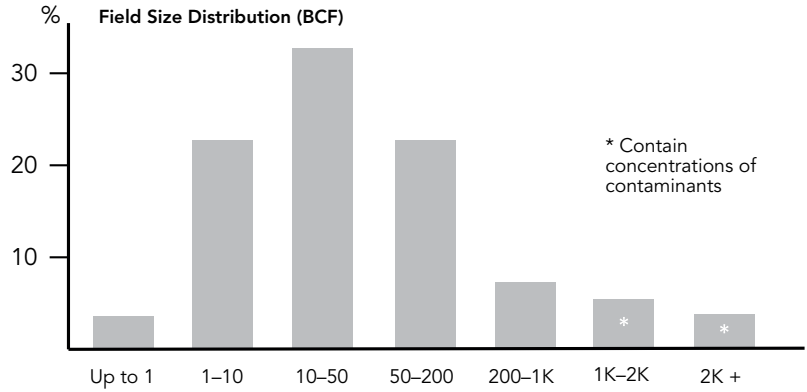
National Security

It has been estimated that up to two-thirds of Pakistan's highest-potential lands may have yet to be explored to any considerable degree. Exploration and appraisal activities in the country have remained very limited due to the unavailability of secure access and a lack of modern telecommunication service within many high-potential areas such as Baluchistan, remote areas of Khyber-Pakhtunkhwa, the Federally Administered Tribal Areas (FATA), and Sindh's tribal areas.

Local societal positions toward natural gas exploration and development range from a general lack of support to violent opposition caused by the disenfranchisement of major segments of the public—which demonstrate a historic mistrust of the government, its policies, its institutions, and its leaders. Civil society has not seen significant benefits of indigenous gas development in the form of direct payments, jobs, or improved power and sanitation services. Social services (such as schools, clinics, roads, and parks) have also failed to be provided as promised. Thus, the development of natural gas resources is perceived by local communities as exploitation—with the major benefits going to special interests, with little left for those most inconvenienced by petroleum operations.

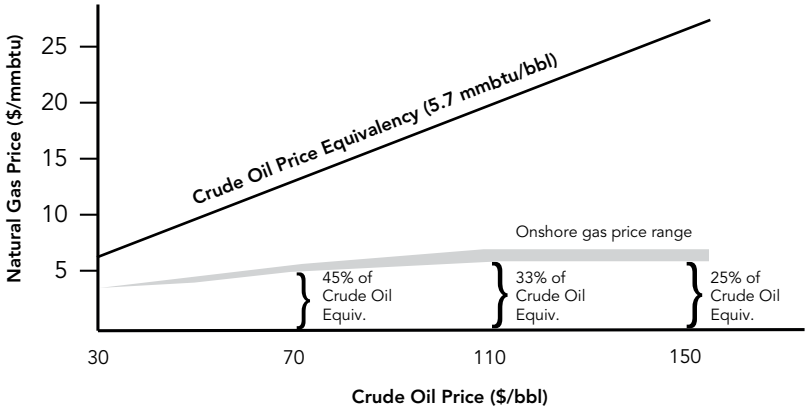
Some companies have formed fragile relationships that allow them to complete minimal work to keep concessions active. However, a

Figure 2: Materiality



Source: Pakistan Energy Yearbook, *Hydrocarbon Development Institute of Pakistan.*[3]
Note: BCF=billion cubic feet.

Figure 3: Pakistan's Natural Gas Policy



Source: 2012 Petroleum Policy, government of Pakistan.[4]
Note: mmbtu=million British thermal units; bbl=barrels of oil.

much deeper partnership between industry, government (provincial and federal), and civil society is necessary for major hydrocarbon development to occur.

Overregulation

Producers have complained that because of the existence of the Ministry of Petroleum and Natural Resources (MPNR), the Oil and Gas Regulatory Authority (OGRA) and other executive-level government commissions and committees, the sector is overregulated. More recently, the passage of the 18th amendment has created a new level of regulatory and tax uncertainty within the industry. The amendment gives the federal government and the provinces "joint and equal rights" over minerals. The scope and limits of provincial exercise of these rights have been the source of much interpretation and debate. Current provincial rhetoric gives rise to concerns that additional burdens (taxes, permits, and permissions) will be placed on the industry as part of normal exploration and production activities. The lack of clarity on this issue is the primary reason that concession awards have not been finalized, and is a contributor to a general gas industry drilling slowdown.

PRIVATE INDUSTRY VIEW

The petroleum industry is truly global, and major investments tend to occur where the risk/reward benefit is believed to be the greatest. In the last decade, the petroleum industry has committed large concentrations of capital in Iraq, where technical risk associated with the production of new oil has been thought to be very low; in Australia, where government tax and regulation is believed to be manageable and predictable; and most recently in the United States, where ample markets, industry infrastructure, and the application of drilling and completion technologies have unlocked an entirely new play of shale oil and gas resources.

Although the opportunities in Pakistan are not prohibitively bad, the combination of low reserve size, low gas prices, security issues, and the prospect of overregulation has caused private industry to choose other

investment options. This has left Pakistan's state-owned companies (SOEs) to carry on much of the exploratory work within the sector.

These SOEs now hold approximately 70 percent of Pakistan's current proved gas reserves. Although these companies are reasonably well-resourced, there is legitimate concern that they are not capable of developing their holdings or of optimizing production from existing developments within the timeframe needed to meet the country's growing energy needs.

UNACCOUNTED FOR GAS

Unaccounted for gas (UFG) is a separate and significant growing problem for Pakistan. It is caused by a combination of poor policy, inconsistent regulation, and general lawlessness. UFG is composed of physical losses, measurement errors, and theft. In 2013, UFG reached 11 percent of total gas produced, and is now considered a major contributor to the country's primary energy shortfall. Almost all of the losses occur in low-pressure distribution systems that are either very old and leaky, or have been newly established in volatile areas where meter-tampering and theft go unpunished.

Reconciliation of the costs of UFG is widely dispersed among state gas pipelines, ministries, OGRA, and other government stakeholders. Recent efforts to reduce UFG have been ineffective, primarily due to a lack of central ownership of the problem and to local political economies and special interests that profit from the status quo.

RECOMMENDED SHORT-TERM GOVERNMENT ACTIONS TO STIMULATE PETROLEUM ACTIVITIES

After two decades, Pakistan's natural gas production shortfall has reached alarming proportions. Unfortunately, even if widespread reform were to be implemented, it would take another two decades for the industry to fully recover. Petroleum exploration and production are phased operations; they require considerable planning and the testing of investments interspersed with periods of analysis before significant new levels of production can be reached. Pakistan's petroleum industry association

estimates that an average-size field on a new concession would take approximately $120 million and 8 to 11 years to develop after the block award is finalized (which can take over two years to negotiate).

In the shorter term, however, there are several actions the government of Pakistan can take to increase sector activity on existing concessions—which could result in important additional natural gas production.

Establish Provincial Authority Limits Under the 18th Amendment

A jointly managed federal/provincial committee should undertake a constitutional law review to determine the limits of provincial rights and obligations regarding the management of hydrocarbons under the 18th amendment. This review would clarify provincial rights to approve, consult, and be informed with regard to the development and enforcement of policy. Written guidelines should be published which outline the processes and procedures that will be employed and include time limits for action, so that industry can better understand the role the provinces will play—and therefore enable industry to more accurately assess non-technical risks associated with investment opportunities in the sector.

Fully Implement the 2012 Petroleum Policy

Several administrative actions should be taken on the dozens of existing requests to qualify exploration and production investments within existing concessions under the 2012 policy. Efforts should be made to fast-track and "screen in" development proposals to accelerate the pace of drilling activities in the country. New concession awards resulting from bid rounds from recent years should be finalized at an accelerated pace.

Take Action on Dormant and Underproducing Concessions

In a multi-step process, the MPNR should identify and value concessions that are technically noncompliant and/or needing remedial work. Results should be prioritized according to currently forgone productive capacity.

The MPNR and relevant provincial governments should then work with current license holders, local stakeholders, and potential investors to establish conditions that encourage and support programs to develop

inactive properties. Solutions may be politically and economically complex and include negotiations with local governments and political/ethnic groups to allow access to land as well as to enable farm-outs and joint ventures—all in order to increase financial resources and to broaden ownership and technical competencies within concessions. Particular emphasis should be directed toward the creation of programs that increase private sector participation in concessions currently held by the SOEs.

Develop a Roadmap for Sector Privatization and Deregulation

Through its ministries, agencies, and state-owned enterprises, the Pakistani government currently plans and awards concession activities; establishes well-head prices; allocates, transports, distributes, and determines costs of supply to end users; establishes allowable UFG limits; and controls 70 percent of current proved natural gas reserves. Given the depth and breadth of the gas industry and the problems caused by government intervention, a good case can be made for a phased transition to a deregulated industry—with increased private ownership of both upstream and downstream gas assets.

In the first phase, a pilot program should be established to deregulate sales between undersupplied, credit-worthy buyers and private sector natural gas sellers with excess supply on state-owned pipeline systems. The pilot program would develop workable and independent gas sales and purchase agreements, gas transportation and balancing agreements, and other supporting documents as models for further deregulated activities.

Additionally, strategic plans should be made for the orderly privatization of distribution systems within state-owned natural gas pipeline companies, and which are the major sources of the sector's UFG problem. These privatizations and other time-bound commitments to transition to an open market system (such as pledging to eliminate price controls) should be designed and made public as part of a deregulation roadmap.

Take Ownership of the UFG Problem

Government intervention to reduce UFG is critical. Such a step can add short-term primary energy supply, reduce import fuel costs, and improve the value of distribution systems which may be targeted for privatization.

The UFG problem should be owned at a high government level, independent of the MPNR. A diagnostic study should be undertaken to build an analytic tool to locate and determine the components of losses within the state pipeline systems. The study should also establish a realistic program to reduce UFG to industry-recognized allowable levels over time.

Pakistan's government must also enforce current laws against gas theft, perhaps in conjunction with similar efforts currently being undertaken in the electricity sector.

CONCLUSION

Pakistan is blessed with significant natural resources and a history of successful hydrocarbon development. Nevertheless, inadequate and backward-looking, ad-hoc policies; uncontrolled demand growth; and unhealthy political economies have resulted in a large and expensive energy gap that may spiral out of economic control by the end of the decade.

Unfortunately, there are no easy, inexpensive, or rapid responses that can erase the deficit. However, actions can be taken to incentivize new investment and to reduce government control and participation in the sector. Such measures may arrest energy gap growth, and create an attractive investment environment—leading to meaningful new natural gas reserve and production contributions over a reasonable period of time.

NOTES

1. "2011 Energy Outlook," Pakistan Institute of Petroleum, http://www.pip.org.pk/images/Outlook_Executive_Summary.pdf.
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Alleviating the Energy Crisis: An Action Plan for the Gas and Electricity Sectors

AKHTAR ALI

It is no longer sufficient to say that Pakistan is passing through an energy crisis. So serious is the crisis now that it is estimated to be costing the economy 2 to 2.5 percent of gross domestic product (GDP) every year.[1]

The problem is that demand keeps increasing continuously with the rise in Pakistan's population, and is expected to almost double in 10 years and quadruple in 20 years. Unfortunately, the institutional and sociopolitical system has not and may not correspondingly progress and grow in capability to provide for this bulging demand. As much new electrical capacity (15,000–20,000 megawatts, or MW) may have to be installed in the current decade as has been installed over the last 60 years. And it is not electrical energy alone; there are demands of primary energies as well for household, transportation, and industrial and commercial sectors. This is a challenge that will continue unabated. Supplies have to be provided at an affordable cost, and preferably lower than or competitive with other countries. Pakistan, in fact, has indigenous energy resources that can make this possible.

Pakistan's immense challenge can be met. The institutional and policy environment must be streamlined and fine-tuned to remove bottlenecks, attract domestic and foreign investment, and bring market forces into play. The purpose of this essay is to examine some of the underlying issues, and offer recommendations for improvement where feasible. The main focus is on gas and electricity.

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GAS SECTOR

Many reliable sources have indicated that in Pakistan there is much more gas—as much as six times more— than has been discovered to this point. Exploration activities have been hampered by a poor law and order situation and by the inefficiencies of Pakistani state energy companies. Gas exploration and development is not rocket science. If we simply get our house in order, activate and energize these energy companies, and apportion some investment, then we can certainly pull it off.

Natural Gas: Supply and Demand

There is currently a shortfall of gas of 2 billion cubic feet per day (BCFPD). Current gas production capacity is around 4 billion BCFPD, which is projected to be halved in the next 10 years. Pakistan wishes to add another 4 BCFPD through liquefied natural gas (LNG) and through the construction of gas pipelines with Iran (the IP project) and with Turkmenistan, Afghanistan, and India (TAPI project). However, demand is projected to be 8 to 9 BCFPD by the year 2020.

Toward Sustainable Gas Pricing

Now is the time to announce that the era of cheap gas is over. As a general policy, Pakistan should enhance well-head prices for new discoveries. The new price should be around $8–10 per MMBtu. This is the wholesale price of gas in Europe (and several other regions as well), where the resource is both imported and locally produced. (By comparison, in Asia, the LNG price is high—80–90 percent of that of oil).

In Pakistan today, CNG is being sold at about 50 percent of the price of gasoline and diesel—which is why there are long queues at gas stations. A more reasonable price difference would be 75 percent, which would mean that its retail cost should be around 100 rupees (Rs.) per kg. Other gas pricing changes should occur as well. The industrial gas tariff should be doubled to around $10 per MMBtu from the present $5.60. A proposed new gas tariff should be implemented in a suitable timeframe—preferably in stages as its purchase cost increases, owing to increases in local wellhead prices and with the induction of LNG.

Figure 1: Pakistan Natural Gas Data

NATURAL GAS POTENTIAL	282 TCF
Original gas reserves	52.9 TCF
Consumed to-date	30 TCF
Net remaining	22 TCF
Current production rate	4 BCFPD
Remaining life of gas, reserves	10–15 years
Existing demand	6.0 BCFPD
Current shortfall	2.0 BCFPD
IP gas imports planned	0.75–1.5 BCFPD
LNG import projects	1.75 BCFPD
TAPI capacity	1.35 BCFPD
Projected demand 2020	8–9 BCFPD
Shortfall	2 BCFPD
Current wellhead gas price (avg)	5 USD per MMBtu
IP gas price	18 USD per MMBtu (76 percent of oil price)
LNG price Pakistan	17–18 USD per MMBtu (recent tenders)
LNG price Europe	8–10 USD per MMBtu
Avg gas price Europe (network)	8–10 USD per MMBtu
Avg gas price USA (wholesale)	3–4 USD per MMBtu

Sources: Oil and Gas Regulatory Authority, Interstate Gas Systems Ltd., Hydrocarbon Development Institute of Pakistan.
Note: TCF=trillion cubic feet. USD=U.S. dollars. MMBtu=one million British thermal units.

Figure 2: Natural Gas Prices in Pakistan (Pakistani rupees)

	AUGUST 2013 PRICES	SUGGESTED
LPG	20.4	20.4
Gasoline	27.4	27.4
Diesel	25.7	27.4
CNG(retail)	13.1(Rs.75/kg)	20.4(Rs.100/kg)
NG(industry)	5.6	10
NG(commercial)	6.36	10
NG(domestic)	2.5	5
NG(CNG pumps)	6.56(Rs.37/kg)	15(Rs.70/kg)
NG(fertilizer)	3	10

Note: LPG=liquefied petroleum gas; CNG=compressed natural gas; NG=natural gas; kg=kilograms; Rs.=Pakistani rupees.

Commercial rates should be increased as well. Meanwhile, fertilizer prices should be stabilized through direct subsidies to farmers. With this new pricing framework, it may be possible to maintain wellhead prices equal to European gas prices. If so, local gas exploration and production could then be encouraged. These higher prices would also discourage wasteful use of gas; low prices tend to encourage waste.

Then there is CNG. It should be said that current pricing of this resource is highly injurious to resource husbanding—and in fact rather irresponsible. There is a strong case for banning the use of CNG for cars with engines bigger than 1000 cubic centimeters. The gas saved in such a move should go to the power sector. Ultimately, consumers would benefit from an increased electricity supply at cheaper gas rates.

Price Framework

Energy planning both by the government and the private sector should be done on the assumption of short-term prices of $120 per barrel of oil and $150 in the long run. Indexing of any energy commodity with oil is a losing game for buyers. Presently both LNG sellers and pipeline

gas sellers insist on indexation with oil, and at 80–90 percent. This is unsustainable. Precious years have been lost trying to get ahold of imported gas, be it LNG or otherwise. Affordable gas and electricity can only come out from hydro and from Thar-based coal. If conditions ever improve in Baluchistan, cheaper local gas resources can be developed.

Only under these circumstances should CNG continue, although at a lower price differential. Let the target be 10 BCFPD for $10 per MMBtu. Local gas exploration would get a boost under this policy. Ten dollars is the right price for gas, be it imported or local. It would be 50 percent of the oil price. This is what prevails in gas-scarce Europe.

Exploration and Production of Natural Gas

Serious efforts in local exploration of more gas, if not for oil, have been lacking for many years. According to Pakistan's Planning Commission, there is a potential of 282 TCF of gas resources—six times the number of gas resources discovered originally. True, the law and order situation has been bad in gas-rich Baluchistan. Yet outside of the Organization for Economic Cooperation and Development (OECD) countries, most source regions of raw materials suffer from poor law and order situations. If Pakistan's current government is able to bring about some sort of political solution to the insurgency in Baluchistan, this excuse would be eliminated.

In addition to conventional gas, there are tight gas, shale and coal-bed methane (in Thar) resources. Pakistan's previous government (the one that ruled from 2008 to 2013) did bring out some policy on tight gas, but nothing seems to have happened. The promise of cheap and abundant gas is too important to be taken lightly, forgotten, or soft-pedaled. Both local and foreign companies should facilitate gas exploration activity in all potential areas.

Exploring Natural Gas Alternatives

Astonishingly, both industrialists and the CNG sector are not investigating alternatives. Instead, they are content to purchase expensive energy from the government and benefit from unfair tariffs that work in their favor. This is naïve and short-sighted.

The hour of truth has arrived. Energy professionals and managers dealing with energy efficiency and conservation projects often complain that industry does not take an interest in saving energy, and instead continues wasting it through inefficient devices and machinery. Hardly any interest is shown in co-generation, at a time when the world is talking of tri-generation and trying to extract 80 to 90 percent out of any thermal resource. We currently are at a level of 30 to 35 percent generally, except for combined cycle power plants where the number goes to 40 to 45 percent. Encouragingly, when awarding permissions to install gas generators, some gas companies have imposed a condition of using co-generation. Unfortunately, however, compliance remains only on paper.

As a result, everybody wants cheap gas and energy, and in the end it is wasted. In Pakistan, the IMF and World Bank are abused when they argue for tariff increases, and they are branded as enemies of Islam and Muslims. Exploiting cheap labor and energy seems to be the motto all around. What happened in the Baldia garment factory (where several hundred people perished in a fire that was potentially controllable) is not unrelated. It is a continuation of the same theme and attitude. Still, the change has to come from within. The nation is looking for strong leadership which has yet to emerge.

Biogas and Bio-CNG

There are alternatives that need to be investigated by the government, its ministries, gas distribution companies, and CNG and industrial users. In order to achieve diversity and energy security, Europe is trying to have 20 percent of gas supplies come from bio sources, although the United States is lukewarm in this respect as it is enjoying a gas glut which may continue for quite a while. Pakistan has both price and energy security imperatives. The biogas issue should be examined beyond the small schemes currently being pursued—and at a very low tempo. There is a critical need to consider large biogas seriously for distributed generation, bio-CNG, and even for gas grid injections.

Estimates show that biogas potential in Pakistan is as much as current annual production. Because it is widely distributed, its potential may be best developed at the point of tri-generation. However, there are many point sources where large-scale biogas can be generated at one location.

The most ready example is Landhi's Cattle colony, where a 20 MW power project of biogas has been formulated. The recent involvement of the IMF and the Karachi Electricity Supply Company (KESC) has given the project more credibility.

There could be several large projects of this size elsewhere in the country as well. Biogas need not be a monopoly of electric power producers; gas companies can and should enter this arena of biogas as well. In fact, they ought to be the primary players. Biogas can be upgraded to pipeline-quality gas. This is not merely theoretical; it is already being done in Europe and there are big targets for 2020 and beyond. European targets should not be taken as lightly as we take ours, because Europeans take these things seriously. In Pakistan, novel methods should be considered in order to take full advantage of biogas. For instance, authorities should consider the use of plastic sacks for holding low-pressure biogas in rural areas.

In Pakistan, the gas sector's alternatives are LNG and Iran-sourced gas, which have not only been problematic but are too expensive to afford. By contrast, a biogas alternative is cheaper and more secure. While it is appropriate to view LNG or Iran gas as potential short-term alternatives that can be brought online quickly, it is clear that there are major uncertainties for both cases.

Thar Coal Gasification

Coal gasification should be pursued as well, whether aboveground or underground. However, such an objective must be pursued through a personalized approach and strategy, and should be structured and organized in a befitting manner. Similarly, all fertilizer production should switch to Thar-based coal. This could take five to seven years to do—but the earlier the better. This is not an empty thought; it is technically and economically feasible. After all, all alternatives are feasible compared to the scary price of $18 for imported gas.

Thar Coal Briquettes as Industrial Fuel

In almost all countries where lignite is mined, brown coal briquettes are used as industrial fuel, and especially in furnaces. Briquettes are

characterized by much cleaner burning fuel than is ordinary coal. Briquettes are easily manageable and handled, and do not leave dust and debris. Throughout Central Europe, briquettes have also been used as domestic fuel, mostly for heating. The same can be done in Pakistan. In winters, there is a pervasive problem of finding enough gas for heating. Gas is not available in Punjab, even for cooking. Large houses can install hearths to burn coal briquettes. The requisite technologies are available in many parts of the world. In some parts of the world, in fact, biomass briquettes are replacing coal briquettes.

Germany is a top-ranking coal briquette user, followed by Thailand, Ukraine, and others. In Pakistan, much more dangerous material, especially in Punjab, is being used as industrial fuel. Thar coal briquettes can be a reasonable alternative to such noxious fuels. Reportedly, the Thar Coal Board has done studies in this respect. Once power projects in Thar begin and once mining is initiated, coal briquetting plants may be installed in the small and medium enterprise (SME) sector. This would not only boost employment and income generation, but also make a significant contribution to filling the gap in industrial gas demand. Biomass briquettes can also be included when feasible.

In fact, one does not need to wait for Thar coal. There are low-grade coal deposits in all provinces. Encouragingly, the Fuel Research Center, housed at the Pakistan Council of Scientific and Industrial Research, is already engaged in relevant research and development on this subject. There is also a project in the tribal areas of Pakistan involving joint efforts by groups that include the Small and Medium Enterprise Development Authority. These initiatives can and should be energized to facilitate the induction of coal briquettes at a fast pace, given the urgency of the situation.

Needed Reforms in the Gas Sector

Reform is needed in the gas tariff system. It would be unfair to blame the Oil and Gas Regulatory Authority (OGRA) in this respect. OGRA is not a supra government agency; it works under the policies of government and is simply tasked with implementing them. At best, OGRA is only slightly more than a calculator. In effect, it computerizes formulas, automatically calculates prices, and posts results on websites. And

because fuel is a multi-sector and multi-ministerial issue, it is rightly being handled at the Economic Coordination Committee level. There is a general mantra, pursued by IMF and World Bank experts, of having a uniform gas and electricity tariff irrespective of the sector or user category. In fact, there is only partial merit to this. In a theoretical setting, price dictates resource allocation and thus has to be left independent to optimize resource allocation. In practice, no government has accepted this interpretation anywhere.

There are separate tariffs for industrial and household customers, and differentiation is made between small and large consumers. Industry and large customers are charged lower tariffs, and households are charged higher tariffs. For socioeconomic reasons, this does not make much sense. And yet the gas and fertilizer sectors are charged such low tariff rates that it is close to nil. It is practically free to them. This robs the gas sector of its legitimate revenue and creates many distortions.

The gas market and the need for competition

Some element of market, competition, and consumer choice has to be brought into the gas sector as well. The existing one or two buyer model has to be modified, and price controls have to be lifted for large consumers. A gas producer should be able to directly sell to large consumers at mutually negotiated prices, outside the OGRA tariff framework. Transmission and distribution companies should be paid their service charges, known as wheeling charges. Under this scheme of things, the government would no longer suffer as much from upward revisions of gas prices. A local gas producer, or a gas importer, may be able to arrive at a short- or long-term deal on the scope and prices of supply. Much bureaucracy and many processes could be eliminated. Local gas exploration and production would be facilitated, and therefore could be more robustly encouraged.

Additionally, instead of protracted and controversial privatization, consideration should be given to dividing and reorganizing gas companies; merging the transmission function of Pakistan's two state-owned gas companies; and establishing smaller distribution companies at divisional levels. About 8 to 10 new gas distribution companies should be established. For all large companies providing public goods and services, a two-board system—such as what prevails in Europe—should be introduced.

Put together, these measures of marketizing, emphasizing wheeling charges, and creating smaller companies can bring about the same or better level of service and efficiency as may be expected out of privatization. Ultimately, it may be easier to privatize smaller companies in a gradual and orderly manner. After all, talk of privatization tends to create unnecessary uncertainty and paralyzes decision making. Fast-track privatization becomes controversial, and brings forth ineligible and unsound parties.

Gas salvage plan

Overall, the gas situation is very grim. There is already a shortage of 2 BCFPD. The production level of existing gas resources is expected to dwindle every year, and is projected to be only 2 BCFPD (50 percent of the current level) in 2020. If a serious attempt is not made to address the demand trend, tremendous economic and social calamites could arise.

There is a way forward, however, and specifically by focusing on the demand side. Demand can conceivably be brought down by 1.349 BCFPD. This demand shift can be achieved through the following measures:

- 50 percent reduction in CNG demand though administrative and pricing measures, to be achieved in one year.
- 50 percent reduction in industrial gas demand by shifting industry to alternatives such as imported coal briquettes.
- 50 percent reduction in gas consumption in the fertilizer sector by converting to Thar coal.
- Reduction of unaccounted for gas (UFG) losses by 50 percent in two to three years.

ELECTRICAL SECTOR

Reducing Transmission and Distribution Losses

Transmission and distribution (T&D) losses in the electricity sector amount to 25 percent, a large portion of it attributable to downright theft and unrecovered receivables. This amounts to some 30 billion

Figure 3: Gas Salvage Plan (Proposed Demand Control Measures)

	CURRENT USE RATE		DEMAND REDUCTION	DEMAND REDUCTION	NET DEMAND
	MCFTD	% OF TOTAL	%	MCFTD	MCFTD
Power	992.5	24.06	0	0	2103.42
CNG	274.6	6.66	50	137.30	137.30
Domestic	799.8	19.39	0	0	799.77
Commercial	111.5	2.70	0	0	111.48
Industrial	780.4	18.92	50	390.22	390.22
Fertilizers	515.1	12.49	50	257.56	257.56
UFG(Losses)	651.7	15.80	50	325.84	325.84
Total	4125.6	100.00	26.93	1110.92	4125.59
SUPPLY AUGMENTATION MEASURES(2020)				SUPPLY INCREASE	NET SUPPLY
Natural Gas	4125.6			-2000	2125.6
LNG	0			2000	2000
Bio-Gas	0			500	500
Coal Gas	0			750	750
Total	4125.6			1250	5375.6

Source: Author's estimates and projections.
Note: MCFTD=Million cubic feet in total, per day.

kilowatt hours (kWh), valued at 200–300 billion rupees. This figure approaches the range of the circular debt in the energy sector, which arises out of subsidies (among other things). If these losses are reduced, electricity costs would come down, and obviate the need for any subsidy. This is admittedly easier said than done, but it is nonetheless feasible. In fact, this may be the only option to eliminate the problem of subsidies and circular debt. Enhancing tariffs may appear easy, but it is politically

explosive—which is why, up to this point, the Pakistani government has avoided making any drastic move in that direction. It also bears noting that, admittedly, enhancing tariffs also enhances the incentives and compulsions to steal electricity. This section explores possible strategies to solve this problem.

One of the largest-loss companies is KESC (also known as K-Electric), with 34.21 percent T&D losses, and representing 31.64 percent of country losses—valued at Rs. 28.25 billion at wholesale prices. By contrast, all Punjab province companies are doing relatively well, with loss figures at the 12 to 13 percent level.

By contrast, India's average level of T&D losses is 31.25 percent. Within Indian states, the figures are Delhi 45.4; Rajasthan 44.68; Gujarat 30.43; and Maharashtra 32.4. Punjab has one of the lowest rates, at 25.42 percent. Ironically, Uttar Pradesh's 34.39 percent is very close to that of Karachi, which is at 34.1 percent. The lowest T&D rates are in Japan (4 percent). Denmark, Germany, Singapore, France, Australia, Canada, China, South Africa, Switzerland, and Sweden are at 6 percent. The United States, United Kingdom, and Italy are at 7 percent. Thailand's T&D losses register at a remarkably low level, given its low level of economic development. Its rate is 10.52 percent.

Pakistan should strive for a 10 percent country-level T&D loss target, which means a higher target for all good performers at 8 percent and 12 percent. For bad performers like KESC and Peshawar Electricity Supply Company (PESCO), the target should be 14–15 percent. This will admittedly not be easy. Unfortunately, the reality is that a loss reduction target of merely 2 percent per year (1 percent technical loss and 1 percent commercial loss) appears to be too much. (It should be noted that in India, one privatized utility, PUZ, reduced its T&D losses by 7 percent in one year.)

Electricity theft and technical losses are not unique to Pakistan. They are rampant in many poor developing countries. In India, losses exceed those in Pakistan. Poverty and government control of utilities are common problems in both countries. However, in India a serious effort has been underway to do away with this problem. Many loss-reduction projects have been funded by USAID. Privatization has also helped. Tata Power, a private operator for New Delhi's distribution network, has managed to reduce T&D losses to a remarkable degree. This has been possible through

a number of measures. These include management overhauls and modernization, government support (which contributed to the introduction of an anti-theft law and energized local police), and the adoption of technical means and new technology like the establishment of smart distribution transformers. This can be a role model for KESC and other privatized distribution utilities of the future. KESC should in fact send a delegation to India to see firsthand how such a miracle—namely, a massive reduction in T&D losses—was so practically achieved.

T&D Loss Reduction: Ways and Means

In many parts of the globe, distribution automation—which involves installing distribution meters and connecting them to central controls—has become quite established, proper and demonstrable, and cost effective. Electrical meters are more data loggers than a simple meter, and are unable to collect and monitor a lot of electricity variables—thereby constraining better distribution and management. Through the installation of online sensors, circuit breakers, and switchers, overload conditions can be avoided by rerouting transformer breakdowns—thus enhancing availability and reducing expensive repair and maintenance, which entails replacement that involves capital expenditure.

In Pakistan, there is virtually no automation or monitoring/controlling of distribution. It is simply based on telephone calls and manual checks made by workers physically going to visit sites. Efficient maintenance management can solve many problems, but in Pakistan the network system has simply become too big and widespread to be adequately looked after.

Smart meters should be phased in to the extent possible. Additionally, cables should be undergrounded, and faulty cables and transformers should be replaced. Furthermore, the following measures should be undertaken:

1. T&D losses should be studied in detail to understand their true and full nature in all distribution companies (DISCOs); the extent of technical losses, outright theft, non-receipt of dues, and billing errors; and the share of various grades of customers like domestic vs. industries, small vs. large industries, rich vs. poor, and large houses vs. small houses. Preferably such a study should be commissioned by the National Electric Power Regulatory Authority (NEPRA).

2. Based on the results of such a study, which should be completed within six months, DISCOs should be required to come up with an action plan to reduce these losses by half within a period of five years. In the case of better-performing DISCOs like IESCO and LESCO (the DISCOs serving Islamabad and Lahore, respectively), which have fewer losses than others, the targets could be different.

3. A T&D loss reduction program should be launched that resembles India's Accelerated Program for Distribution Reforms, which involves providing financial assistance to DISCOs under a targeted program. Additionally, a loss reduction fund should be created. This can be financed out of multilateral and bilateral donors and via reductions in subsidies. Capital expenditure requirements of DISCOs can also be financed from this new fund. Taxation incentives—such as 100 percent write-offs of such expenditures and other suitable measures like the conversion of loans into grants—should be considered and then built into the scheme.

4. Performance-monitoring of companies should be introduced and translated into personal targets for executives and management. This should also serve as a basis for promotions.

5. On the legal front, some innovative changes in relevant laws may have to be introduced that involve community participation in and responsibility for controlling power theft. In the spirit of Pakistan's water user associations (community groups that monitor water usage), electricity user associations can be organized with a specific focus on distribution transformers (DTs). Losses should be measured in the context of DT use, and some penalty or surcharge should be levied on defaulting DT users. These proposed electricity user associations should have the powers to conduct audits and to identify and report electricity thieves in their neighborhoods. In the case of industries, regional associations already exist, and they could be entrusted with additional functions and responsibilities along these lines. However, this cannot be done until DISCOs install meters.

Reducing Cost-Price Differentials and Subsidies

The only short term and immediate solution for the electricity crisis is to increase the electricity tariff. This would definitely have a major political cost. Indeed, the present government has been willing to pay the political cost of load-shedding, but not to increase the tariff. If this problem is to be solved, then there must be a bipartisan approach. There has to be an agreement among all or major political parties on a suitable enhancement of the electricity tariff—while insisting that no political party make political capital out of such a decision, and that all parties to the agreement stand behind it and support it.

There is a case to be made for a 24–30 percent tariff increase, half of which should be introduced immediately. Industry should bear the bulk of the proposed increase. The industrial tariff in Pakistan is comparatively low—almost 30 percent lower—relative to many states in India. As compared to Maharashtra, it is 80 percent lower. In Gujarat, industry and large residential tariffs are almost identical. In Pakistan, industrial tariffs are currently 57 percent of large residential tariffs. The time has past for maintaining such large differences in tariff rates.

Many studies have argued that, except for lifeline customers and other small exclusions, the cross subsidy should not be more than 15 percent. The cost of Pakistan's energy shortage has been tremendous, and has caused at least a 2 percent reduction in the rate of economic growth. Pakistani industry is notorious for wasting energy. It must learn to conserve and save energy. The only effective instrument that forces conservation is the right and optimal tariff—one that adequately covers the cost of production.

Few countries rely on oil for electricity production as much as Pakistan does. Even most of the oil-exporting and rich countries of the Middle East rely on cheaper and local energy sources of coal, nuclear, gas, and hydro. In Pakistan, this state of affairs can be attributed in part to the Pervez Musharraf regime's policy of postponing the exploitation of Thar coal and instead installing oil-based power plants (most of those installed in the last decade came courtesy of the Musharraf government).

More mid-term and long-term solutions should include the development of indigenous energy resources of Thar coal, as well as of gas and hydro and even wind power. On wind power, there is a sordid story to

tell of NEPRA awarding an unduly high tariff, thereby making this vital resource unaffordable and thus meaningless in the current circumstances.

Reorganization of Electrical Sector

Delay privatization of DISCOs

In an energy policy utopia, the entire power sector would be privatized; there would be no subsidies; and there would be separate regional or DISCO tariffs—thus no Water and Power Development Authority (WAPDA) or Pakistan Electric Power Company (PEPCO). Indeed, some power experts with multilateral agencies hope that subsidies—and the country's uniform electricity tariff—can magically go away.

Unfortunately, it is not nearly that simple.

The entire electricity sector in Pakistan has been structured under a unified model of a uniform tariff and central investments. All assets and fuel sources have been developed under it. Despite passage of the 18th constitutional amendment in 2010 (which devolved many previously federal responsibilities and resources to the provinces), power remains a federal subject. In effect, subsidies may go, but for now a regional tariff appears to be an impossibility. In a decade, the sector configuration may change appreciably due to an increased contribution of independent power producers (IPPs) and to a more robust provincial role in the power sector. At that point, a regional tariff may be a possibility.

Pakistan's current PML-N (Pakistan Muslim League-Nawaz)-led government seems to be committed to privatization. However, there is a lack of political consensus on this issue. All major political parties are opposed to privatization, and especially in the power sector. Despite the PML-N's comfortable majority in Parliament, it is highly unlikely that privatization would proceed satisfactorily. The government faces many political challenges that will prevent it from taking a defiant privatization step—and particularly one that has already been roundly opposed by major opposition political parties such as the Pakistan People's Party (PPP) and Pakistan Tehreek-e-Insaaf (PTI), among others.

There are many other obstacles to privatization that go beyond politics. In the past, for example, courts have opposed and reversed privatization deals. Additionally, there are issues related to transparency. And finally, there may not be many private parties ready to bid for Pakistan's

DISCOs. Consequently, DISCOs would have to be sold at throwaway prices—which would invite allegations of corruption and favoritism. Matters would be taken to court, and, as usual, there would be sufficient numbers of inadequacies in the process. The likely outcome is that the courts would once again reject privatization transactions. In the process, DISCOs would further suffer due to uncertainties. Their institutional strengthening would be delayed, causing more losses.

In sum, irrespective of the merits or demerits of privatization, the lack of a fair chance of success leads one to counsel against it—or at least against a hasty form of it. It also bears mentioning that KESC is a privatized DISCO and an integrated utility, and yet despite better post-privatization management, it has not enjoyed significant loss reductions.

For now, the best policy is that in lieu of privatization, Pakistan use a holding and controlling company model. This is a model that worked in the past for various sectors. Under this arrangement, a (private) holding company serves as a professional intermediary between public sector companies and the bureaucracy of the ministry, which obviates the need for the latter to play a direct role in the day-to-day affairs of the public sector companies. The holding company is also supposed to take care of (or "control") sectoral issues and their development, and to suggest policies and advise government. To be sure, there will be resistance, and particularly from ministry bureaucracies, which want to maintain a role in managing the public sector company's day-to-day affairs. Still, for the immediate term, this is a much more desirable and realistic model than outright privatization.

Smaller distribution companies or franchises

There is something to be said for a smaller distribution company. The underlying notion in a smaller company is that the impact of theft would be immediately felt and therefore not as easily absorbed and conveniently forgotten. Additionally, as a smaller company would presumably have jurisdiction over a smaller area, those responsible for theft would be more easily identified. Distribution companies should ideally be divided into smaller local companies or distribution franchises. If divided at the district level, there may be more than 100 companies. If that appears to be too much, three to four divisions of existing companies would be quite feasible. This would mean about 20 companies.

Hyderabad Electric Supply Company (HESCO) can be converted into three franchises or companies; Quetta's electric supply company can be converted into three regional companies; and Peshawar's into four or five. In Punjab, the supply companies in Faisalabad and Gujranwala are already compact companies. Multan's is definitely a case for division into at least three or four companies. Similarly, Islamabad Electric Supply Company may be a misnomer. IESCO controls areas up to Attock in the west, Murree in the north, and Jhelum in the south. It can easily be divided into three companies.

Franchising may be a good and viable means for getting the results that may be expected from privatization but never actually accrue. Franchising separates ownership from operation. It is always very difficult to privatize—that is, to transfer the ownership of assets to a private party. There are a host of issues including transparency, confusion, and strong opposition from various quarters and stakeholders. In franchising, asset ownership remains with the owner government, while operations are transferred under a management contract. Franchising may be marginal—limited merely to bill collection—or it can extend to capital investments in fixed assets. It may extend to the whole of the utility, or be limited to a few and difficult geographical areas. One possible option is for associations in Faisalabad's textile region, or in industrial parks, to be given an electricity franchise, or even a gas distribution one.

The legitimate expectation may be that this arrangement better controls theft, is able to manage demand, and makes exclusive franchise arrangements for supplies. Furthermore, even a private utility like KESC can benefit from franchising. It can divide its concession areas into zones, and franchise off some of the zones or towns. Franchising, incidentally, is already being practiced in India, Southeast Asia, and Australia—with varying levels of penetration and success.

The feasibility of GENCO privatization

Excluding two or three generation plants out of 15 generating units of Pakistan's generation companies (GENCOs), average or typical thermal efficiency is around 25–28 percent. GENCO thermal efficiency is generally 50–60 percent that of IPPs. The original designed efficiency of these plants is in excess of 33 percent and in some cases even 40 percent. There appears to be a systematic degeneration of efficiency. It is

widely known that the management of GENCOs and their repair and maintenance activities in particular are in a shambles. The total installed capacity of GENCOs has come down significantly in recent years, to the tune of 33 percent. Thus, there is a loss on two counts: reduced thermal efficiency by 40 percent and a reduction in capacity of 33 percent.

Eventually, most of the GENCO capacity will need to be renewed. This should be done in a planned manner. In this case—unlike with DISCOs—privatizing closed sites may be a better option than relaunching them in the public sector. The arguments which militate against DISCO privatization do not apply in the case of GENCOs with as much intensity, and for a variety of reasons. With GENCOs, fewer workers are involved, they have a lower profile, and they have smaller areas of influence. In effect, GENCOs tend to be smaller and have less scope and scale than DISCOs. For this reason, they are easier to privatize.

BROADER CORRECTIVES

Toward Zero Energy Taxation

Petroleum taxation is a major cause of inflation in Pakistan, and especially in sensitive price indexes. All daily consumption items have to be transported from long distances to retail outlets, and daily workers travel to suburbs located at the city limits—which requires major transportation expenses. This all suggests a need for phasing out energy taxation.

What is a zero-energy taxation regime? Simply put, this means integrating the energy sector and its taxation, or, stated differently, pooling taxes and subsidies to balance and cancel each other. This type of arrangement would allow for a withdrawal of electrical subsidies, resulting in falling petroleum prices and a rise in the electrical tariff. This should be acceptable and affordable to all parties. It would mean lower prices for consumers, and no budgetary loss. Above all, it would be sellable to lenders and donors, both of which can pose a major constraint in independent economic policymaking.

That said, a marginal petroleum tax should still be maintained to cover user charges and financing needs of the transportation sector.

Conservation and Energy Efficiency Issues

As energy demand and consumption increase, there is a great need for promoting and encouraging conservation and efficiency. Price arguments are important, though not enough. Keeping prices at their real economic value does dissuade the consumer from profligacy. However, policy measures are still required to promote and even enforce conservation and efficiency.

One area for focus is the building sector in Pakistan, which tends to use energy very inefficiently (this is the case generally in South Asia as well). The issues of passive cooling and zero-energy buildings are not even discussed and talked about, much less implemented. It is, however, heartening to note that in some cases an energy code for buildings has been introduced. That said, much more effort and support are required at the implementation level.

Similarly, electric fans, water pumps and motors, washing machines, and air-conditioners are highly energy inefficient, and therefore offer tremendous potential for energy saving. Modest technical assistance programs aimed at traditional manufacturing clusters could pay many dividends. Also, there is a need to control the importation of inefficient electrical appliances, though this is easier said than done due to a highly competitive and price-sensitive market. Energy equipment labeling programs, whereby energy consumption data of household appliances are required to be printed on the labels attached to these appliances, have proved very effective in Europe, North America, and Asia. Equipment ratings create remarkable incentives on the part of manufacturers to produce energy-efficient equipment. Similarly, such ratings assist consumers in making decisions about buying energy-efficient equipment.

RECOMMENDED REFORMS

Markets and Competition

Bring competition, transparency, and openness into the energy sector. Encourage large consumer choice, co-generation, and market aggregation. Introduce and strengthen wheeling charge approaches in both the electricity and gas sectors.

Institutional and Bureaucratic

Integrate energy decision making to avoid the pitfalls and predicaments of similar initiatives of the past. Ministry consolidations may be too disruptive in the beginning when so much has to be done. Instead, a chief energy advisor's office should be created with multi-ministry jurisdiction under the Cabinet division. The merger of NEPRA and OGRA would also be highly desirable.

Reorganize distribution companies so that they are smaller. Divide gas and electricity distribution companies into smaller units and organizations, to possibly include adding another 8 to 10 companies each in the electricity and gas sectors. If political circumstances permit, seek to provincialize distribution companies; launch extensive programs (political and technical) for T&D loss reduction both in gas and electricity; and establish separate organizations to undertake all of this. There is not sufficient societal consensus on privatization, and a critical mass of support is lacking. Ultimately, talk of privatization creates uncertainty. Instead, focus on institutional strengthening—particularly institutions such as PEPCO.

Pricing

Reform oil and gas concession units; launch a major political-cum-commercial package to boost local exploration and production of gas; and consider upward adjustments in whole-sale/producer gas prices in view of very high imported gas prices in LNG and gas from Iran. Balance American vs. Iranian interests and get a favorable LNG supply from the United States and/or better prices for gas from a prospective pipeline from Iran.

Reduce the cost of production and at least arrest the escalation in rising costs; introduce competition; and make regulation and control an exception and market and competition a norm. With the exception of transmission and distribution, both in gas and electricity, introduce auctions and tendering in place of cost-plus projects, and introduce coal and hydro to bring down prices. Keep a 10 cent ceiling on all new power projects, and a ceiling of $10 per MMBtu on gas prices, imported or local.

Implement a gas reallocation plan; discourage CNG; close the price differential to 75 percent of gasoline in terms of Btu prices; encourage public transport on CNG; immediately ban CNG use in large private vehicles; encourage and introduce Bio-CNG; and put gas wasters on notice (these would include those with captive generators illegally running single cycle facilities, thereby violating terms of license). Dislocations produced due to curbs and CNG can be partly filled by local LPG. Local LPG production is increasing again. It is already in surplus in summers. The Pakistani government has already announced a 25 percent reduction in LPG prices.

Similarly, local fertilizer production should be reduced to half of its present levels by taking away 50 percent of the gas allocation. Fertilizers should be imported in summers, and subsidies should be shifted to imports or adjusted through agricultural support prices. Tariffs to the fertilizer sector should be enhanced to create incentives for a shift to coal, and preferably Thar coal. China is currently producing most of its fertilizer from coal.

Energy Mix

Fast-track the Thar coal project, and launch a transaction for 5,000 MW of Thar coal simultaneously with the Gadani imported coal power project. Fast-track the conversion of GENCOs to coal (sourced locally or foreign or both); convert diesel engine IPPs to biogas where feasible; give notice to fertilizer plants to convert to coal; organize coal gasification projects in a more structured way, while inviting foreign companies to assist; and fast-track 5,000 MW of hydro projects already in the pipeline. Hydro projects will bring the average cost of production down.

Promote competitive renewable energy that can be afforded and can improve supplies; solar and wind projects take one to two years to implement. Launch 300 to 500 MW wind power auctions every six months; encourage local content; facilitate and mandate local content; launch solar power schemes for diesel-replacing applications (such as tubewells); organize IPPs for solar roof projects; encourage bioenergy such as biogas and bio-CNG; and extract energy from solid and liquid waste.

Political and Legal

Resolve political issues pertaining to the energy sector. These include the question of how to divide up hydro and coal royalties, as well as the provincial role in the energy sector. Consider instituting zero energy taxation, which involves balancing oil and gas incomes with subsidies on electricity.

Introduce energy conservation laws to cover, inter-alia, the following: mandatory energy standards for manufacturers, energy labeling of household durables, building energy codes, opening hours for shops; minimum and maximum temperatures in buildings; cogeneration in industry; and energy audits.

NOTE

1. Unless otherwise stated, data and statistics in this essay come from Pakistani government and private sector sources, and also from estimates and projections prepared by the author.

Addressing the Present Energy Crisis by Avoiding Mistakes of the Past

JAVED AKBAR

Pakistan is blessed with bountiful energy resources. So why is there an energy crisis?

To answer this question, one must first consult the historical record. The troubles of the present can be traced back to inadequate government energy policies of the past.

ENERGY HISTORY OF PAKISTAN

At the time of its creation in 1947, Pakistan was primarily an agricultural society. Small towns comprised 20 percent of the population (the overall population distribution was about a quarter urban and three quarters rural), and the basic energy requirement of the rural community for cooking and heating was derived from the land—energy sources such as dried animal dung, wood, and biomass. Kerosene lamps provided light in homes and shops. In some towns, residents relied on coal for cooking and heating. Electricity in homes was simply for lighting, fans, and the family radio. In 1947, the total power generation capacity of Pakistan was only 60 megawatts (MW), which was generated from oil and coal. There was a small refinery at Attock in northern Punjab, which derived its crude supply from adjacent oil fields in Potohar.[1]

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Figure 1: Pakistan's Current Energy Portfolio (million tons oil equivalent)

SOURCE	MTOE	PERCENT	REMARK
Natural Gas	30	48%	Indigenous
Petroleum	20	31%	75% imported
Hydel Power	7	11%	Needs revival
Coal	6	9%	Thar for power
Nuclear	1	1%	Location?
Wind & Solar	0.1	-	Good potential
Total	**64.1**	**100%**	**2–3% growth**
Biomass	30		Improve efficiency

Source: Pakistan Energy Yearbook 2013*, Hydrocarbon Development Institute of Pakistan (HDIP).*
Notes: "Percent" denotes percentage of the overall energy mix. Biomass does not appear in statistics compiled by HDIP. This energy source, however, is used extensively in rural areas, small rural industries, and as a fuel in sugar mills.

Within 10 years of Pakistan's existence, natural gas had been discovered at Sui in Baluchistan, and major hydroelectricity projects were initiated. Pakistan also embarked on industrialization and established new refineries in Karachi that relied on cheap imported crude oil. By the 1970s, Pakistan had developed a natural gas infrastructure that replaced coal in urban homes, and enabled large fertilizer plants to be established. The reliance on gas has continued to the present day. The current portfolio of energy in Pakistan shows the substantial contribution of natural gas to the country's economy.

Pakistan introduced a central planning process, called five-year development plans, soon after it came into existence. There was strict discipline in preparing these five-year plans, and as a result major hydroelectricity projects were implemented in the 1960s and 1970s. Specifically, large dams were constructed to manage and store water for agriculture, and for the generation of hydroelectricity. However, in 1980, the military government of Zia ul-Haq (along with the United States) got involved in supporting mujahideen fighters in Afghanistan

to oust the Russians. Consequently, attention was diverted from long-term planning. This attention continues to be diverted today.

The trouble, however, began even before 1980. Unfortunately, after 1971, due to the break-up of Pakistan (with the establishment of Bangladesh), to political turmoil, and to military rule, little attention was given to the development of power generation. With massive power black-outs occurring in the early 1990s, the government of Benazir Bhutto invited the private sector to quickly establish thermal power plants in Pakistan through the introduction of an attractive private power policy. This policy continues to this day. Currently, independent power projects (IPPs) produce half of the utility power in Pakistan. In the 1990s, the government also started allocating natural gas to industry to set up captive power units. The capacity of these units is equal to 20 percent of the total capacity of utility power plants. There is about 3,000 MW of captive power in Pakistan versus a generation capacity of 15,000 MW for utility power plants, which are overseen by the public sector.

In 2000, the government of Prime Minister Shaukat Aziz (under General Pervez Musharraf) encouraged consumer-led growth in the economy, which resulted in a high demand for power caused by the easy availability of air conditioners and home appliances. Unfortunately for Pakistan, the price of crude oil increased from $25 to $100 in the 2000s, which resulted in the government throttling oil-fired power plants to conserve foreign exchange, and also to maintain lower electricity prices in Pakistan. Today, however, oil-fired power costs more than double the price of gas-fueled power.

In Pakistan's national elections of 2013, the prevailing energy crisis became a major agenda point. The present government is aggressively working on enhancing power generation in Pakistan at an economical price for consumers. Yet it faces a tough road ahead.

Three Major Misses in Past Pakistani Energy Projects

During the period of 1985 to 2005, large energy-related projects were explored. However, they could not be developed due to an incompetent bureaucracy, political squabbling, and security issues in Baluchistan, where there is strong potential for gas. The following few paragraphs

describe three examples of promising energy-related projects, based on indigenous resources, which did not materialize in Pakistan.

First, in 2005, Shenua, a Chinese energy company, offered to establish a coal power project in Thar for an attractive tariff of 5.7 cents per kilowatt (kw). Both the provincial government of Sindh and the federal government endorsed the project. However, the Water and Power Development Authority (WAPDA) bureaucracy rejected the offer because it thought Shenua's tariff offer was too high. This frustrated Shenua, which promptly abandoned the proposed project after having spent considerable human resources and time assessing Thar's coal resources and the project's feasibility. Ironically, today Pakistan is offering a tariff rate to initiate Thar coal power projects that is more than 50 percent higher than the 5.7 cent one proposed by Shenua back in 2005.

Second, the Kalabagh dam project was conceived over 50 years back. It is seen as particularly advantageous due to its accessible location in Punjab province and to the ease of construction (at least relative to other large dams in northern Pakistan). This dam is projected to cost half of the price of the Diamer Bhasha dam (which is being developed today), and its projected construction period (three years) is about a third of the time that Diamer Bhasha is expected to take to be built. In addition to 3000 MW of hydel power generation, the Kalabagh dam would also boast the capability to draw water for irrigation in Punjab and Khyber Pakhtunkhwa provinces. The construction of this dam is not supported by Sindh province, which worries that some of its water allocation would be diverted. And yet the dam would offer a tremendous advantage for Pakistan and Sindh specifically: Global warming effects are causing frequent floods in Punjab and Sindh, and the Kalabagh dam would quickly reduce the impact of these floods.

A highly politicized debate over the question of constructing Kalabagh dam has raged for over 30 years, and diverted attention from constructing other large hydel power projects in Pakistan. As a result, hydel power has plummeted from 65 to 30 percent of the power mix in the country. Recently, the Pakistani government finally decided to go ahead with the construction of the Diamer Bhasha dam in northern Pakistan, which is expected to take eight years to accomplish. This dam, unlike the proposed Kalabagh one, will not have the capability to divert water for irrigation purposes. The much-ballyhooed Kalabagh

dam remains purely aspirational. In 2004, Musharraf announced his plan to begin building the dam—but little came of it. Then, in 2012, Pakistan's Supreme Court ruled that construction should begin. Yet little progress has been made.

The third failed energy project originates in the late 1980s. Back then, Exxon, the world's largest energy and oil exploration company, acquired a lease for the Kohlu block in the Dera Bugti tribal area of Baluchistan, an area blessed with the potential for a large gas reserve. Exxon established an office in Islamabad, but could not commence exploration activity in Kohlu due to the inability of the federal and Baluchistan governments to provide security and access to the tribal region. Exxon exited after two years. There may be some hope on this front, however. Recently, the Pakistani public sector energy company Oil and Gas Development Company Limited (OGDCL) began exploring Kohlu block after constructing an 80-kilometer access road. OGDCL estimates that this block could hold 15 trillion cubic feet (TCF) of natural gas, which would add over 30 percent to Pakistan's existing reserve of conventional natural gas.

HISTORY'S IMPACT ON PAKISTAN'S ENERGY SECTOR

This brief perusal of Pakistan's energy history highlights a clear pattern: In decades past, public sector efforts to address the country's energy challenges have often been insufficient. This has brought troubling consequences for various dimensions of the energy sector today. Fortunately, there are still feasible correctives. As described below, they range from privatization to a greater emphasis on alternative energy resources. In addition, development of the large indigenous coal resources in Thar (in Sindh Province) would significantly add to power supply from 2020 onward.

Power Generation

In 1980, Pakistan was producing 60 percent of its electricity from hydel sources, and the remainder from oil and gas. A few industries, such as fertilizer plants, were generating their own requirements of power. However, massive power shortages started occurring in the 1990s due

to the slow growth of power generation capacity, which lay in the public sector. It was at this point that the government encouraged foreign private investors to quickly establish IPPs, thermal power plants that have continued to materialize in more recent years.

With crude oil prices having increased four-fold since 2000, power generation prices have increased significantly (oil is the fuel for one-third of Pakistani power plants). Also, with little development of hydroelectric projects in the past 30 years, thermal power generation has increased to 65 percent in Pakistan. Fortunately, half of its thermal power is produced from indigenous natural gas—which costs one-third of oil. Presently, there are three nuclear power plants in operation, which generate about 5 percent of Pakistan's power. About 100 MW of wind power have recently been commissioned. There is also the potential to produce 1,000 MW of surplus power from sugar mills in Pakistan through the conversion of boilers to high-pressure technology. Overall, a substantial part of power sector growth in Pakistan can emerge from large hydel and coal-powered projects.

Unfortunately, although Pakistan has over 20,000 MW of power generation capacity, it is not able to produce more than 15,000 MW. This is due to a shortage of fuel, to operating problems in public sector thermal power plants, and particularly to the limitations of the transmission and distribution system. Recently, Pakistan's government made additional fuel available for electricity during the Seher and Iftar time of Ramadan—only to discover that the power transmission and distribution system was inadequate. It appears that the power ministry has been concentrating on establishing power generation plants while neglecting matters related to public sector transmission and distribution companies. Power curtailment is rampant throughout Pakistan, and especially in the summer when there is a doubling of air conditioning usage in the residential and commercial sectors. Utility companies resort to intermittent power curtailment (load shedding) of 5 to 10 hours per day in cities, and over 12 hours per day in rural areas and small towns.

The imperatives of privatization and solar

This all points to the urgent and immediate need for the privatization of WAPDA's public sector thermal power units. This would help improve their efficiency and reliability. The best way to improve the capacity

and efficacy of distribution companies is also through privatization. Admittedly, this is a daunting task, because distribution companies are spread over thousands of localities with issues related to theft, security, and access. Privatization in the power sector has already occurred to some extent. The major success story so far has been the Abraaj group's takeover of generation, transmission, and distribution of KESC (Karachi Electric Supply Company, also known as K-Electric) in 2008. During its first five years post-privatization, K-Electric was able to increase generation capacity by 39 percent, increase fuel efficiency in power generation by 23 percent, and reduce transmission and distribution losses from 36 to 28 percent. During this same period, public sector power plants showed little improvement in performance and reliability.

In recent years, the price of photovoltaic (PV) solar cells has decreased considerably, creating possibilities for the government to quickly augment the supply of power in two ways. First, it should develop utility company-sized solar power sites (larger than 50 MW) countrywide, and directly connect them to the power transmission grid to support peaking power demand during daytime. This has in fact recently been initiated with the construction of Quaid-e-Azam solar park in southern Punjab. Second, the Pakistani government should encourage, through duty-free imports, the installation of solar panels on homes and buildings to share increasing power demand in the residential and commercial sectors. Power distribution companies should also develop the capability to take surplus solar power (net-metering) from homes and buildings to complement their peak power demand during the day.

Natural Gas

Indigenous natural gas has been the backbone of Pakistan's energy mix for the past three decades, and currently provides half of Pakistan's energy at low cost. However, newer gas finds are more expensive to develop. As the government is continuing to provide subsidized natural gas for residential use, the price of natural gas for industry and power plants is rapidly increasing. The government has recently introduced an additional charge into the gas sector called the gas infrastructure development cess (GIDC), which is meant to raise revenue in order to finance

Figure 2: Natural Gas Users in Pakistan

SECTOR	%
Residential & Commercial	26
Power Plants	24
Transportation	10
Fertilizer	15
Industry	25
TOTAL	**100**

Source: Pakistan Energy Yearbook 2013*, HDIP.*

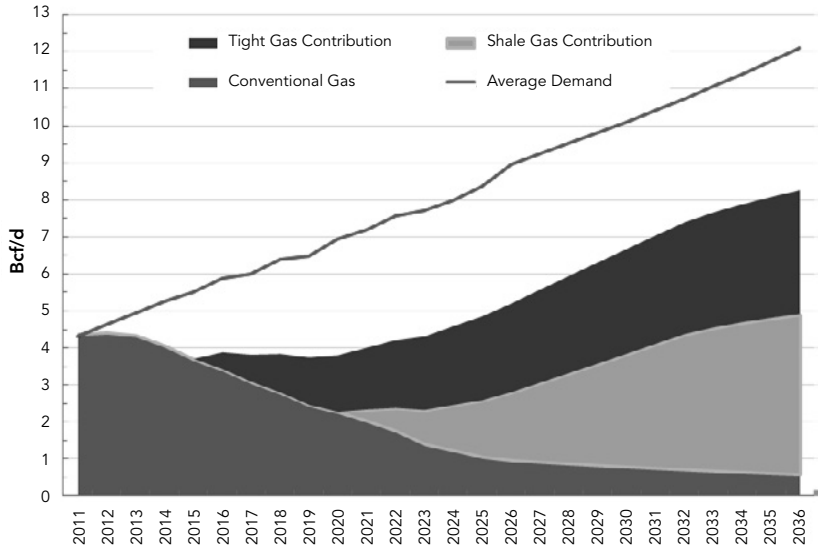
natural gas import projects for the country. And yet, even with all of these price-inflating policies, in Pakistan the natural gas price continues to be one-third of the oil price. The current consumption of natural gas in Pakistan is highlighted in Figure 2.

The exploration and production (E&P) policy of Pakistan was not revised for a decade even after the international price of crude increased rapidly (quadrupling, in fact) after 2000. Since the E&P policy is benchmarked with the crude oil price, some foreign E&P companies did not consider expanding into Pakistan. They also moved their experienced Pakistani staff to countries offering better returns on hydrocarbon finds. The government needs to be more aware of such international competitive developments when formulating policies.

Tapping into shale and tight gas reserves

Over the past few years, unconventional gas has been in the news because of the rapid development and production of shale gas at low prices in the United States. Yet it is not just America that boasts reserves of this promising resource. A global assessment of shale oil and gas resources conducted by the U.S.-based Energy Information Agency has placed Pakistan high on its list of countries with shale oil and gas resources. In view of ongoing gas shortages, the Ministry of Petroleum in Pakistan has taken a step toward producing unconventional gas by introducing a policy on "tight gas," which is easier and cheaper to produce than is shale gas. Incentives for tight gas are considerable, and production has already

Figure 3: Projection of Pakistan's Tight Gas and Shale Gas Production



Source: Projections of Pakistan Petroleum Limited (PPL), 2013.
Note: Bcf/d=billion cubic feet per day.

commenced in a joint venture of Pakistan Petroleum Limited (PPL) and the Polish Oil and Gas Company in the Kirthar block of Sindh province.

The Pakistani countryside's reserves of tight and shale gas are estimated to be more than four times the remaining reserves of conventional natural gas. The potential of tight and shale gas in Pakistan can be seen from Figure 3, which is based on a projection made by PPL in January 2013. It illustrates how the decline of conventional gas production in Pakistan can be quickly offset by developing tight gas resources. Subsequently, shale oil and gas production technology can result in Pakistan doubling its natural gas production within 20 years.

Here, as is the case in the power industry, the private sector can be very helpful. The potential of tight and shale gas development in

Pakistan can be quickly triggered by divesting a strategic portion of equity and management of the public sector corporation PPL, which has numerous unexplored leases in Pakistan. In this regard, the government should advertise the sale of 26 percent of PPL's equity to an overseas company having access to technology for exploration and the rapid development of Pakistan's tight and shale gas and oil resources. In the past, the government has periodically divested 5 percent of PPL shares in the stock market—and yet this has not resulted in bringing technology to, and improving the exploration activities of, PPL. A strategic investor with management control over PPL has the potential to accelerate PPL's hydrocarbon production growth. If the experience of the strategic divestment of PPL is successful, then the government should consider a similar divestment of OGDCL, the larger Pakistani public sector hydrocarbon company.

Staged development of Iran–Pakistan pipeline project

The Pakistani portion of the Iran-Pakistan gas pipeline is envisioned to run along the coastal highway of Baluchistan and past the port of Gwadar, which is close to the Iranian border. The construction of this pipeline has been on hold due to ongoing sanctions on Iran. However, a preliminary deal reached in early 2015 between the United States and Iran on the latter's nuclear program has created expectations that Iran's energy transactions could soon intensify, if and when sanctions are reduced. This means that new life could be breathed into the Iran-Pakistan pipeline initiative.

Iranian gas could add up to a billion cubic feet per day to Pakistan's supply of natural gas, so this is a very significant project for Pakistan. The Pakistani government should consider a staged development of this project by initiating construction of 750 km of the pipeline up to the port of Gwadar, which has idle deep-water berths. Liquefied natural gas (LNG) can then be imported from Qatar and regasified at Gwadar port for transmission in the pipeline into Pakistan. Subsequently, if and when sanctions on Iran are lifted, the short distance of pipeline from Gwadar to Iran can be completed. This staged construction of the pipeline would save two years of project development and construction time, and the remainder of the pipeline connection to Iran could be accomplished within six months of the lifting of sanctions on Iran. For these reasons,

Pakistan has a compelling reason to immediately initiate construction of the pipeline up to Gwadar. There is also a very recent incentive to quickly begin work on the project: In April 2015, China suggested that it would be willing to finance Pakistan's portion of the pipeline (the capital cost of Pakistan's portion is estimated at about $1.5 billion).

For Pakistan, the financial benefits of all this are numerous. There would be a capital cost saving of $150 million by not needing to construct a second LNG terminal at Port Qasim. There would also be a capital cost elimination of $500 million by not needing to build a 250 km pipeline from Port Qasim to Nawabshah (this is because the Iran-Pakistan pipeline would go to Nawabshah).

Additionally, given that Gwadar port is closer to the Arabian Gulf than is Port Qasim (the latter is further east in Karachi), there would be savings on LNG carriage charges amounting to $30 million per 5 million tons of LNG import. And if and when sanctions on Iran are lifted, the remaining pipeline from Gwadar to Iran could be constructed within six months—thereby saving 18 months of project time. Considering that Iranian gas would be $3 million British thermal units (Btu) cheaper than

Figure 4: Proposed Route for Iran-Pakistan Gas Pipeline

LNG, there would be savings of $600–$1200 million over the 18-month period. This is the main benefit of fast-tracking gas supply from Iran.

Finally, Pakistan would have the flexibility to use its portion of the pipeline for both imports from Iran and LNG imports from elsewhere. This would mitigate future risks on imports of Iranian gas.

MOVING BEYOND FAULTY ENERGY POLICIES

Pricing

In Pakistan—and likely elsewhere as well—energy policies are influenced by industry, entrepreneurs, and bureaucrats. In the 1990s, the natural gas price for industry in Pakistan was pegged to the price of the cheapest petroleum fuel (which at the time was high sulfur fuel oil, or HSFO, and also expressed as furnace oil). However, successive governments over the past 20 years have deviated from benchmarking natural gas with petroleum prices. With crude oil prices increasing fourfold, the natural gas price is now only one-third of the HSFO or furnace oil price. Thus, industries with access to natural gas have an economic advantage.

To enable the production of cheap urea fertilizer, the government provides an "indirect subsidy" in the form of a low gas price to fertilizer plants. However, this indirect gas subsidy should be substituted with a direct subsidy on urea that is produced—a policy already in place for imported fertilizer. The elimination of a subsidy on natural gas to the fertilizer industry would, among other benefits, end discriminatory complaints by other industries against the fertilizer industry.

Currently, the price of natural gas is based on the weighted average of the production price of indigenous gas. The result is a low price of natural gas. This is both good and bad. It is good because it benefits urban dwellers, but bad because it is harmful for rural dwellers. Here are several reasons why:

- Urban homes, amounting to 25 percent of Pakistani households, generally have access to low-priced natural gas. Rural areas, where the majority of Pakistanis reside, have to burn wood, dung, or use fuels such as LPG or kerosene—which is 10 times more expensive than subsidized natural gas provided for residential use.

- Natural gas in the form of compressed natural gas has been substituted for petrol for middle and high income groups for use in cars. However, 55 percent of petrol is currently consumed in motorcycles, which tend to be used by lower income groups. In other words, low-income groups are saddled with the more expensive resource of petrol. The price of petrol, diesel, and kerosene is burdened with an additional tax, called the petroleum development levy (PDL), which amounts to 6 to 10 Pakistani rupees (Rs.) per liter. These three fuels with PDL are mostly consumed by low-income groups via motorcycles, buses, trucks, and cooking.
- Diesel, among the most expensive and taxed fuels in Pakistan, is primarily used for transporting people, goods, and agricultural products that are mostly in the domain of low-income groups.

No to PDL, yes to GIDC

The price disparity between natural gas and petroleum is exacerbating the socioeconomic disparity between the urban middle class and rural poor. The government should consider providing relief to lower income groups by discontinuing PDL. A diesel price reduction would also benefit industry, which incurs significant costs for the transportation of their raw materials and products. The PDL revenue loss to the Pakistani government would be about Rs. 120 billion per year (about $1 billion). To be sure, this is no small sum, and the lost revenue for the government would be considerable.

The recent levy of the GIDC (a tax placed on gas infrastructure development) is a reasonable step because it can help reduce the price disparity between natural gas and petroleum. The GIDC has increased the price of natural gas in Pakistan. However, natural gas is still cheaper than petroleum-based fuels that are in turn based on $50 crude oil.

The GIDC is expected to provide the government with Rs. 145 billion ($1.5 billion) in 2014–15 to develop gas pipelines and infrastructure for the import of natural gas. Progressively increasing natural gas prices will also result in the more judicious use of gas and in conservation in homes and in industry. Higher prices of natural gas have the potential to reduce gas consumption in homes and existing industries by 15 to 20 percent within three to five years. This will make more natural gas

available for industry and the power sector. Indigenous natural gas is an asset for all Pakistanis, and it should not be given at "throwaway" prices to just a few privileged members of the population.

One recently emerging, and encouraging, issue in Pakistan is the sharing of energy-related "taxes" between the federal government and three provinces (Sindh, Baluchistan, and Khyber Pakhtunkhwa) that produce 95 percent of the natural gas in the country. The federal government currently receives all taxes and royalty on gas and oil produced in Pakistan, and passes on a small portion to the provinces. Pakistan's previous government introduced the 18th constitutional amendment, which among other things cedes ownership of natural resources to the provinces. However, this amendment is vague, and the three provinces of Pakistan associated with natural gas resources (all but Punjab) are now negotiating with the federal government for a greater stake in gas allocation and a larger share of taxes for their natural resources.

Theft, Wastage, and Other Energy Misgovernance

Successive governments in Pakistan have mismanaged the development of the energy sector by overlooking the theft of electricity, subsidies on electricity, and poor financial governance (such as not facilitating the recovery of electricity payments for public sector distribution companies). Also, numerous federal and provincial government departments and entities do not fully pay their power bills. After including theft of electricity, the payments received by some power distribution companies in Pakistan are less than half of their billing totals. Circular debt within the energy sector has amounted to a whopping Rs. 500 billion ($5 billion). This includes companies involved in gas and petroleum supply, power generation and distribution corporations, government departments and entities, and the finance ministry.

The theft of electricity is rampant throughout Pakistan. It is reported to be over 20 percent. (Interestingly, the theft of natural gas is reported to be lower, registering at below 10 percent. There is less theft in the residential sector because gas bills are relatively affordable.) In poor localities, electricity has been stolen for decades through simple wire connections to overhead power lines. This has become the norm in these communities. Local politicians do not support disconnection, in order to

prevent communal disturbances in their areas. Some utility companies are slowly regularizing electricity connections through the installation of meters. However, meter bypassing and tampering prevail because the price of electricity is high for poor people, and because of consumerism—which has brought air conditioners into low-income communities. Theft is also prevalent in middle class and affluent areas, mostly with the connivance of electricity meter readers.

Greater enforcement, efficiency, and awareness

Although legislation on the theft of natural gas and electricity exists, there is a need for strict implementation with tougher measures—such as not allowing bail. Finally, the government, media, religious leaders, and academia should play an active role in educating people about their social responsibility not to commit energy theft.

The best way to improve the efficacy of distribution companies is through privatization, which, as noted earlier, is a daunting task. Nonetheless, it is essential. The government should start the process of privatization of distribution companies by targeting smaller ones in Punjab.

Ironically, the gas shortages sweeping Pakistan in recent years offer some reason for hope that major advances can be made in combating energy theft. The urgency of these shortages has led to an emphasis on investigating the reasons for losses, and these investigations have uncovered numerous gas theft cases, including some discovered in small industrial establishments. This improvement in governance—at least in the context of anti-theft measures—represents a positive development for the future.

CONCLUSION

Throughout Pakistan's history, the government has enjoyed an inordinate amount of control over the energy sector. Even today, energy-related policies are formulated and determined by the federal government. It determines the implementation and interpretation of energy policies, and decides how to allocate increasingly precious energy resources (mainly natural gas and electricity) within the country. Additionally, public sector energy corporations continue to enjoy great levels of influence and clout.

They are responsible for half of the country's power generation capacity and natural gas production. And yet they are also poorly managed and unable to keep pace with the growing demand for energy. As a result of this heavy government involvement, Pakistan's energy sector is afflicted with chronic inefficiency—and it is also highly politicized.

Privatization—within the power and gas sectors, among others—can help address these challenges. So can a greater focus on unexplored, alternative energy resources—from tight gas to solar. More broadly, there must be more strategic planning focused on the development of indigenous energy resources. Furthermore, there simply needs to be more thinking about Pakistan's energy problems—and particularly more socioeconomic-based research focused on energy growth, tariff determination, and energy conservation.

If there is any hope of moving quickly to ease Pakistan's energy crisis, then the need of the hour is simple: To avoid letting history repeat itself. Implementing the reforms advocated in this essay would be a positive step in that direction.

NOTE

1. Data and statistics cited in this essay, unless otherwise stated, come from a variety of private and public sector sources in Pakistan, and from some institutions outside Pakistan, such as the Energy Information Administration in the United States.

How to Incentivize Energy Innovation and Efficiency, and Encourage the Rapid Deployment of Affordable Solutions

SHANNON GREWER

Pakistan's energy sector has a long pattern of ad-hoc, crisis-driven decision making. It has focused on short-term benefits, to the exclusion of responsible and comprehensive planning. Unfortunately, several recent decisions–made with inadequate technical and economic analysis—have only continued this pattern.

For example, a key tenant of the country's latest energy policy is to promote the rapid development of coal-fired power generation, based on the assumption that it will be a low-cost solution. Unfortunately, projects were planned without adequate consideration of the actual costs that would be incurred to develop the necessary infrastructure to transport coal to plants, and to upgrade transmission and distribution systems to absorb the thousands of megawatts of power to be generated. As of this writing, a few coal projects are proceeding, but most have been shelved because they are either uneconomical or impractical—which makes financing them impossible.

Another key component of Pakistan's current energy policy is the development of renewable energy resources, particularly wind and solar, which can be constructed quickly and financed relatively easily. However, there have been major delays in releasing the tariff for solar

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projects above 10 megawatts (MW), due to political disagreements. Sadly, the policymakers who designed the tariff seem to be constrained by misguided beliefs that have encouraged the construction of poorly designed and inefficient technologies. These beliefs have also plagued prior policies, as this essay will explain. In order to break this cycle and provide a true foundation for the sustained development of the energy sector, this essay explains the importance of refining current policies to incentivize the development of low-cost energy solutions.

A TROUBLED HISTORY OF ENERGY POLICY

For the past 30 years, Pakistan's energy sector has endured a costly and unsustainable boom-and-bust cycle. The gap between the supply of electricity produced and demand has steadily increased over the last five years, and is now estimated to be between 4,500 to 5,500 MW, resulting in load shedding of 12 to 16 hours per day in various parts of the country. In addition, domestic production of natural gas has been insufficient to meet the demand for residential and commercial use, resulting in low pressure and frequent outages. These energy shortages have resulted in a crisis that is strangling economic development and adversely impacting the daily lives of a rapidly growing population. It has become one of the most destabilizing issues facing the country.

In August 2013, Pakistan's newly elected government, which had made energy one of its priority election campaign platform issues, released a National Power Policy for Pakistan. It offers a high-level strategy to diversify the energy mix and rapidly develop new generation capacity. It has been nearly two years since this power policy was released, and as of this writing virtually no meaningful action has taken place. The current government appears to be repeating the mistakes of the past by making politically motivated decisions based on insufficient data and analysis. Capable developers and third-party equity investors that had been eager to explore opportunities in Pakistan are becoming frustrated with delays and a lack of progress. Furthermore, the dominant focus by the administration on investments by Chinese companies has raised doubts in the minds of investors from other countries as to whether there really is a level playing field.

Defining this strategy further, integrating it with other efforts, and prioritizing its successful implementation will require a cohesive approach based on a solid understanding of the benefits and consequences of past and current power policies. Also of essence is solid data regarding different generation options and the associated real costs.

The landscape that exists in Pakistan today is almost identical to what the government faced more than 20 years ago. Back in 1994, a new power policy was adopted to spur foreign private investment in the energy sector. The policy was designed to offer attractive incentives and to minimize project risks for developers. While the policy succeeded in attracting a record level of investment, numerous unintended consequences in the years that followed pushed energy prices to unaffordable levels. The 1994 policy was based on a cost-plus model, which guaranteed investors a set return on their invested capital without regard to the actual performance of the plant. Since these returns were guaranteed for the life of the project, a project developer had no incentive to design and build efficient plants. The lack of planning and coordination resulted in the construction of a number of small and poorly designed plants that were expensive to build and produced energy at a higher-than-average cost.

Policymakers today are wary of repeating the same mistakes, yet understand that many of the provisions included in prior power policies are necessary to mitigate the inherent development risks in a market like Pakistan's. The problem has not necessarily been the policies themselves, but rather the application of these policies. There is nothing wrong with offering investors certainty with respect to their return on investment, and with ensuring their ability to repatriate that capital. However, there must be adequate oversight and management of this process by regulators to ensure that there is an overall energy plan and that the proposed development is in alignment with that plan.

As Pakistan's decision-makers engage in the process of determining new sector-specific tariffs and developing power policies, they have the benefit of hindsight and an opportunity to evaluate what worked and what went wrong over the last 20 years. This requires a concerted effort to separate reality from perception, and to develop a path forward that is based on a systematic analysis of the data. Policymakers must also remain cognizant of the divergent perspectives of key constituents, and

balance their objectives—which are often in conflict—to find solutions that incentivize the developer without raising the cost of production to an unaffordable level.

Figure 1 offers some examples of the differing objectives that must be effectively reconciled.

Finding a balanced approach is particularly challenging for Pakistan's policymakers because of a widely held belief that independent power producers (IPPs) that developed power generation under prior policies benefited from windfall profits, while the people of Pakistan paid the price. While it is true that the IPPs achieved consistently high returns during the recent energy crisis, there is virtually no correlation between their profits and the increased costs the government paid for the power. However, rather than focusing on fixing the aspects of the policies that

Figure 1: Differing Objectives of the Government and Private Investors/Developers

GOVERNMENT	EQUITY INVESTOR/DEVELOPER
Cost-effective generation capacity that can be rapidly deployed and scaled to decrease the supply-demand gap.	Commitment from the government regarding the off-take of power at an agreed-upon-price for the duration of the project; timely payment of receivables.
Power generated by low-cost fuels, with a preference for domestic fuels.	Availability of fuel at a fixed cost.
Increased efficiencies to boost capacity while generating lower cost power.	Transparency and streamlined processes at the ministries and the regulator to reduce project delays and minimize disputes.
Minimal investment required for infrastructure improvements.	Guaranteed evacuation of power at no additional cost to the developer.
Associated revenue through taxes.	Tax incentives to reduce project costs guaranteed for project duration.
Reduced environmental impact	Protection from changes in law that can increase project costs.
	Protection from currency devaluation.
	Ability to repatriate dividends.

resulted in a high cost of power, the main objective unfortunately appears to be capping the potential return on investment at a level that the National Electric Power Regulatory Authority (NEPRA) deems appropriate—regardless as to whether this has any effect on the per kilowatt cost of generation. This misplaced focus has led to recent strategies that favor suboptimal technologies and act as a disincentive to innovate and improve efficiencies.

LESSONS FROM THE 1990s

The power policies that were implemented in response to the energy crisis of the 1990s offered attractive upfront tariff rates, guaranteed returns on equity of 15 to 18 percent, and various tax exemptions. As a result, Pakistan succeeded in attracting over $5 billion in investment while adding close to 4,500 megawatts of private generation to the grid in record time. This resulted in a power surplus for a number of years, and for a short time Pakistan was hailed as a model for the development of power sector projects in the developing world.

Under this cost-plus model, after justifying the costs to the regulator, the return to the investors was fixed for the life of the project and paid through capacity payments. The returns were based on how much the investor spent on the initial capital investment, not how well the plant performed. Since the returns were fixed for the life of the project, the investor had no incentive to invest in technology that would maximize the efficiency of the plant to generate as much energy as possible at the lowest cost. Instead, the investor was incentivized to maximize the project costs up to the ceiling allowed by the regulator in order to achieve the minimum stated efficiencies allowed. The developer received an identical return on investment regardless of whether investments were made in costly technologies that produce electricity at an overall cost to the government of $0.06 per kilowatt hour (kWh), or less expensive technology with an overall cost to the government of $0.25/kWh.

As a result, most of the new generation that came online during this period was built without regard to the cost or long-term effects of the newly installed capacity. The lack of sufficient analysis, coupled with the absence of a clear energy plan and a poorly developed selection process,

resulted in the construction of projects that were less than optimal in terms of fuel sources, location, size, and technology. Power policies favored private developers that were willing to build low-cost facilities that could be brought online quickly. Most of the projects were designed to run on oil, because these plants were relatively inexpensive to build as compared to other available technologies.

An immediate decline in electricity demand—due to slower-than-projected economic growth—combined with an overbuilding of capacity strained the ability of the government off-taker to make capacity payments under the power purchase agreements. Within a few years, demand caught up with supply. However, when the price of fuel increased, the cost of the energy produced became too expensive, and the government lacked the flexibility to mitigate the cost increases. In some cases the cost of generation was as high as $0.24/kWh.

There is a common misperception that the owners of IPPs are to blame for the high cost of power, and that they made excessive amounts of money by selling expensive power to the government. This is completely false. The high cost of energy was because the price of oil increased and the rupee experienced significant devaluation. When the government designed the power policies, it was determined that the risk of fuel increases (and the benefit of fuel decreases) and the risk of foreign currency depreciation (and the benefit of currency appreciation) would be borne by the government and not the IPPs. Allocating this risk to the government made it much more attractive for a foreign investor to enter the market. If the IPPs had retained these risks, lenders would have required that the risks be hedged. This would have added an incremental cost to the project and had a slight impact on the returns to equity investors, but it would have meant that the cost of power to the government would not have increased. It is a myth that the IPPs were at fault. In reality, the factors that contributed to the high costs of energy were completely outside the control of the IPPs.

Although there have been some slight modifications to the original 1994 power policies, the cost-plus model remains largely unchanged and is still in effect today. The price at which the government off-taker purchases the power is based on a formula with two components: (1) the fixed costs, which make up the capacity purchase price, and (2) the variable costs, which make up the energy purchase price.

Figure 2: Capacity Purchase Price Vs. Energy Purchase Price

CAPACITY PURCHASE PRICE	ENERGY PURCHASE PRICE
Project debt payments (interest and principal)	Fuel cost (set by the government)
Guaranteed agreed upon return on equity	Variable element of O&M costs
Fixed elements of the operations and management (O&M) costs	
Insurance costs on the plant	

The capacity purchase price is a constant regardless of the number of kWh actually purchased by the off-taker. This is standard in the industry, and will generally be required by lenders to ensure there is a stream of cash flow to cover financing costs, insurance costs, and the costs of maintaining and operating the plant. This payment is made by the off-taker even if a smaller amount of power than what was contracted for is actually purchased. During periods when the off-taker elects to purchase less than all of the available capacity of a plant, the costs on a per kilowatt hour basis are higher. This cannot be blamed on IPPs, however.

The energy purchase price is variable, and will change depending on fuel costs and non-fixed operating and maintenance expenses. In the past, when policymakers determined that these costs were to be passed through to the off-taker, the risk of fuel prices increasing shifted from the project sponsor to the government. Over time, oil prices increased dramatically and the government paid the price. Additionally, power policies shifted any devaluation of the rupee from the investor to the government by providing cover for the foreign exchange risk. There were no programs in place that provided the government with the ability to hedge these risks. The devaluation, together with the increase in fuel prices, constituted more than 80 percent of the increase in tariffs during the period since the IPPs were commissioned. Neither of these factors were within the control of the IPPs, and nor did they affect the returns that flowed to the IPPs.

The revenue generated by the IPPs was based on the guaranteed return on equity (ROE) that the government agreed the investor should

be entitled to as long as the plant continued to meet certain thresholds. This amount was fixed and yielded a constant return to the project and ensured that the IPPs remained profitable, even though the country was faced with serious power shortages. This caused significant public outrage, particularly because the IPPs were actually making more than just the agreed-upon ROE. They were generating additional revenues by arbitraging the late payments due to circular debt and from payments for fuel that they were not actually consuming.

For example, some of the IPPs were able to make a small margin on late payments they were receiving from the government for the power purchaser by borrowing from local banks at a cost that was lower than the penalty the government had to pay to the IPP for the delayed payments. The benefit to at least one of the IPPs was even greater, because the late fee it was entitled to from the power purchaser exceeded the late fee it had to pay to fuel providers. In addition, the fuel usage of the plants was calculated based on the agreed efficiency factor at the time the tariff was set. In many cases, this was a few percentage points less than the actual efficiency factor of the plant. Since the fuel component of the tariff was calculated based on the amount of fuel that would have been required to operate a plant at the agreed efficiency factor (as opposed to the actual efficiency factor) multiplied by the actual number of kilowatt hours purchased by the off-taker, the difference went directly to the bottom line of the plant. Based on informal discussions, it is believed that this benefit was approximately $12 million per year to one or more of the IPPs.

These unintended benefits that accrued to the IPPs at a time when the country was suffering from crippling power outages evoked the ire of policymakers and the regulator. The backlash has resulted in a pervasive and constant belief that the profits to an equity investor in a power project must be capped to protect consumers.

LESSONS NOT LEARNED

Rather than accept responsibility, successive administrations politicized the issue, criticized the policies, and blamed the IPPs for the country's energy problems. Instead of updating the policies in a manner that would have encouraged new investment in lower-cost energy, government

after government maintained the status quo while supporting large and unsustainable subsidies under the guise that they were looking out for the poor. In reality, these subsidies mainly benefited middle and high-income households. For a number of years, there was very little development. Projects that were approved encountered such extensive delays that deal fatigue set in. Investors walked away from their projects—and their sunk costs.

In an effort to encourage new development in a more cost-effective manner, NEPRA experimented with offering a series of upfront tariffs. Under an upfront tariff regime, a per-kilowatt-hour price is fixed in advance and the project sponsor agrees to accept that tariff regardless of what its cost to build will be. There are certain upper limits that NEPRA has set for different elements of project costs. If you exceed the costs in certain categories such as financing costs, you can petition NEPRA to adjust the tariff upwards. However, if your costs are less than the upper ceiling, NEPRA has the right to reduce the tariff.

In 2006, the regulator approved an upfront tariff for wind at $0.95008/kWh. Under the then-existing renewable energy policy, wind developers had the option to accept the upfront tariff or seek a determination on a cost-plus basis. The Fauji Fertilizer Company, which was issued a letter of interest from the Alternative Energy Development Board in 2006, had elected to seek a tariff under the cost-plus regime. A tariff of $0.161090/kWh was finally determined by NEPRA in August 2010. The 49.5 megawatt plant was fully commissioned in November 2012, six years after development began. Around the same time, NEPRA released a new upfront tariff of $0.146628/kWh.

Typically an upfront or feed-in tariff is determined by the regulatory authority, and is based on an extensive evaluation of the likely project costs and the expected return on investment that a power developer requires to make the investment. These project costs are based on an analysis of the market conditions and determined in consultation with experts based on the various factors of the project. The regulator must balance the need to attract investors to develop generation capacity against the long-term cost of buying that power since the price is usually locked for the duration of the power purchase agreement, which is often up to 20 years. Once the government has made a decision on that cost, then whether the project owners are able to increase their return on the

investment should be irrelevant to the government or regulatory agency. Most likely, because of the backlash against the IPPs described above, this is not the case in Pakistan. The upfront tariffs designed by NEPRA have been overly complicated in an effort to limit the upside potential of project owners. Rather than focusing on how to encourage investment in the most efficient technologies, Pakistan's policymakers have focused their attention on ensuring that there is a cap on the amount of money the project owners can make on the project. This inability to strike the correct balance has resulted in policies that reward project developers for using the lowest cost solutions, even if there are alternatives that would produce less expensive energy on a per kilowatt basis.

Consider the case of upfront wind and solar tariffs. In the draft 2013 upfront wind tariff, NEPRA proposed limiting the tariff to the extent of net annual energy generation supplied to the government off-taker at 31 percent of the net annual plant capacity factor. Any excess energy would be purchased at an amount equal to 20 percent of the tariff for energy produced in the case of a net annual plant capacity factor between 31 and 43 percent, and 10 percent of the tariff for energy produced in the case of a net annual plant capacity factor above 43 percent. Power producers argued that they should be entitled to 100 percent of the tariff for all energy produced:

> A better quality wind turbine will generate more electricity from the same wind speed than an inferior quality wind turbine. With energy up to 31 percent plant capacity factor to be sold at full tariff, the equipment evaluation favors price over performance and quality. There remains no incentive for the wind power generation companies to maximize wind power generation from the operational wind farms. Once the wind farm is built, the operator should be incentivized to operate at maximum available capacity at all times.[1]

NEPRA had a different perspective. Its position was that the price being offered was high enough to allow for a recovery of the costs to build the plant and provide a "sufficient return" to the investor. Therefore, any excess revenue earned was a bonus to the IPP and would enable it to generate higher revenues. NEPRA's objective was to limit the potential upside to the IPPs. In this case, they reached a compromise that included

a sliding scale based on a 31 percent net annual capacity. Anything above 31 to 32 percent was worth 75 percent of the tariff, above 32 to 33 percent was worth 50 percent of the tariff, above 33 to 34 percent was worth 25 percent of the tariff, above 34 to 35 percent was worth 20 percent of the tariff, and above 35 percent was worth 10 percent of the tariff.

In reality, the costs to build the projects, even at the higher plant capacity factors, were lower than the costs NEPRA was allowing. Project developers were faced with a choice: They could build an efficient project at a cost that was close to or equal to the maximum costs allowed by NEPRA, in which case they would receive an incremental benefit from the "bonus" energy produced. Or, alternatively, they could opt for a cheaper and less efficient technology that would meet the 31 percent and overstate their actual costs up to the maximum amount allowed by NEPRA to improve their returns. Given that choice, it is hard to understand why anyone would select option number one.

Given this experience with the wind sector, there was hope that NEPRA might get it right with the solar sector, and establish a tariff mechanism that would encourage project developers to opt for efficient technologies capable of higher energy output over longer periods of time. A review of the recently released upfront solar tariff suggests that this is not the case. NEPRA sat on this tariff for over six months, and held numerous hearings and meetings. Some of the best and most capable solar developers weighed in and presented NEPRA with specific examples as to why the proposed structure was flawed. These arguments are nicely laid out in the January 22, 2014 tariff determination. There was quite a bit of debate on how to determine the appropriate energy performance certificate costs, the costs related to local civil works, the financing fees, and the allowed duration of construction. However, the most important issue is the adjustment mechanism for capacity factors greater than 17.5 percent. SunPower, a subsidiary of Total Energies Nouvelles Ventures, a commentator at the proceedings, explained the following to NEPRA:

> A PV power plant's capacity factor is a key driver of a solar project's economics. It is a function of (1) the irradiation at the project location; (2) the performance of the PV panel (primarily as it relates to high temperature performance); (3) the orientation of the PV panel

to the sun; (4) the system electrical efficiencies; and (5) the availability of the power plant to produce power.[2]

Companies like SunPower are actively building and operating PV plants in markets around the world, with plant efficiencies at or exceeding 23 percent. These technologies increase energy production by more than 30 percent, which means more electricity is generated per megawatt capacity installed. These projects are being built in markets with solar characteristics similar to Pakistan, and at a cost that is equal to or less than the upper limits NEPRA has set in the tariff for technology that produces energy at a 17.5 percent efficiency.

Unfortunately, NEPRA appears to have completely ignored the overwhelming evidence that the sharing adjustment would result in the use of less efficient technology. The following adjustment was included in the upfront tariff: for the first 1 percent increase in energy the IPP is entitled to 75 percent of the tariff, the next 1 percent is 50 percent of the tariff, the next 1 percent is 25 percent of the tariff, the next 1 percent is 20 percent of the tariff, and anything above that is 10 percent of the applicable tariff. NEPRA's logic that without a sharing adjustment the effective tariff for a 23 percent efficiency plant would be $0.1819/kWh does not make any sense—the per unit price to the off-taker remains the same regardless of the amount of energy produced. A plant capable of generating more energy will be able to sell more energy into the grid. If the tariff remains the same for 100 percent of the energy that is produced, the IPP will generate returns in excess of the proposed 17 percent on equity because the IPP elected to invest in a more efficient technology—provided that the cost of such technology does not exceed the upper limits NEPRA has established.

THE METAPHOR OF THE APPLE FARMER

Energy is complex. The terminology can be confusing for the average consumer who is not familiar with the technical aspects of energy production. The metaphor below compares the current energy shortage to a food shortage, and illustrates what would happen if policies similar to those enacted in the energy sector were enacted in agriculture.

Imagine a country where 80 percent of the population is starving. The government enacts a policy to incentivize farmers to invest in growing apple trees by agreeing to buy a certain number of apples from farmers for the next 20 years at a set price, which will guarantee the farmers a return on their investment of 17 percent. In order to determine this return, the government tells the farmers how much they can spend on the seeds and the labor to produce the apples. The government also agrees to buy any extra apples the farmers produce, but at a significantly reduced price—which continues to decrease as more apples are produced. The government believes that once the farmers have achieved their guaranteed return, the benefit of any excess production should be shared by reducing the price the government pays for the "extra" apples.

At the seed store, the farmer is presented with two options—the ordinary seeds or special seeds. The special seeds will yield about 30 percent more apples per season, but the trees are a bit tricky and require some special attention and a slightly more expensive fertilizer. The ordinary seeds will produce exactly the number of apples per season that the government has agreed to buy at the highest price per apple. Even though the ordinary seeds generally sell for less than the special seeds in neighboring countries, the seed seller has priced the ordinary seeds at a higher price than that of the special seeds—because he knows that the government has guaranteed the same returns to the farmer as long as he does not exceed the price ceiling the government has set. Since the seed seller will make a higher margin on the ordinary seeds, he agrees to give the farmer a credit against future purchases of supplies.

In this case, the capital investment of the farmer is slightly less if he opts for the ordinary seeds, because he can use the less expensive fertilizer and labor costs to tend the crops will be less. Plus, there is the added benefit that the seed seller is giving him a credit against future purchases. Based on the commitment from the government to buy a certain number of apples at the fixed price per apple, the farmer will achieve a 17 percent return on his capital investment as long as his trees produce the requisite number of apples. Alternatively, the farmer could purchase the special seeds, which will yield 30 percent more apples from the same number of trees. His capital investment will be slightly more because of the higher priced fertilizer and the extra labor costs.

Ultimately, the farmer determines that even though he would be able to increase the number of apples he can grow by almost one-third while incurring only a slight increase in his costs, it simply is not worth it because the amount that the government is willing to pay for the excess apples is so low that the farmer's overall returns do not justify the increased risk. So the farmer opts for the ordinary seeds. If the government had agreed to buy all of the apples produced at the same price, the farmer would have been incentivized to buy the special seeds and grow as many apples as possible in order to increase his returns.

Unfortunately for the government, its policy has led the farmer to make a damaging decision: the country ends up full of less-than-optimal apple trees producing 30 percent less apples to feed its starving people—even though the cost to grow the higher producing trees would have been about the same. Instead of worrying about the amount of money the farmers would make, the government should have designed the policy to incentivize the most cost-efficient production of as many apples as possible to bring down the per unit price as low as possible.

The apple farmer made his decision, much like the energy investor would, based on a financial analysis of whether the incremental upside from the sale of the excess production was worth taking a risk on the more efficient technology that maximized production. While it might appear on its face that this is a better result for the government, because it has the option to purchase the excess apples (or energy) at a lower per unit price, that is in fact not the case. In a country with solar resources like Pakistan, the lowest cost option is to maximize production using the most efficient technology. A detailed financial analysis using irradiation data specific to Pakistan has indicated that NEPRA could have reduced the proposed upfront tariff by close to $0.02 for plants that optimized their design and equipment—and the return to the investor would have been equivalent or higher than the 17 percent proposed by NEPRA. The benefits to the people of Pakistan would have been more efficient projects requiring less land to produce the same energy—and at a lower per unit cost for the duration of the project.

An IPP developer will evaluate the technical aspects of a project and determine, taking into account the potential risks, which equipment and design will yield the maximum return on the investment. As a result of the sharing mechanism included in the upfront tariff, NEPRA has made

this decision for the IPPs under the guise of containing the cost to the consumer. Based on discussions the author has had with three of the world's leading solar developers, the cost of developing a more efficient plant would be less than the costs NEPRA has used to determine the upfront tariff for a less efficient plant.

The construction of less efficient plants means fewer kilowatt hours are produced, and the cost per unit is higher than it has to be. This is not at all ideal for a country with a huge energy deficit. Additionally, there is less transparency because it is difficult to challenge the actual costs incurred in connection with project development. The project developer and/or equipment provider are able to achieve very profitable margins in connection with the construction, most of which will likely flow offshore immediately.

In effect, the tariff is higher than it needs to be. If NEPRA were to set plant capacity factors correctly, it would encourage developers to choose the best available technology and a lower tariff could be set by getting rid of the sliding scale and averaging it out to a single amount that would be paid for 100 percent of the power generated. This would mean that an experienced power developer, with access to equity and the ability to construct a highly efficient project on time that is capable of generating more energy at a lower cost, might achieve returns that are higher than those deemed to be acceptable by NEPRA.

Unfortunately, the upside offered to the IPPs in this case will very likely be insufficient to offset the risk of investing in the more efficient technology. The lower efficiency technology presents less risk, and large margins can be made by marking up their costs to the maximum amounts allowed by NEPRA. If the economics of the project do not work, a project developer will be forced to cut corners to maximize returns or to look to different markets to deploy resources and capital.

A BLUEPRINT FOR ENERGY SECTOR SUCCESS

Pakistan has suffered tremendously as a result of the mistakes made over the last 20 years. Initially there was quite a bit of hope that the current government would reform the system, and make the politically difficult decisions necessary to fix the energy crisis. Today's policymakers must

let go of the preconceived notion that IPPs have made too much money, and focus on developing policies that encourage investment in energy generation at a price that the country can afford. Transitioning from a cost-plus model to a system of well-thought-out upfront tariffs would provide Pakistan with the best possible chance of attracting world-class investment in the power sector.

Systematic and Credible Data Collection

Effective policy cannot be made in a vacuum. NEPRA must be provided with the resources to collect necessary information, conduct appropriate evaluations, and be free to make final decisions without political interference. Rather than relying on information provided by donor-funded consultants, who may or may not have the requisite expertise or any incentive to actually do it correctly, NEPRA should undertake a systematic approach to collecting and analyzing necessary information from well-respected project developers and equipment providers in order to establish an informed opinion as to what the actual costs would be for a developer to construct and operate a project. Collecting this level of data requires significant engagement with the private sector, and a deviation away from the status quo of government-organized delegations and trade missions. Extensive due diligence is necessary to identify which companies have successfully developed similar projects in markets that have project development challenges similar to those of Pakistan. Leading international power developers would happily engage with policymakers to devise a cost structure that reflects the considerations discussed above while also promoting the development of cost-effective power solutions capable of generating cost-effective power—even while still yielding attractive returns for the investor.

Effective Financial Modeling

Once the data is collected from appropriate sources and validated, NEPRA needs the internal resources to develop financial models that will show how all of the proposed incentives being offered to an investor will affect future revenues flowing to the government, and what the commensurate effect on an investor's returns will be during the life of

the project. Using the information collected from leading project developers, NEPRA would be able to determine a range of expected project costs and related energy outputs. Once this baseline has been established, it would be relatively simple to calculate a tariff that provides an incentive for development at the lowest price possible.

The idea that Pakistan cannot afford to be selective in choosing who to engage with is wrong. Furthermore, any overreliance on a country because of an expectation that larger geopolitical concerns will override the fundamental economics of the project is a mistake. The international power community understands that there is significant upside potential in Pakistan, and will invest in projects provided that the economics are sound and the process is streamlined. Any policies designed to cap the overall potential upside to an investor will function as a disincentive, and should be avoided. An investor will always look to improve his or her returns, and should be encouraged to do so through policies that incentivize innovation and efficiency.

Support for Rapidly Deployable Renewable Energy Projects

The price of solar- and wind-generated power continues to come down. Pakistan has an abundance of both resources, and plants could be brought online in less than 12 months by qualified developers. To be sure, these plants would not solve the energy crisis. However, they could play a large role in bridging the current demand and supply gap in the near term. Unlike coal or natural gas-fired power projects, the only infrastructure upgrades for solar and wind projects that require additional investment by the government are related to transmission and distribution systems. True, solar and wind will not replace the need for baseload power projects. However, if NEPRA is able to structure policy correctly, and particularly through the implementation of reasonably priced tariffs, then these technologies can provide rapidly deployable energy solutions that will be cost-competitive with other fuel sources throughout the life of the projects.

Ultimately, Pakistan's policymakers need to learn from the mistakes of their predecessors. Ramping up the development of solar and wind projects, while emphasizing more efficient pricing regimes to help them flourish, would be a major step in the right direction.

NOTES

1. "Determination of National Electric Power Regulatory Authority in the Matter of Upfront Tariff for Wind Power Generation," National Electric Power Regulatory Authority, government of Pakistan, April 24, 2013, http://www.nepra.org.pk/Tariff/Upfront/TRF-WPT%20UPFRONT%20WIND%2024-04-2013%203942-44.PDF.
2. "Determination of National Electric Power Regulatory Authority in the Matter of Upfront Generation Tariff for Solar PV Power Plants," National Electric Power Regulatory Authority, government of Pakistan, January 22, 2015, http://www.nepra.org.pk/Tariff/Upfront/2015/Determination%20of%20NEPRA%20in%20Upfront%20Tariff%20for%20Solar%20PV%20Power%20Plants.pdf. PV is an abbreviation for photovoltaic.

Power Sector Reforms: Pakistan's Energy Crisis and Ways Forward

NARGIS SETHI

Pakistan went through an extraordinary period of surplus electricity from the late 1990s to 2004–05.[1] However, since then, the country has faced an acute shortage of electricity. After independence in 1947, Pakistan constructed two new dams, Mangla Dam in 1968 and Tarbela Dam in 1974. They produced 2000 megawatts (MW) of electricity. And yet after that, despite the development of heavy industry, a rise in population, and the increasing sprawl of urban centers, no attention was paid to power generation and distribution.

The present crisis started in 2006–07, with a gradual widening in the demand and supply of electricity. This gap has now grown, and assumed an alarming proportion. Pakistan's energy sector has suffered a financial crisis due to rising fuel prices. It has also suffered because of weak governance, political interference in decision making, an adverse impact of power purchases from independent power projects (IPPs), inefficient power utility operations, power theft, reduced billing and collection, nonpayment of arrears, and so on. Furthermore, the absence of effective planning and an economically and financially viable strategy, as well as an incapacitated regulator, have resulted in the supply-demand gap. The situation has been further compounded due to high transmission and distribution losses, the development of a black market for power, and declining revenue collection. This has led to the persistent accumulation of circular debt. Consequently, the federal budget has had to absorb a huge quantum of subsidies to bridge the financial gaps in the power sector. This has threatened fiscal stability on the one hand, and increased public debt on the other.

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All of this has led to power outages and load shedding. Reforms and adjustment measures—including the introduction of a market-driven system—have become the need of the hour. These are needed to restore the financial and operational viability of this very important sector so that it can be self-sustaining.[2] This paper will analyze the current energy situation in Pakistan, highlighting different issues and challenges that aggravate the crisis. These include an examination of technical, financial, governance, and operational and management issues. Similarly, after identifying these key issues, a future course of action or way forward (where we would like to be in the coming years) will be chalked out. This paper will advocate that these reforms will and can address Pakistan's energy crisis in the short, medium, and long term—and allow Pakistan to better channel the capacities of the private sector.

First, it is important to highlight how these challenges are being tackled under the present leadership of the Ministry of Water and Power. Unless sincere efforts are taken, the energy situation in the country will remain precarious. The people of Pakistan have to realize that unlike air that we breathe and get for free, electricity/power is something which we all have to pay for. There is a price for it, and unless there is more awareness about the proper utility of this sector, the general public will keep suffering, and power theft and pilferage will continue. Without proper, realistic, and people-centric reforms, the energy sector will keep suffering and the vision for a better and prosperous Pakistan will be far from reality.

KEY CHALLENGES FACED BY PAKISTAN'S ENERGY SECTOR AND OBSTACLES THAT CAN BE ANTICIPATED: WHERE WE ARE RIGHT NOW

Weak Institutional Capacity

Organizational and institutional weaknesses have led to inefficient management, poor maintenance of equipment, old and obsolete technologies, corruption, and so on. Some years back, the government unbundled the Water and Power Development Authority (WAPDA) into eight distribution utilities, three generation companies (GENCOs), and the National

Transmission and Dispatch Company (NTDC). However, so far, the unbundled entities have not been privatized and continue to be under the administrative control of the Ministry of Water and Power. The operational and financial performance of the unbundled entities has not been satisfactory, resulting in load shedding, high levels of accounts receivable, and high system losses.[3] The Pakistan Electric Power Company (PEPCO) still serves as a holding company for the unbundled WAPDA entities. Similarly, the capacity of the power sector regulator was enhanced when the National Electricity and Power Regulatory Authority (NEPRA) was authorized to issue licenses and tariffs. However, there are still issues between government and NEPRA on the issue of tariffs. Additionally, the Ministry of Water and Power is totally preoccupied with operational and development matters, and this is why it is not able to give adequate time to policymaking and policy formulation. Thus its capacity needs to be strengthened so that it plays an important part in ensuring that energy issues are handled in an effective way by bringing all stakeholders on board.

Generation Capacity

Over the years, the demand for electricity in Pakistan has been rising. It is said that population growth alone adds many megawatts per year to the country's electricity needs. However, energy generation has not increased, and existing power plants are in bad condition. The problem has been exacerbated by existing generating capacity not being fully employed. In May 2013, out of 11 public sector thermal power plants, seven were completely shut down and the rest were not running at full capacity due to fuel shortages.[4] It is, therefore, critical that existing power plants are not only made fully operational, but also efficient if an adequate supply of fuel is provided to them. Similarly, in the long run, the generation companies and unbundled entities of WAPDA need to be privatized. This is because these unbundled distribution and generation companies do not have full autonomy. Therefore, there is no incentive for them to strengthen their technical capabilities, foster accountability, and end corruption.

Pakistan is in a developing stage, and its gross domestic product (GDP) is rising. It was 4.2 percent for 2014–15. The computed peak

Figure 1: How Energy Demand is Distributed in Pakistan

CONSUMERS CATEGORY	NO. OF CONSUMERS (AS OF MAY 30 2014)		CONSUMPTION (JULY 2013–MAY 2014)	
	NOS.	% AGE	BILLION UNITS	% AGE
Domestic	19,266,523	85.55%	29.871	46.42%
Commercial	2,625,959	11.66%	4.316	6.71%
Industrial	304,397	1.35%	18.899	29.37%
Agricultural	309,497	1.37%	7.411	11.52%
Others	14,228	0.06%	3.857	5.99%
Total	22,520,604	100.00%	64.354	100.00%

Source: Ministry of Water and Power, government of Pakistan, 2014.

demand of the country for 2014–15 was 20,800 MW, and it is expected to become 31,445 MW in the year 2019–20. This equates to an increase in demand of 10,645 MW. At present the demand of 20,800 MW is distributed primarily in the domestic consumers sector, which consumes 46.4 percent of it. The domestic sector is 85.55 percent of the total consumers in the country.

Revenue

Power sector revenues are heavily dependent on subsidies. Power sector subsidies had been costing about 2 percent of GDP, and taking 15 to 17 percent of Pakistani government revenues. However, these subsidies have now been done away with. In this regard, a very bold decision has been taken by the government.

Furthermore, tariffs have been increased, but costs have also risen faster. Insufficient revenues and payment indiscipline have also led to circular debt, which is seriously constraining liquidity and investment. The need is for a sustainable and predictable tariff regime that includes all costs in determined tariffs, closing the gap between determined and notified tariffs, and eliminating circular debt. Even if tariffs are insufficient for cost recovery, distribution companies (DISCOs) should

be making every effort to ensure that they collect all the revenues that they bill, based on prevailing tariffs. When bills remain uncollected, they are booked as receivables in the DISCOS' accounts. This practice has been widespread over many years, and with a significant cumulative impact.

Circular Debt

Circular debt is one of the most critical issues in the power sector. It affects not only the power sector itself, but also has an impact on other sectors like oil and gas as well as the financial sector. The liquidity crunch created by circular debt brings losses in generation, defaults of financial institutes, and supply chain disruptions in the oil and gas sectors. Circular debt results due to a number of reasons. These include tariffs that do not cover all costs, line losses that are not just limited to technical but also theft (which is not quantifiable), and billing and collection systems that pay back much lower amounts than what has been billed. Among these causes, low recovery rates of revenue and high levels of theft are major contributors to circular debt.

Circular debt can be partly arrested with measures like targeting subsides and recovering losses. But to fully contain it, the sector's payment mechanism must become automated and transparent. Putting in a metering tree covering the system from generation to transmission, to common delivery points to 11kV feeders, and at the end to consumers is an important element in the overall resolution of the problem.

Line Losses

System losses worsen the effect of high costs. Almost all DISCOs incur losses higher than what the regulator has allowed to these companies. The effect is compounded with generators, and transmission losses worsen the overall costs of the system. As a result, a major portion of energy is either lost or unaccounted for. Public sector plants take about a third more gas and furnace oil than IPPs to generate a kilowatt hour. Fuel inputs to these plants are found to be off specifications. A substantive percentage of purchased electricity is lost in distribution. To reduce losses, a baseline of key performance indicators for GENCOs

and DISCOs should be the first step of a systematic plan to achieve reductions in losses, improvements in transparency through network-wide metering, increases in collections, disconnections of defaulters who remain connected, and so on. Enacting and implementing legislation to criminalize theft along with a vigorous program to prosecute theft are also important steps.

Inefficient Power Transmission and Distribution System

Another big challenge for Pakistan has been a terribly inefficient power transmission and distribution system that currently records losses of 23–25 percent due to poor infrastructure, mismanagement, and the theft of electricity. The cost of delivering a unit of electricity to the end consumer has been estimated by NEPRA at 14.70 rupees (about 14 U.S. cents). The transmission system has been expanding over the years, but at a slower pace. Additionally, the load in recent years has tightened transmission capacity, leading to overloads and bottlenecks.

The transmission system in Pakistan consists of 500 and 220 kilovolt (kV) networks with sub-transmission voltage levels of 132 kV and 66 kV.[5] There are 12 500 kV and 32 220 kV grid stations in the country. The length of lines is 5,143 kilometers (km) on 500 kV networks and 8,991 km on 220 kV networks. Similarly, the distribution system networks also appear to be lower than load growth. 132 kV grid stations are overloaded, resulting in frequent breakdowns and trippings. Thus, transmission lines and distribution infrastructure are not adequate to cater to the additional load, which results in frequent trippings due to overload. Furthermore, to minimize the effect of load shedding, some plants are being operated around the clock, thus incurring additional maintenance costs. Furthermore, feeder wise monitoring of losses and recovery has not been effectively carried out by distribution companies.

Financial Costs Due to Obsolete Billing System

The financial issues of the power sector are turning it into a huge drain on the national exchequer instead of producing a revenue-making sector. Recoveries in comparison to the service that they provide are always on the lower side. We have old and obsolete meters and billing

systems, which makes it very easy for anybody to tamper with meters. In fact, meter readers themselves interfere with the billing system. Clearly, there is no accountability and transparency. Defective and faulty meter-reading is rampant in DISCOs. The current billing system is a major impediment to ensuring financial stability. It is a legacy-based system with human intervention at all levels. These discretions have created a lot of issues for the sector.

No Performance Audit, Resulting in Management and Governance Issues

Governance issues have a major impact on the macroeconomic performance of any country, and in the case of Pakistan they have hindered the sustainability and effectiveness of the energy sector. Due to weak governance, the sector suffers from inefficient utility operations, electricity theft, meter-tampering, reduced billing and tariff collection, non-payment of arrears, wastage, and a buildup of financial insolvency of energy companies. Although most of the companies have financial audits, performance audits are always missing. There is no central system that controls or monitors the corporate entities. Similarly, there is a lack of control by CEOs of DISCOS and GENCOs, and no coordination between field formations and headquarters. Boards of directors are busy with routine duties and do not take a keen interest, and there is no clarity about the functions of internal or statutory audits.

WHERE DO WE GO FROM HERE?

In order to progress and be self-sufficient in the energy sector, we need to strengthen existing governance mechanisms. We have to reform governance of the sector to see any transformative change. Key reforms include aligning the ministries involved in the energy sector; reforming the structural aspects of NEPRA and the Oil and Gas Regulatory Authority (OGRA) to ensure regulatory autonomy, effectiveness, and accountability; privatizing distribution companies; addressing technical losses; establishing an effective mechanism to eliminate corruption and theft, improve efficiency, and minimize wastage; eliminating redundancies in

the workforce; attaining more economical user charges, and so on. All of these require a fundamental change in our governance process.

Revamp the Ministry of Water and Power and Change its Role

In the past, the Ministry of Water and Power—the government ministry assigned the task of looking after the energy sector—has had an administrative role in the everyday functioning of the sector. In the current scenario, it is very important that this role become strengthened, and that capacity is increased, so that the ministry can develop and implement power policies. This ministry has to be a "nerve center." It has to coordinate, lead, and be a watchdog so that public complaints are redressed and energy policies and plans are fully implemented without any bottlenecks and unnecessary bureaucratic hurdles.

Being fully conscious of this, we have already taken many practical and proactive measures. Nowadays, there is complete monitoring of grid stations and the power distribution system, which occurs 24/7 and on an hourly basis. Through video link, all DISCOs and all other entities are connected to the ministry, and DISCO CEOs along with their management teams apprise the ministry secretary of all pending issues. Public grievances are addressed immediately, and any faults in the transmission lines and grid stations are rectified on a priority basis. A fully functional and equipped complaints center has been set up in the ministry with a 24-hour helpline. Thus, a two-pronged strategy is being executed by the government. This involves an emphasis on increasing generation of electricity, but also on addressing the governance issues fully responsible for the energy crisis.

Generate Additional Energy

The key element in coping with this crisis is to meet the growing demand of the system and to bridge the demand and supply gap. Power sector demand grows at a rate of about 7 to 8 percent per annum. The generation additions so far have been inadequate to meet growing demand, because the system in place right now cannot even take the current load. Thus, transmission and distribution networks are not capable of transferring full generation to end consumers due to various system constraints.

More generation is thus critical, and can be provided through rehabilitating and replacing existing plants in the public sector; unblocking stalled projects; and setting up new plants. The installed capacity in the national grid is de-rated to lower levels which are available for generation. A major portion of the installed capacity is dependent upon the seasonal flow of water in rivers and provincial water release indents. Available generation capacity is further reduced by gas shortages and funds shortages for furnace oil. Rehabilitating and replacing the larger public sector plants (Jamshoro, Muzaffargarh, Guddu) is a medium-term action that can add significant new capacity at higher efficiency. To date, about 400 MW of power has been restored under various rehabilitation projects in public sector power plants.

While progress on Pakistan's large hydropower and coal resources is critical, these are expected to take a longer time. Hydel will not be available for another six to eight years, whereas coal may be available by 2017. Therefore, in the medium term, coal-based power plants are the key toward bridging the supply and demand gap. Another option is liquefied natural gas (LNG) support of the baseload. To attract additional capital to the energy sector, the private sector should be involved (currently, only the NTDC is involved). Some direct contracting between generators and large creditworthy customers can also help increase generation from existing resources. This can be achieved through the wheeling policy already in place.

Privatize DISCOS and GENCOs, and Restructure NEPRA and PPIB

The government's strategy of privatizing DISCOs and GENCOs aims at selecting owners and operators with adequate resources and competence through a transparent and competitive process. Pakistan's power sector needs to step up investments in generation, transmission, and distribution to improve efficiency within the existing system, and to expand them in order to meet increasing demand.[6] The Karachi Electricity Supply Company, now known as K-Electric, was financially restructured and then privatized in December 2005 with the purchase of a 71 percent stake in the company by a consortium of Pakistani and foreign businesses. This has resulted in improvements in its operational and financial performance. It has also managed to reduce losses (although a lot

more still needs to be done). Thus, one can safely say that a competitive environment in the energy sector is badly needed so that there is competition in the ownership of the distribution utilities as well as generating plants. Privatizing these companies and deregulating the energy market will create a level playing field for private sector enterprises.

Additionally, there is always agreement that the regulatory framework needs further development. Thus, the role of NEPRA and the Public Private Infrastructure Board (PPIB) needs to be revisited. Some of the areas that need to be addressed include establishing an effective mechanism to resolve potential disagreements between NEPRA and the government. Attention must also be given to disputes between NEPRA and the licensees that it regulates.

Overhaul Old Transmission Lines and Grid Stations

Even if we build more dams and generate more electricity, without overhauling the obsolete system of transmission and distribution all our efforts will be in vain because the system will not have the capacity to absorb extra electricity. We need to put in major investments in improving our transmission and distribution networks so that they become fully functional and can handle the extra load of power.

Rationalize Tariffs and Improve Recovery

An important step that the government is taking refers to the increase in tariff. It is believed that since consumer tariffs have been insufficient to cover the cost of power generation, a further build-up of circular debt cannot be avoided without sharp upward adjustments in power tariffs. According to the Ministry of Finance, in order to improve the flow, measures such as ensuring 100 percent recovery of bills are underway—with defaulters disconnected 45 days after payment due dates (this is reduced from 90 days previously).[7] The government can help recover receivables owed by federal and provincial government offices. A budget adjuster should be in place to help recover arrears of the provinces. Monthly financial planning is being implemented and should be further strengthened for smooth financial flow in the power sector. The government deserves credit for making the tough decision of regularly

revisiting power tariffs in line with international oil prices on a quarterly basis, in order to recover the cost of power—even despite political compulsions and severe criticism.

Balance the Energy Mix to Reduce Costs

The World Bank estimates that, worldwide, electricity production is most accounted for through coal (40 percent), followed by gas (19 percent), nuclear (16 percent), hydro (16 percent), and oil (7 percent). However, in Pakistan, electricity is most accounted for by oil (37 percent), followed by gas (31 percent), nuclear resources (3 percent), and coal (only 0.2 percent), with the rest covered through hydro resources. Coal and nuclear contributions to electricity generation are extremely limited, with vast potential for growth. The high dependence on imported oil for electricity production places a considerable strain on the economy, as compared to the impact on the economy caused by the use of domestic gas and hydropower. Thus, Pakistan needs to have an energy mix so that we are not dependent upon expensive fuel to generate that energy.

As previously stated, simple generation additions will not solve the energy crisis. Generation additions of the least-cost path have to be adopted. Costs can be brought under control by first shifting the generation fuel mix from expensive residual fuel oil (RFO) to coal and hydel-based generation, and then by shifting to indigenous resources. In recent years, the fuel mix has shifted away from domestic, price-capped gas and hydropower to imported, market-priced furnace oil. Additionally, gas shortages cause gas-fired power plants to use diesel, adding further costs. Thus, more domestic gas to the power sector can significantly reduce costs. Also, gas and oil must be directed to the most efficient plants. Some additional hydropower may arise from adjustments in the rules for operating hydro plants. Better wellhead prices at existing fields could bring incremental gas, while more attractive investment terms would be needed to bring significant increases in domestic gas production.

One of the most immediate solutions of the fuel mix change is the introduction of coal-based power plants into the system, like Gaddani (6600 MW), Port Qasim (1320 MW), and Sahiwal (1320 MW), among others. In the midterm, hydel—which can be produced through the Tarbela 4th and 5th extension power projects and the Neelum Jhelum

hydropower project—will optimize the fuel mix issue in the country. The projects based on coal in Gaddani, Port Qasim, and Sahiwal Punjab are essential in not only bridging the demand and supply gap, but also in changing the fuel mix from expensive RFO-based to coal-based. The current share of thermal plants is 59.5 percent, whereas hydel is 34 percent, nuclear 4.1 percent, wind 0.2 percent, and others 2.2 percent. The share of coal in the national grid is less than 1 percent.

With new plants coming on to the national grid based on coal and renewables, the coal share will increase to about 35 percent, and the share of RFO will drop to 34 percent.

Conserve Energy

Efficiency in the use of energy can generate substantial gains in supply, thus reducing the supply-demand gap. Pakistan's total energy savings potential is estimated at 2,250 MW. Savings from energy efficiency could reach 18 percent of total energy consumed in the country. This corresponds to a 51 percent reduction in net oil imports. Furthermore, for each dollar of GDP, Pakistan consumes 15 percent more energy than India and 25 percent more than the Philippines.[8] There is a margin of over 20 percent savings in electricity consumption across all sectors.

Unfortunately, proper management—such as improving energy efficiency and loss reduction programs which have the lowest incremental cost—has not been accorded the same priority as new supply-side initiatives. Thus, it is evident that besides having new supply-side initiatives, we need to make sure that there is no wastage, and that electricity is conserved. One way of encouraging the general public could be to create proper economic incentives to ensure conservation behavior on the part of consumers—an essential ingredient of any energy policy. There should be a proper enforcement system for energy usage to prevent power theft, and the concept of "no free lunch" should also be applied to the power sector. Even those who can afford more air conditioners and can pay heavy bills should be made aware that energy has to be conserved and not wasted. It is a sad fact that the elite of Pakistan resort to wasting electricity by using many air conditioners and other gadgets in their homes, at the expense of relatively poor and lower middle class consumers. But the irony is that since they are also not paying the full

amounts of their electricity bills, therefore, even by using many more appliances, they do not feel the pinch. It is about time they are made to truly "pay" for what they consume, and at the same time to realize that this energy should not be wasted.

In Pakistan's case, demand-side management is absent. The more energy is generated, the more it is wasted. The installation of time-of-day meters at large commercial and residential sites under NEPRA targets and the enactment of an energy conservation law (among other measures) can be important steps to make the masses realize the importance of conservation.

There should also be media campaigns highlighting the importance of energy conservation. Furthermore, even our educational institutions should have programs and curricula on how to use energy efficiently and on how to make the best use of our resources. Another important intervention in energy conservation could be strict laws and legal action that target any kind of power theft, wastage, and meter tampering.

CONCLUSION

This essay has analyzed the current power crisis in Pakistan by highlighting key issues and challenges. It contends that successive governments have only focused on the demand-supply gap, with no major plans or projects for the upgradation of the existing system. Our transmission and distribution system is old and obsolete—and therefore, generation is not compatible with it. The result is that the national grid is unable to handle generation. This essay has argued that despite issues of increased power generation, distribution, and transmission, governance issues are far more important than generation. All our efforts to bring in more power will be in vain until existing systems are made functional, proper maintenance is done, an accountability and performance audit is established, capacity building is strengthened for staff and officers that handle the systems, and there is more awareness-raising about the proper use of energy and its conservation.

Reforms in the energy/power sector are key to the smooth implementation of energy policies as well as to the micro and macroeconomic development of the country. The reforms presented in the preceding pages have the potential to address Pakistan's immediate energy crisis.

They are much more realistic compared to past attempts at power sector reforms, because they give a holistic view and a systemic analysis of all issues confronted by Pakistan in the energy sector. In the past, the emphasis was mainly on power generation, and it was argued that once there was more power and energy than all major issues would be resolved. However, this paper has highlighted that unless governance reforms go hand-in-hand with power generation, distribution, and transmission, we will continue to face a number of issues.

After being given the challenge to turn the energy sector around, the present leadership of the Ministry of Water and Power is ensuring that the vision for a prosperous and energy-efficient Pakistan becomes reality. To achieve this, all efforts are being put in place. The most encouraging and positive part is of course the commitment of the present government, which was extremely supportive of all my efforts. That is why I was able to do crisis management with the energy sector—because the power sector is the number one priority of the government of Pakistan, and it is focusing on this issue in a big way.

NOTES

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Pakistan's Energy Sector: Putting It All Together

ZIAD ALAHDAD

The critical state of Pakistan's energy sector is a primary constraint on the country's economic development. Lost opportunities, prohibitive delays, implementation performance, and reform reversals contribute to prevailing conditions. The economic fallout of the crisis is well-documented, as are a host of options for short-term remedial measures, mainly within individual energy subsectors. Yet the deterioration continues, contributing to an ever-widening energy deficit. Many say that Pakistan's energy sector, and by extension, its economy, are beyond redemption. This is completely unsubstantiated. If every crisis presents an opportunity, Pakistan, with so many crises, should also have many opportunities. This story of the energy sector is symptomatic of all sectors of the economy.

What is lacking is the ability to bring together the various subsectors of the broader energy sector through a robust mechanism—one that can establish a program of policy and investment options that can operate even within the financial, credit, and capacity constraints faced by Pakistan. This mechanism must also prevent short-term decisions that deviate from a longer-term vision or, even worse, are launched without a clear vision. In the energy sector, where projects are typically highly capital-intensive with long lead times, the cost penalties of sub-optimal decisions are prohibitive. Paradoxically, defining the long-term vision is an immediate requirement, and adhering to it through the short-term is an imperative.

This essay identifies the lack of coordination in Pakistan's energy sector as an urgent and critical issue, and introduces an integrated approach as a means of addressing this lack of coordination. Emphasizing the importance of building capacity, the essay briefly explains the concept of

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Integrated Energy Planning and Policy Formulation (IEP) and its two components, analytical and institutional. It traces the development of IEP at the international level. It presents a summary of the size and characteristics of Pakistan's energy sector, followed by a history of IEP in the country and the prospects of re-vitalizing it, while emphasizing organizational and bureaucratic pitfalls. The essay then goes on to show how IEP can address Pakistan's energy issues in the short-, medium- and long-term, and how the absence of IEP explains the present predicament.

ADDRESSING THE PROBLEM

Repeatedly, through several five-year planning cycles, Pakistan's policymakers have been remarkably adept in articulating policy objectives for the energy sector to support the economy. Despite this, the sector is in a dire state. The problem is not lack of clarity on *what* needs to be done, but *how* it is to be done. The criticism in this essay is meant to be constructive, and should be taken in this spirit. Credit is due to those who have managed to influence policy despite insurmountable obstacles, many of which are rooted in poor governance.

Analysts agree that the absence of coordinated policy formulation is a key shortcoming in Pakistan. This essay attempts to show how this shortcoming must be dealt with, focusing on a fundamental missing element that should be the starting point of energy sector reform: IEP, a mechanism tried and tested the world over, without which decision-making is reduced to shooting in the dark.

The essay avoids prescriptive solutions, but rather suggests the type of capacity that needs to be built up for IEP to take root, and identifies the institutional structures essential for its sustained implementation (Pakistan's implementation performance is a well-known Achilles heel). Ultimately, the objective is to help Pakistanis make their own informed decisions.

CAPACITY BUILDING: THREE LEVELS

Building capacity is the core function of the development process, and the *raison d'etre* of the international development community. Traditionally,

efforts were focused on the individual, with an emphasis on training. This was clearly insufficient, and development remained elusive. In more recent years, state-of-the-art analysis by key development institutions such as the World Bank Institute has indicated that in order to be effective, capacity must be built concurrently at three levels.[1]

The first and most disaggregated level is developing the skills and knowledge base of the individual. Once trained, the individual can only be of benefit if she or he works in an appropriately structured institution that uses appropriate acquired skills. Hence the second level is institutional. The third level is the policy environment, which provides the incentive structure and governance for the running of institutions. The combination and mutual compatibility of all three levels are essential for building and sustaining capacity. This essay examines the extent to which capacity building in Pakistan's energy sector deviates from these principles, and its implications.

IEP CONCEPT

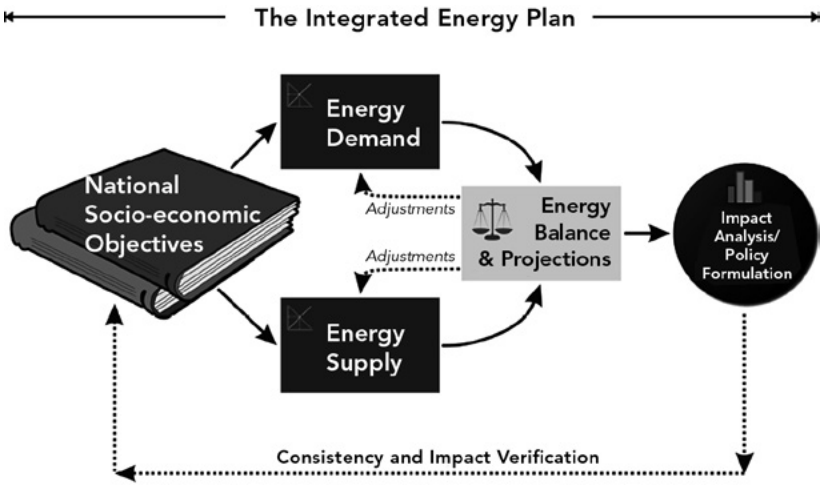
IEP deploys all three levels of capacity building, and has two distinct and equally essential components: an analytical framework to feed the decision-making process, and an appropriate institutional structure at the policy level to facilitate sound decision making. IEP addresses short-, medium- and long-term issues.[2] The short-term impact needs emphasis, as Pakistan's energy sector requires immediate support. Pakistan has good long-term prospects but to get there, it needs to traverse the troublesome short term.

Analytical Component

Simply stated, IEP integrates energy subsector plans and policies to support national objectives, and arrives at a range of policy scenarios that are tested for impact on the economy. As Figure 1 shows, this all represents a five-stage process.

IEP operates in three tiers. At the first tier, which represents the most aggregate level, IEP analyses the economic impact of policies affecting energy supplies, pricing, and taxation. As energy affects every part of the

Figure 1: The IEP Process



economy, the energy sector is analogous to the financial sector; some analysts describe energy as the physical counterpart of money. The second tier treats the energy sector separately, in terms of its subsectors, analyzing the economics of inter-fuel substitution, optimal development, and the supply and consumption of fuels. The third tier, the most disaggregated level, consists of least-cost investment plans and policies within each subsector.

A range of policy tools is available to achieve desired objectives. Physical tools, for short-term responses to energy shortages, include load-shedding and fuel rationing. Technical tools deploy the most efficient technologies for production, utilization, fuel mix, and substitution. Education tools raise public awareness. Pricing and taxation tools provide incentives and generate public revenue.

IEP addresses short-, medium-, and long-term time horizons. Since shorter horizons are based on more reliable information, IEP is very effective for addressing short-term issues (one to two years), facilitating supply and demand management to deal with unexpected problems, including supply disruptions. Contingency measures include physical rationing, price surcharges, and subsidies. Some countries, including

Pakistan, tend to stop at this short-term horizon, thereby adopting a continuous crisis management mode. The medium term (two to five years) facilitates decisions on project planning and implementation, pricing, inter-fuel substitution, and conservation and environmental policies. The long term (five to ten years) facilitates resource development, energy use patterns, and the adoption of emerging technologies.

Examples of policy objectives which IEP can help achieve include determining energy needs to achieve growth and development targets while maintaining environmental standards; achieving the optimal energy supply mix to meet future needs; conserving energy and eliminating waste; enhancing energy security by diversifying and reducing reliance on imported energy; meeting the energy needs of the poor and reducing poverty; saving foreign exchange; reducing trade deficits; developing regions with special needs; raising funds to finance sector development; and achieving price stability. Without IEP, the default energy situation drives the outcome in each of the areas mentioned above. With IEP, policymakers are able to influence these (often-conflicting) economic objectives.

Institutional Component

The successful implementation of IEP depends on establishing a separate ministry or department of energy with overarching responsibility for the sector, and with access to top policy levels.

International Experience

IEP was introduced in the 1970s and successfully implemented in a wide range of nations, amended to suit each country. In the 1990s, in the wake of a major push by international development agencies to promote market economies, IEP began to wane on the assumption that the free market would determine appropriate policy choices. This assumption, in fact, does not hold for most countries in the developing world. It might have been ideologically motivated to counter the "Gosplan" heritage of the newly independent states of the former Soviet Union (Gosplan was the Soviet Union's central economic planning agency).[3]

Interestingly, the former Soviet Union's newly independent states, while assimilating market reform principles to varying degrees, nonetheless

retained the essence of the IEP approach. Perhaps the reason for this was that the initial euphoria of independence rapidly gave way to a common sense of economic reintegration among and within the new republics.

Fast forward several decades. Many other countries that dropped IEP began to regret their mistake, and eventually started clamoring for its return. As part of feedback received for the update of the World Bank's global energy sector strategy for 2010, countries overwhelmingly flagged the absence of "long-term comprehensive energy planning" as the most common and serious issue. In response, the Bank's current energy strategy accords top priority to sector-wide planning.[4] The strategy advocates holistic engagement to catalyze the transformation of the energy sector in the context of long-term, system-wide, technology-neutral planning. It involves system-wide optimization, supply-demand integration and, where beneficial, expanding coverage to a regional level. This change clearly signals the triumph of economic common sense over ideology to achieve a practical balance.

Through all this, many developing countries have maintained IEP in some form. Notable among them are: Indonesia, Malaysia, Thailand, Philippines, Poland, Bulgaria, Romania, Hungary, Slovakia, Czech Republic, Cambodia, Vietnam, Russia, Ukraine, Belarus, Turkey, Tajikistan, Kyrgyzstan, Uzbekistan, Uganda, and Kazakhstan. Best practice examples for Pakistan include Turkey and Kazakhstan. Both of these countries have been able to address critical energy issues by maintaining three important characteristics of IEP: coordinated analysis, policy-level institutional arrangements supporting close coordination, and a strong emphasis on implementation.

PAKISTAN'S ENERGY SECTOR: SIZE AND CHARACTERISTICS

As shown in Figure 2, total primary energy supply in Pakistan is 66 million tons of oil equivalent (MTOE). This involves 48 percent natural gas, 33 percent oil, 11 percent hydro, and 6 percent coal.[5] Pakistan imports 30 percent of its energy requirements, mostly as crude oil and products, and at a cost of $14.5 billion a year. With rising oil prices, this will soon reach a prohibitive $38 billion.[6] (While there has been some respite due to lower global oil prices, it is not certain how long this will

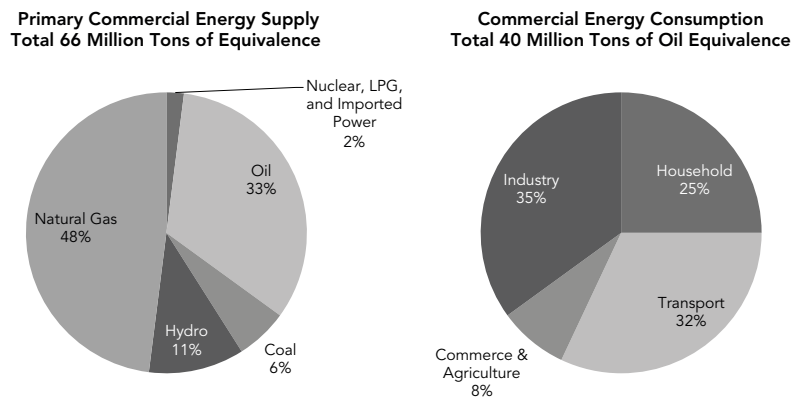
last. In fact, prices have already begun to rise once again. Pakistan, or any country for that matter, should treat the present situation as a windfall rather than as a long-term trend.) Pakistan's energy consumption is 40 MTOE. Industry is the dominant consumer with 35 percent of the market, followed by transport (32 percent) and households (25 percent).[7]

There is close correlation between Pakistan's growth rates for energy consumption and gross domestic product (GDP). This confirms what may be intuitively known: energy fuels Pakistan's economy and, conversely, its shortages impede economic growth. Energy has been, and remains, a key determinant of Pakistan's economic growth.

The Third Annual Report of the Institute of Public Policy quantifies the prohibitive cost to the economy of energy shortages, and convincingly demonstrates how these shortages impede Pakistan's economic development. In the industrial sector alone, power outages in 2009 cost $3.8 billion, about 2.5 percent of GDP. Half a million jobs and exports worth $1.3 billion were lost—and this is only a small part of the overall problem.[8]

The state of Pakistan's energy sector in relation to the world can be seen from two indicators: The first, energy consumption per capita in

Figure 2: Pakistan's Energy Supply and Consumption, 2013



Source: Hydrocarbon Development Institute of Pakistan.
NOTE: LPG=liquid petroleum gas

Pakistan (0.49 TOE/capita), is less than a third of the world average. This reflects the level of development and, since energy availability is a key determinant of the standard of living, it also indicates the high incidence of poverty.[9] The second, energy consumption per dollar of GDP growth in Pakistan, is nearly three times the world average.[10] This indicates low efficiency of energy use in Pakistan, and emphasizes the need for policy reforms that stimulate efficiency. In a constrained supply situation, efficiency gains mean increased supply.

IEP IN PAKISTAN: HISTORY AND PROSPECTS

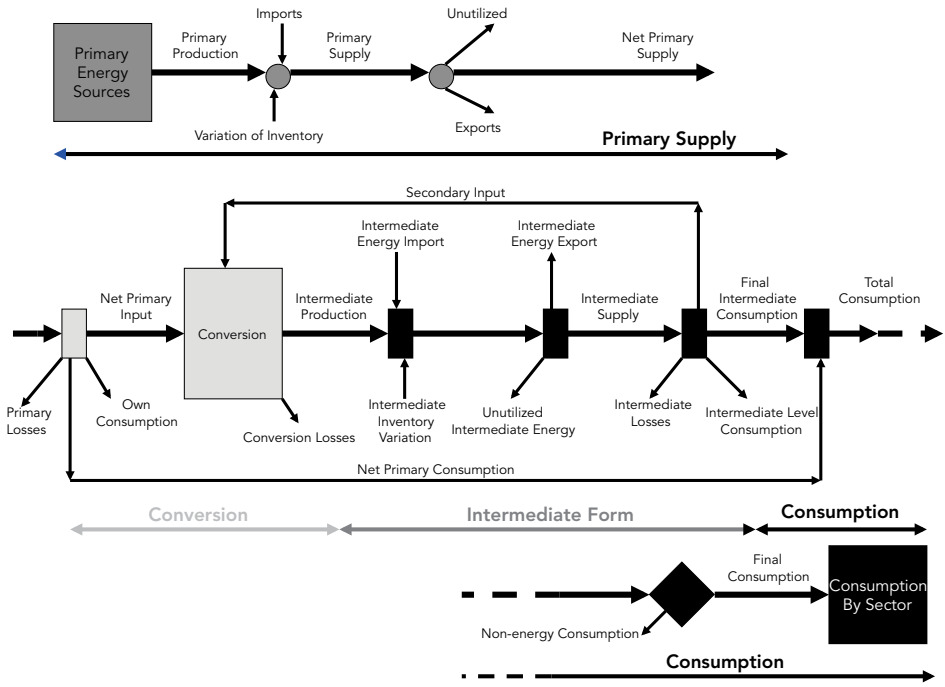
The lack of a coordinated energy policy is a key issue in Pakistan requiring immediate attention. Pakistani economist Shahid Javed Burki, focusing on the subject of commercial energy, has written of "the need for a comprehensive strategy to deal with the problem of energy."[11] Another Pakistani expert, Sabira Qureshi, while discussing noncommercial traditional fuels, has argued that "it is imperative that government policies and strategies recognize" the "near invisibility of the role of traditional fuels." She urges "better inter-sectoral policy coordination, and integrated development approaches," and reminds us that "the costs of inaction are high."[12] Additionally, the issue has not escaped international attention. The *New York Times*, as early as April 2010, quoted a Pakistani senior official as saying "There is nobody in Islamabad who is working on a coherent, integrated plan. The discussion just keeps going in circles."[13] An energy assessment by USAID back in 2007 maintained that the most glaring shortcoming in Pakistan's energy sector is "the ability to perform system-wide planning in the electricity and energy sector as a whole, both in terms of technical analysis and ability to develop and implement plans of action."[14]

That said, there is good news for Pakistan on the analytical side. The most sophisticated part of the IEP process is the construction of the energy balance. The Hydrocarbon Development Institute of Pakistan (HDIP) produces an impressive document, the *Energy Yearbook*, which includes comprehensive energy balances. This is testimony to the fact that, despite the brain drain from Pakistan, islands of excellence remain. This offers hope for the future, and gives pause to those who maintain

that the situation is beyond redemption. Figure 3 is an example of a flow diagram from which the energy balance is constructed.

In other words, IEP is not unknown in Pakistan. In fact it was introduced in the country, albeit partially, in the early 1980s.[15] The government, firmly committed to introducing IEP, established a planning unit within the Directorate General of Energy Resources. There was a decision to move this to a central neutral location in the Planning Division. Administrative orders were issued and budgets approved.[16] In bureaucratic parlance, this implied a done deal. An Energy Policy Board, with top-level representation from all energy-related ministries, was instituted to facilitate integration with national plans and make policy decisions. The Executive Committee of the National Economic Council or the Cabinet dealt with decisions having nationwide impact.[17]

Figure 3: Energy Balance Flow Diagram



It was a noteworthy start. However, unraveling was inevitable since there was no follow-through on the necessary organizational changes. Instead of moving toward a simple integrated structure, there was a gradual fragmentation of policy institutions—which compounded the complexity, confusion, and overlap of responsibilities. Instead of one integrated agency at the policy level, there are now over 15 agencies and ministries involved, making coordination well-nigh impossible.

Fragmentation is not confined to energy institutions. On the contrary, it pervades the entire bureaucracy. In 2010, the *Washington Post* counted 61 federal ministers and ministerial-level advisors, many on party patronage, in contrast to most countries' cabinets, which consist of around 15 to 20 members.[18] The U.S. federal cabinet has 16 members. Even the Nigerian cabinet, considered prohibitively cumbersome, has about 40.

Listing the energy-related lead ministries, planning institutions, and regulatory agencies and their responsibilities illustrates the extent of the fragmentation and overlap. The Ministry of Petroleum and Natural Resources is responsible for the oil and gas subsectors and the coal subsector. Coal exploration and development, however, are managed by the Pakistan Mineral Development Corporation through leases granted to the private sector and administered by provincial governments. The Ministry for Water and Power oversees the electric power subsector. The Pakistan Atomic Energy Commission oversees nuclear power generation. The Ministry of Urban Affairs, Forestry, and Wildlife oversees the fuelwood subsector. The Ministry of Food, Agriculture, and Livestock handles other biomass such as agricultural residues. The Alternative Energy Development Board is the central national body for renewable energy, and is also charged with rural electrification in areas remote from the power grid. The Pakistan Council of Renewable Energy Technologies coordinates and facilitates technology development. The South Asian Association for Regional Cooperation (SAARC) Energy Center was set up to address regional and global energy issues, to facilitate energy trade within SAARC, and to enhance more efficient energy use within the region. The Ministry of Finance, Planning, and Economic Affairs is involved in energy pricing and taxation policies. The Ministry of Production is involved in policies for petroleum refining. The Ministry of Production and the Ministry of Industries both deal with industrial energy conservation policies.

The Oil and Gas Regulatory Authority regulates petroleum product distribution (including compressed natural gas, or CNG, for vehicles), sets safety standards, and equalizes prices across the country. The National Electric Power Regulatory Authority is charged with ensuring fair competition and consumer protection. The Private Power and Infrastructure Board was set up to improve investment incentives in the power sector and to serve as a one-stop facility for investors. Regulatory functions for other energy subsectors (those besides oil and gas) are included in the respective subsector ministries, while key pricing and taxation regulatory functions are held in central ministries such as finance and planning.

There are two main reasons why IEP did not take root in Pakistan. The first is the power of vested interests, which are always wary of sound analysis that exposes their efforts to promote suboptimal projects and policies. The second is the expected inertia of the bureaucracy to resist institutional change, and especially if this change involves authority shifts or downsizing. Both reasons are governance-related, and therefore emphasize the urgent need to introduce IEP.

Going forward, while we cannot rule out bureaucratic wrangling, turf battles, and job protection, the situation can in fact be remedied rapidly. The steps to start IEP in Pakistan have already been taken once before, and the necessary records should be retrievable. For the sophisticated analytical component, the situation is, paradoxically, easy to handle. It is simply a question of transferring skills from HDIP to an energy cell in the Planning Division or to a new ministry of energy. The cell should be strengthened by expertise in noncommercial, alternative energy.

Formation of the ministry of energy can be phased in gradually to minimize organizational disruption, and the functions of regulatory agencies would need to be reviewed to ensure independence and to eliminate overlap. To signal political will, the decision to form the new ministry, its structure, and a timeframe must be officially announced up front. If not, there would once again be the risk of unraveling.

In the recent past there have been signs of progress toward forming a ministry of energy—consider the reports from 2011 of a possible merging of the Ministry of Petroleum and Natural Resources with the Ministry of Water and Power (the Pakistani government, however, immediately denied these reports).[19] At the same time, plans for a separate ministry for irrigation, agriculture, and hydropower have also been tabled—a

retrograde step, and one that could once again increase fragmentation.[20] This legacy of one-step-forward-two-back must be checked.

ADDRESSING PAKISTAN'S KEY ISSUES WITH IEP

IEP can address five key sets of issues in Pakistan's energy sector.

Suboptimal Plans

A key benefit of IEP is its ability to quantify the cost penalty of pursuing suboptimal plans. This is vital for a cash-strapped economy confronted with poverty and inequitable income distribution, where access to and affordability of energy are critical concerns among the urban and rural poor.

No country actually adheres to the optimum. Departures will be necessary. However, the degree of departure from the optimum marks the difference between the success and failure of energy policy. Knowing the cost of deviation is vital for informed decision making. Without IEP, the optimum remains undetermined in Pakistan, as does the cost of deviations.

Pakistan purports to have a pro-poor energy policy. Some argue that national growth alone reduces poverty through a trickle-down effect. Early empirical data supports this. Subsequent work, however, shows that growth alone is not sufficient. Adequate distribution measures are equally essential. This is an approach labeled inclusive growth, for which two provisos are necessary: incentives to deploy the growth in productive channels, and social protection measures for equitable distribution.

Poverty cannot be eradicated overnight and requires a long-term vision. In Pakistan, the vision is drowned out by immediate concerns—resulting in flawed, prohibitively expensive short-term measures with little relevance for the poor. Recent examples include rental power plants (an extremely expensive option); diesel back-up generators for individual households (an improper choice of fuel); the development of CNG for transport without assessing long-term availability (which represents a lack of coordination within the same energy subsector); skewed subsidy arrangements that favor the wrong segments of the population; and a reliance on bailouts to reduce circular debt without addressing endemic

issues. Thus, income disparity continues to increase. Poverty levels, exacerbated by energy shortages, do as well.

Social protection involves subsidies and cross-subsidization in the short-term. Subsidies are fine if they are targeted, affordable, transparent, consistent with a long-term strategy, and the moral hazard of encouraging waste is minimized. IEP is very effective at measuring the impact of energy subsidies on the economy, thereby generating informed choices.

Unsustainable Energy Mix

This relates to two contradictory characteristics of Pakistan's energy sector: substantial resource potential and a large, expanding deficit. Today the deficit is 20 MTOE, with an expected increase to a prohibitive 120 MTOE by 2025.[21]

Since Pakistan's resource potential has been extensively covered elsewhere, this essay simply mentions a few key points. Of Pakistan's vast prospective basin (830 square kilometers), less than 4 percent of probable oil reserves and 19 percent of gas reserves have been confirmed.[22] The reserves-to-production ratio for oil is 13—precariously low given the high and rising level of import dependence, and only a third of the world average of 40.[23] For natural gas, the ratio is 19, against a world average of 59.[24] Most significantly, while drilling density in Pakistan is a fifth of the world average, its success rate is seven times the world average. It is patently evident that enhanced exploration, and appraisal and delineation drilling (the latter refers to the process of establishing the location and extent of an economically productive area of an oil or gas field), would considerably expand confirmed reserves as well as production potential—thereby reducing (and eventually eliminating) imports. Without this, we are inevitably constrained to consider major high-cost import pipelines from Iran, Turkmenistan, and other parts of Central Asia.

Even with only 1 percent of coal reserves proven, at present production rates, reserves will last 400 years.[25] Assay results from the Thar deposits (the fifth largest find in the world) indicate poor quality with high sulfur, ash, and moisture content. However, there are conflicting claims on quality—thereby signaling the need for urgent work to update assay results and assess the feasibility of treating the coal.

Pakistan's large-hydro potential is 41,700 megawatts (MW). Only 16 percent has been harnessed. A mere 4 percent of the 1,500 MW small-hydro potential has been tapped.[26] Solar and wind energy potential remains virtually untouched. Wind regime studies estimate a potential of 41,000 MW.[27] These are large figures, considering that the national installed power capacity is 20,000 MW.

The combination of prohibitive deficits and abundant resources tempts policymakers to promote all forms of energy. This is in fact a common trap that is wasteful and unaffordable. IEP can prevent this by striking an affordable balance. Pakistan has a clear advantage here: An ability to draw on the experience, good and bad, of countries that are ahead. Take, for instance, Germany's faltering renewable energy program.[28] This is a classic case of politically motivated reform that failed to analyze the impact of rapidly deploying alternative technologies. Rather than reduce emissions, which was the aim, the reverse has occurred. Even the most advanced countries can deviate too far from the optimum. It is the management of resources, and not their abundance, that makes the difference between the success and failure of economies.

Soaring Debt

The complex and convoluted problem of circular debt is simply the result of payment arrears of power utilities, their suppliers, and their clients. Revenues are insufficient, and production costs too high. Endemic issues relate to system management and structure, maintenance, operational efficiency, system losses (25 percent of net generation, including theft), and tariff collection (30 percent outstanding).[29] Since take-or-pay arrangements are in place with independent private power producers (IPPs), the inability of the public power utility to honor payments severely curtails the power output of IPPs.[30] Less than half of Pakistan's installed capacity of 20,000 MW is utilized, and only 70 percent of peak demand is met.[31] It should be clarified that one reason for the low utilization is due to the mix of hydro and thermal generation, which is sensitive to seasonal fluctuations in water storage. Instead of focusing on the endemic issues, the solution has been a series of unconditional bailouts—which present a major moral hazard. IEP would address endemic issues and rely less on stopgap bailouts. No amount of bailout will improve

the situation without time-bound conditions for tackling endemic issues. Moreover, IEP would give priority to system management, maintenance, and upkeep as much cheaper ways to upgrade power availability than building new power plants.

Neglect of Noncommercial and Traditional Energy

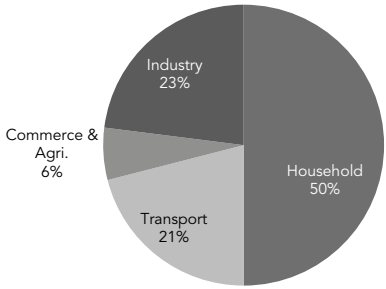
As reflected through the years in HDIP's *Energy Yearbook* statistics, Pakistan's policymakers have continued to neglect noncommercial/traditional energy.[32] Commercial energy is a key ingredient of national growth and *prima facie* warrants the lion's share of attention from policymakers under pressure to jumpstart the economy. However, there is an inherent fallacy in this approach. While commercial energy stimulates GDP growth, neglect of noncommercial consumers retards growth over the longer term. Consequent unregulated, unchecked practices and technologies have disastrous effects on the eco-system and on poverty.

Integrating noncommercial energy through IEP changes the picture dramatically, as shown in Figure 4. Traditional biofuels would lead energy supply; households would become the primary consumer, using 50 percent of the mix.[33] The most egregious aspect of the noncommercial omission is that this form of energy accounts for half of overall demand. An IEP-based integrated picture will drive major shifts in emphasis. More efficient household cooking stoves will have greater impact than industrial energy conservation. And environmental and poverty impacts will be brought front and center.

Missed Opportunities

One of Pakistan's many missed opportunities relates to Central Asia in the early to mid-1990s, when all six of the new republics—under immense internal economic pressures—sought ways to export surplus energy.[34] The focus was on the southern corridor through Pakistan to tap the energy-starved South Asian market and gain access to the Arabian Sea. This was well before the security situation in Afghanistan had begun to deteriorate. As expected, there were competitors promoting alternative routes. The Great Game was on again, being played with higher stakes and at considerable speed.

Figure 4: Pakistan's Energy Consumption: Commercial and Noncommercial



Source: Fueling the Future: Meeting Pakistan's Energy Needs in the 21st Century *and HDIP Yearbook*.

Central Asian authorities and international consortia made several attempts to engage Pakistani authorities. However, progress was elusive. The efforts of competitors drowned out Pakistan's relatively weak response. And the rest is history. One can only surmise how the trade corridors, had they been established, would have transformed the region. The benefits from trade, energy transport tariffs, and increased energy supplies would have brought prosperity to Afghanistan, Pakistan, and India. Resulting interdependence between the three countries and the uplift of economically deprived transit areas would have helped mitigate—or even prevent—the conflict that currently engulfs the region.

IEP, had it existed, would have signaled the need for Pakistan to aggressively pursue southern corridor projects as a policy imperative for the country and, in this case, for the region on the whole.

CONCLUSION

With IEP, Pakistan's policymakers can finally go beyond *what* needs to be done to *how* it is to be done. Its immediate revitalization must be part of the short-term energy reform agenda. The necessary skills exist in Pakistan, and with political will, the resulting revival of the energy sector can accelerate the country's overall economic recovery.

NOTES

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