Energy Security (East Asia)

The term energy security *has typically meant little more than securing access to sufficient quantities of fossil fuels at reasonable prices. A broader concept of energy security is needed to adequately consider the full costs and benefits of potential energy policies to cope with challenges ranging from climate change to the social, political, and radiological fallout of Japan's Fukushima nuclear power plant accident in 2011.*

For policy makers in East Asia and globally, the term *energy security* has been interpreted mostly to mean assuring access to fuel oil, coal, and natural gas. This concept is occasionally broadened to consider the benefits of other types of home-grown energy supplies such as renewable energy and nuclear power, though the latter's status as a "domestic" resource may be arguable. This conventional energy security concept, however, has become less salient to policy formation due to increasingly global, diverse energy markets combined with emerging energy-related local, regional, national, and transnational issues, including climate change, local air pollution, acid rain, and water quantity and quality issues. The nuclear disaster at the Fukushima Daiichi plant in Japan, initiated by the March 2011 Sendai earthquake and tsunami, was underlain by a complex set of energy security–related policy decisions dating back decades, and provides only one example of why a broader view of energy security is in order. Japan made a choice in the 1970s to focus on nuclear energy as a key to reducing its dependence on foreign oil and other fuels, as well as its exposure to the volatility of the oil market. This energy security policy, together with its subsequent nuclear energy technology and siting choices and the close relationship between regulators and the regulated in the nuclear industry, all helped to set the stage for the unfortunate combination of natural disaster and technological/institutional failure. With the March 2011 accident as a riveting cautionary example, policy makers around northeast Asia and beyond—including in China—are realizing that there are multiple facets to energy security that must be considered. In order to be of use today, a policy-oriented rationale for energy security must encompass not only energy supply and cost but also environmental, economic, technological, social, and national and international security considerations. As a consequence, a more comprehensive operating definition of energy security is needed, along with a practical framework for analysis of which future energy plans, paths, or scenarios are likely to yield greater energy security in that broader sense.

Work done in the late 1990s as a part of the Nautilus Institute's Pacific Asia Regional Energy Security (PARES) project began the development of a broader definition of energy security and described an analytical framework designed to help compare the energy security characteristics—both positive and negative—of different quantitative energy paths as developed using various software tools. This analytical framework has been elaborated and adapted for use in subsequent Nautilus Institute projects. Additional details of the PARES project's achievements can be found in the report *A Framework for Energy Security Analysis and Application to a Case Study of Japan,* available from Nautilus Institute (Suzuki et al. 1998). The present article draws from PARES project documents, as well as from summaries of the energy security analysis approach that has evolved from the project and were published earlier (for example, von Hippel 2004), and developed in related articles (Hayes and von Hippel 2006), as well as articles published in the November 2011 Asian Energy Security Special Section of the journal *Energy Policy* (von Hippel et al. 2011a; von

Hippel, Savage, and Hayes 2011), and a chapter in *The Routledge Handbook of Energy Security* (von Hippel et al. 2011b). Along with a summary of conventional approaches to defining energy security, descriptions of key elements of the broader energy security definition are provided below, along with a brief investigation into trends in implementing a more comprehensive view of energy security specifically in Chinese energy planning. As it is impossible to cover every aspect of this broad and varied topic in an article of this length, the focus here is on providing a summary of an approach to evaluation of energy security costs and benefits, along with a few specific examples of the consideration of energy security in energy planning.

Conventional and Broader Definitions

Many of the existing definitions of energy security begin, and end, with a focus on maintaining energy supplies and particularly supplies of fuel oil (see, for example, Clawson 1997). This supply-based focus has several goals as its nominal cornerstones: reducing vulnerability to foreign threats or pressure, preventing a supply crisis (including from restrictions in physical supply or an abrupt and significant increase in energy prices), and minimizing the economic and military impact of a supply crisis if it occurs (see, for example, Samuels 1997). Current national and international energy policies, however, have been facing many new challenges—with the figurative fallout from the Fukushima accident just the newest and thus currently most imperative of these—and as such need to have their effectiveness judged by additional criteria. This broader array of criteria needs to be considered among key components of new energy security concepts.

Why has oil been the primary focus of energy security policy? There are good reasons behind this particular focus. First, oil is still the dominant fuel, amounting to about 34 percent of global primary energy supply as of 2011 (BP 2011). Second, the Middle East, where the largest oil reserves exist, is still one of the most politically unstable areas in the world, and it is still unclear whether or not the numerous uprisings that began in late 2010 across the Middle East and North Africa, termed the "Arab Spring," and other geopolitical shifts will help to stabilize the region over the longer term. Third, and related to the second reason, oil supply and prices are often influenced by political decisions of oil suppliers and buyers. Fourth, world economic conditions are vulnerable to oil price volatility, since there are certain key sectors that are heavily dependent on oil (transportation, petrochemical industries, agriculture, military equipment, and others) with limited short-term alternatives for substitution. Fifth, the key words here are *volatility* and *instability;* although globalization has improved the transparency of the oil market, oil prices remain to some extent at the mercy of speculators (Harris 2008; Singleton 2011), as well as being affected by fluctuations in currency values, subject to manipulation by oil suppliers and, of course, sensitive to the forces of market supply and demand. This was dramatically shown when oil prices roughly doubled between mid-2007 and mid-2008, followed by a 75 percent decline in price by early 2009, followed by a return to fall 2007 price levels (near $80 per barrel) by early 2010, with prices rising to $115 per barrel in 2011 before falling back to $80 by the fall of 2011 (Reuters 2008a and 2008b; USDOE EIA 2011).

Only a few studies have made serious attempts to clarify the concept of energy security. One was that of the Working Group on Asian Energy and Security at the Massachusetts Institute of Technology (MIT) Center for International Studies. The MIT Working Group defined the three distinct goals of energy security mentioned above: reducing vulnerability to foreign threats or pressure, preventing a supply crisis from occurring, and minimizing the economic and military impact of a supply crisis once it has occurred (Samuels 1997). These goals implicitly assume that an oil supply crisis is the central focus of energy security policy, and the central concerns are the reduction of threats to oil supply and crisis management. This view has had wide currency among key energy policy makers in both the East and West. Though the major energy consuming/importing countries have largely shared the above view of conventional energy security thinking, there are critical differences in how they have pursued energy security policy. Important factors include natural and geopolitical conditions. One country might have abundant natural resources (for example, Russia) and another might not (for example, Japan or the Republic of Korea). Some consuming countries are located close to energy-producing countries, and some are distant or are separated by daunting geographical or political barriers (such as the seas, difficult terrain, sensitive ecosystems, and North Korean borders separating the Russian Far East from its potential fuel customers in the Republic of Korea, China, and Japan), and thus need to transport fuel over long or difficult distances. Those conditional differences can lead to basic differences in energy security perceptions.

In sum, there are three major attributes that define the differences in energy security thinking between countries. First is the degree to which a country is rich or poor in energy resources. Second is the degree to which market forces are allowed to operate, as compared to the use of government intervention to set prices and select resources to address energy security concerns—for example, the degree to which countries are willing to trust that international markets will supply fuels in the event of a crisis. Third is the degree to which long-term versus short-term planning is employed. (See von Hippel et al. 2011a, for a comprehensive discussion of these attributes.) Despite these differences in thinking, however, energy policies in both resource-poor countries and resource-rich countries are arguably converging, as both types of countries confront the need to face a new paradigm in energy policy.

Issues and Concerns

National energy policies must address issues and needs on multiple fronts and must incorporate these considerations into a new concept of energy security.

Environment

If environmental problems are to be solved, energy policies will have to be reformulated. International environmental problems such as acid rain and global climate change present arguably the greatest impetus for changes in definitions of what it means to be energy secure. Some of these problems have relatively straightforward (though often expensive) technical solutions, including flue gas desulfurization devices to reduce the emissions of acid rain precursors. Other problems, such as greenhouse gas emissions and related climate change and long-term radioactive waste management, require solutions that consider a much longer time perspective and that demand much more national and international coordination than businesses and governments currently practice.

Technology

Risks associated with development and deployment of advanced technologies have been understated by conventional energy policy thinking, which tends to see them as short-term, not long-term. The clearest examples of risks associated with advanced technologies include nuclear accidents such as those at Three Mile Island in the United States (1979), Chernobyl in the former Soviet Union (1986), and Fukushima (2011). Natural disasters also affect complex energy infrastructure, such as Hurricane Katrina's impacts on oil and gas production in the Gulf of Mexico (2005) and the impact of the July 2007 earthquake near Niigata, Japan, on the seven-unit Kashiwazaki-Kariwa nuclear plant. Advanced fossil fuel systems also carry risks, with examples being major spills during oil transport and the April 2010 Deepwater Horizon oil rig fire and spill in the Gulf of Mexico.

Another class of issues related to advanced technologies includes the failure of research and development (R&D) efforts to perform as expected, such as the US programs during the 1970s and 1980s that attempted to develop synthetic fuels, a fast breeder reactor, and solar thermal resources. Risks from dependence on advanced technologies can be transnational; the accident at Chernobyl spread a radioactive cloud across much of Europe, and the impact of the Fukushima crisis, while not severe for other nations in the radiological sense, is having reverberating and profound impacts on energy policy not just in Japan but around the world (Schneider 2011; Takubo 2011). Also, markets for advanced technologies are becoming global, and as a result technological risks can be exported. Nuclear technology, for example, is being exported to a number of developing countries, most notably China and India, but also Vietnam (Bloomberg News 2011) and potentially Indonesia, Thailand, Pakistan, and Malaysia (IAEA 2007), as well as Middle Eastern nations including the United Arab Emirates (World Nuclear Association 2010). As the world moves rapidly toward more technology-intensive energy systems, a new energy security concept must address the various domestic and international risks associated with reliance on advanced and sometimes unproven technologies, as well as the risk-reduction benefits that such technologies may bring.

Demand-Side Management

Until the mid-1980s, conventional energy policy almost always sought to assure energy supply while assuming that demand was a given—and often assuming also that demand would continue to grow, sometimes exponentially. This notion has been changing since the mid-1980s, when the concept of demand-side management (DSM)—balancing demand and supply of energy by making energy use more efficient or changing its timing—was first incorporated into energy planning. Now, management of energy demand is almost on an equal footing with management of supply. New technologies such as distributed generation and smart grids in fact blur the distinction between demand and supply, in that the distributed generation can serve both on-site demand and demand on the electrical grid, and in that control and data gathering equipment used in smart grids can be used to manage both distributed electricity supply equipment and electricity demand. In addition, DSM is recognized as a key tool in the achievement of climate change mitigation and other environmental goals. Making effective use of DSM for energy policy development requires a shift from the conventional supply-side-oriented paradigm. There are risks associated with DSM technologies and policies, just as there are with energy supply options. Risks stem from, for example, DSM measures or programs not performing as expected, though these risks are more often related to social and economic factors than to technical considerations. Often risks of DSM underperformance can be reduced by the large number of small, independent applications of energy efficiency and related technologies that are typical in DSM implementation.

Social and Cultural Factors

Not in my backyard (NIMBY) stances and environmental justice concerns are becoming global phenomena, making it increasingly difficult, time-consuming, and costly in many countries, including in northeast Asia, to find sites for what are considered "nuisance facilities," such as large power plants, waste treatment and disposal facilities, oil refineries, or liquefied natural gas terminals. There are enviro-economic concerns as well, such as matching risk to host communities with compensation, but even in cases where the parties bearing the risk receive payment, circumstances can change that cause, for example, host communities to reconsider whether the economic compensation they are receiving, or indeed any amount, suffices to offset the risk. The social impact of the Fukushima accident is again a prime example, as nuclear reactor host communities throughout Japan are, as of late 2011, carefully considering whether or not to allow the restarting of reactors taken off-line for inspection, even though reactors produce huge revenues for the communities. Public confidence is also a key social factor influencing energy policy. Once lost, public confidence is hard to recover. Cultural factors can include the loss of homelands and ancestral sites through, for example, inundation by new reservoirs for large dams—as with the Three Gorges Dam in China, completed in 2006—or through destruction of landscapes by coal mining operations. Accounting for social and cultural factors and the role of public confidence in energy choices are therefore central components of a new concept of energy security.

International Relations and the Military

New dimensions in international relations and new military risks are challenging traditional energy policy making. The end of the Cold War has brought in its wake a new level of uncertainty in international politics. Although the risk of a world war is drastically reduced, the threat of regional clashes has increased, as demonstrated by ongoing conflicts in the Middle East, the Balkans, and the former Soviet states of the Caucasus, to name just a few. The international politics of plutonium fuel cycle development, with its associated risks of nuclear terrorism and proliferation, is an area where energy security and military security issues meet. Political factors can further complicate these risks, as, for example, in North Korea in the leadership transfer following the death of ruler Kim Jong-il in December 2011. The brave new world of post–Cold War international relations must be accounted for in a new concept of energy security.

Comprehensive Concept

The above five key components—environment, technology, demand-side management, social and cultural factors, and post–Cold War international relations—are central additions to the traditional supply-side point of view in a more comprehensive energy security concept.

A nation-state is energy secure to the degree that fuel and energy services are available to ensure (a) survival of the nation, (b) protection of national welfare, and (c) minimization of risks associated with supply and use of fuel and energy services. The six dimensions of energy security include energy supply, economic, technological, environmental, social and cultural, and military/security dimensions. Energy policies must address the domestic and international (regional and global) implications of each of these dimensions.

What distinguishes this definition of energy security is its emphasis on the imperative to consider both the national and extraterritorial implications of the provision of energy and energy services, while recognizing the potentially complex impacts of national energy security policies on the different dimensions of energy security, as well as the complexities, uncertainties, and subjective judgments inherent in measuring national energy security. The definition takes into consideration emerging concepts of environmental security, which include the effects of the state of the environment on human security and military security, and the effects of security institutions on the environment and on prospects for international environmental cooperation (Matthew 1995).

Evaluating and Measuring

Given the multiple dimensions of energy security identified above, and the linkages and overlaps between energy security dimensions and the dimensions of sustainability and sustainable development, a framework for evaluating and measuring—or at least comparing—the relative attributes of different approaches to energy sector development is needed. Such a framework should be designed to help identify the relative costs and benefits of different possible energy futures—essentially, future scenarios driven by suites of energy and other social policies. The discussion below identifies some of the policy issues associated with the dimensions of energy policy noted above, and presents a framework for evaluating energy security, as broadly defined.

Conceptual Framework

The dimensions of energy security as broadly defined above are provided in table 1, along with a sampling of

Table 1. Energy Security Conceptual Framework

Dimension of Risk or Uncertainty	Policy Issues	Examples of Management Strategies: For Routine Risk	Examples of Management Strategies: For Radical Uncertainty
Energy Supply	• Domestic vs. imported • Absolute scarcity • Technology/energy intensity • Incremental, market-friendly, fast, cheap, sustainable?	• Substitute technology for energy use • Put efficiency first • Diversify of import sources and types of fuel	• Detect potential and analyze technological breakthroughs • Explore to develop new reserves
Economic	• Price volatility • Cost-benefit ratio • Risk-benefit ratio • Social cost of supply disruption • Local manufacturing of equipment • Labor • Financing aspects • Benefits of "no regrets" strategies	• Compare costs/benefits of insurance strategies to reduce loss-of-supply disruption • Invest to create supplier-consumer interdependence via shared infrastructure • Insure by fuel stockpiling (uranium reactor fuel, oil, gas, coal), global (IEA) or regional quotas (energy charters)	• Export energy-intensive industries • Focus on information-intensive industries • Export energy or energy technologies
Technological	• R&D failure • Technological monoculture vs. diversification • New-materials dependency in technological substitution strategies • Catastrophic failure • Adoption/diffusion or commercialization failure	• Invest in renewables • Improve resilience and optimize scope of energy supply, demand, and distribution systems • Consider nuclear fuel cycle (recycling vs. once-through, alternative uranium resources)	• Develop permanent nuclear waste storage/disposal strategies
Environmental	• Local externalities • Regional externalities both atmospheric and maritime • Global externalities • Pursue precautionary principle	• Risk-benefit analysis and local pollution control • Pursue treaties • Emissions mitigation • Technology transfer	• Work to understand thresholds for radical shifts of state such as sea level rise and polar ice melt rate
Social-Cultural	• Managing consensus and conflict in domestic or foreign policy making among different actors • Institutional capacities to address problems • Siting and downwind distributional impacts • Populist resistance to or rejection of technocratic strategies • Existing perceptions and lessons from history with regard to different energy systems	• Transparency • Participation • Accountability • Side payments and compensation • Education • Training	

(*continued*)

Table 1. *Continued*

Dimension of Risk or Uncertainty	Policy Issues	Examples of Management Strategies: For Routine Risk	Examples of Management Strategies: For Radical Uncertainty
International-Military	• International management of plutonium • Proliferation potential • Sea lanes and energy shipping • Geopolitics of oil and gas supplies	• Nonproliferation treaty/security guarantees (NPT/SG) regime • Security and physical protection of energy facilities against terrorism • Creation of security alliances • Naval power projection • Transparency and confidence building	• Disposition and disposal of excess nuclear warhead fissile materials • Military options for resolving energy-related conflicts, securing infrastructure • Combating terrorism

Source: authors.

policy issues with which each dimension of energy security is associated, plus examples that might be used to address the types of both routine and radical risk and uncertainty that are faced in the planning, construction, and operation of energy systems. It should be noted that while table 1 provides what is intended to be an extensive, but by no means complete, list of policy issues, even the categories shown are not necessarily independent. Certain energy technologies will be affected by climate change (for example, hydroelectric power and inland nuclear power plants may be affected by changes in water availability), and there are many other examples of interdependence that need to be carefully thought through in a full consideration of the energy security impacts of candidate energy policies.

Testing Different Energy Scenarios

Evaluation of energy security impacts of different policy approaches will include such tasks as deciding on manageable but useful level of detail, incorporation of uncertainty, consideration of risks, evaluating tangible and intangible costs and benefits, comparing impacts across different spatial levels and time scales, and balancing analytical comprehensiveness and transparency. With these factors in mind, a framework was devised by the authors that is based on a variety of tools, including diversity indices and multiple-attribute (trade-off) analyses, as described below. A prime example of a tool for evaluation of alternative energy and environmental paths or scenarios for a nation or a region is the Long-range Energy Alternatives Planning (LEAP) software system, developed and distributed by the Stockholm Environment Institute (SEI–US) and used in the Asian Energy Security project (COMMEND 2012). Central to the application of the framework is its application to the search for robust solutions—sets of policies that meet multiple energy security and other objectives at the same time.

The framework for the analysis of energy security (broadly defined) includes the following steps:

1. Define objective and subjective measures of energy (and environmental) security to be evaluated. (Within the overall categories presented in table 1, these measures could vary significantly between different analyses.)
2. Collect data and develop candidate energy paths/scenarios that yield roughly consistent energy services but use assumptions different enough to illuminate the policy approaches being explored.
3. Test the relative performance of paths/scenarios for each energy security measure included in the analysis.
4. Incorporate elements of risk.
5. Compare path and scenario results.
6. Eliminate paths that lead to clearly suboptimal or unacceptable results and iterate the analysis as necessary to reach clear conclusions.

The possible dimensions of energy security, and potential measures and attributes of those dimensions, range from the routinely quantified—such as total direct costs, capital costs, greenhouse gas emissions, or fraction of fuels sourced from abroad—to essentially unquantifiable—such as risk of social or cultural conflict (see von Hippel et al. 2011a and 2011b, for additional examples). It should be noted that many of these dimensions and measures can and do interact, and a solution to one problem may exacerbate another. It is therefore incumbent on the analyst evaluating energy security policy choices and on policy makers reviewing analytical results to take a comprehensive approach to reviewing the options available, making sure to consider different points of view.

There is often a temptation, in step 5 of the procedure above, to attempt to put the attributes of energy security into a common metric, for example, an index of relative energy security calculated through a ranking and weighting system. Such systems almost invariably, however, involve procedures that amplify small differences between paths/scenarios, play down large differences, hide necessarily subjective analytical choices, and give an illusion of objectivity to weighting choices that are by their nature quite subjective. More reliable is the laying out of each of the energy security attributes of each path/scenario side by side, which allows reviewers, stakeholders (i.e., those people who have a stake in an enterprise), and decision makers to see the differences and similarities between different energy futures for themselves and to apply their own perspectives and knowledge, in consultation with each other, to determine what is most important in making energy policy choices. Also not explicitly included in steps 5 or 6 are mathematical tools for optimizing energy security results over a set of paths or scenarios. Optimization can be attractive, as it appears to identify one "best" path for moving forward. Optimization models can in some cases offer useful insights, provided that the underlying assumptions and algorithms in the analysis are well understood by the users of the results. Optimization, however, like weighting and ranking, involves subjective choices that may appear objective, especially when applied across a range of different energy security attributes, and as such should be employed only with caution and with a thorough understanding of its limitations in a given application.

Toward a Comprehensive Approach: China

Although energy planning worldwide continues, arguably dominated by traditional energy security considerations (securing adequate supplies at a reasonable price), a more comprehensive type of energy security analysis is beginning to be used in a number of nations and contexts. In the United States in the 1980s and 1990s, elements of the comprehensive energy planning framework described above were required in some states under the rubric of least-cost or integrated resource planning (see, for example, Swisher, Jannuzzi, and Redlinger 1997). With climate and environment increasingly becoming issues that impinge on energy planning, particularly in the post-Fukushima world, energy planners are more frequently called upon to meet multiple objectives in development of energy policies. This is increasingly the case in China.

The context for energy planning in China has changed markedly. As a result of the economic downturn that followed the Asian financial crisis of 1997–1998, and a major restructuring of state-owned industries, China had an energy surplus in the late 1990s and early 2000s. Over the course of the early 2000s, with the gross domestic product growing in excess of 10 percent per year, this surplus dramatically turned to deficit, and by the end of the first decade of the twenty-first century China had become the world's second-largest crude oil importer and a net importer of coal, its most abundant domestic energy resource.

Increased reliance on oil and coal imports was an important factor driving changes in energy planning in China, but not the only one. Four other developments contributed to a broadening of the scope of energy security considerations, even if not always explicitly labeled as such. First, energy prices in general, and coal prices in particular, rose dramatically, raising fears of inflation and its impact on social and political stability. Second, China's leadership determined that the environmental impacts of uncontrolled fossil fuel combustion, once seen as a necessary cost of development, were no longer acceptable. Third, the corporatization of China's state-owned enterprises created a new political economy of monopoly power in the energy industries, to which the government's long-term solution, given its limited regulatory powers, is competition and diversification. Fourth, rapidly rising energy imports and the need to secure energy supplies has made energy an important, and costly, dimension of China's foreign policy.

All of these factors led to a concerted effort by China's leadership to diversify energy sources, focusing on domestic resources but also on reducing the share of coal in the country's energy mix. In the early twenty-first century, the National Development and Reform Commission (NDRC), China's chief planning agency, developed plans to massively increase use of energy from biofuels, hydropower, nuclear, solar, and wind, making China a global leader in alternative energy.

These efforts have had mixed success, however. China, as of 2012, is now more dependent on coal than it was a decade ago because its economy and energy demand grew faster than the expansion of noncoal energy resources. Additionally, development obstacles for alternative energy are emerging, and expansion plans have been scaled down. Biofuel plans, for instance, ran aground on conflicts with food and land security and have been significantly reduced or abandoned. With greater attention in China to the environmental and social impacts of large dams, hydropower development is increasingly subject to scrutiny, with some domestic hydropower projects postponed and a high profile cross-border project with Myanmar (Burma) cancelled. As a result of the Fukushima disaster, the NDRC's nuclear plans have been similarly scaled back, with new plant applications put on hold and the broader future of nuclear expansion in China uncertain. Wind development is also uncertain, as integrating large amounts of wind into China's inflexible, coal-dominated power system has proved difficult.

The collision of broad energy security concerns with a realization of the uncertainties and limits of new energy resources has created a new dimension to China's energy security discourse —moderating energy demand growth. End-use energy efficiency has been a core part of China's energy strategy since the 2000s, but energy efficiency is now also seen to be a finite resource. With limited options for expanding energy services, China's Twelfth Five-Year Plan (2011–2015) set more moderate targets (6–7 percent per year) for national gross domestic product growth. Importantly, these national targets are much lower than those set by provincial officials, setting the stage for a conflict in priorities between the central and provincial governments. China, perhaps more than any other nation, has recognized the links between the pace of economic growth and the severity of emerging energy security concerns across a wide spectrum of issues—trade, macroeconomic, environmental, political, and foreign policy. China's leaders will undoubtedly continue efforts to diversify energy sources, but the trade-offs between economic growth and energy security, and the consideration of energy security in a broader sense that includes environmental, social, international policy, and other considerations, are likely to figure more prominently in discourse over energy planning going forward.

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See also Association of Southeast Asian Nations (ASEAN); China; Energy Industries—Nuclear; Energy Industries—Renewables (China); Energy Industries—Renewables (India); Five-Year Plans; Green Collar Jobs; India; Japan; Korean Peninsula; Three Gorges Dam; Utilities Regulation and Efficiency; Water Security

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