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ABSTRACT

This study explores how Asian energy security issues are perceived in China, India, and Japan. It investigates perceptions of 16 energy security challenges drawn from an extensive survey, as well as how such conceptions differ between Asian energy consumers and across these dimensions of energy security.

KEYWORDS: energy security, perceptions, China, India, Japan

INTRODUCTION

China, India, and Japan—the three largest economies in Asia—face some daunting energy security challenges. Regionally, projected growth in energy consumption, both in terms of per capita use and total use in aggregate, is expected to rise dramatically for Asian countries in the next few decades.[1] As a whole, Asia-Pacific's per capita electricity demand was only about 1,300 kilowatt hours (kWh) in 2005, compared to the world average of more than 2,500 kWh. In Asia-Pacific, between 2005 and 2030:

- Energy demand is expected to grow at 2.4%, whereas the world average during the same period will be 1.5%;
- Net imports of fossil fuels are expected to more than double;

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1. International Energy Agency (IEA), *World Energy Outlook* (Paris: OECD [Organization for Economic Cooperation and Development] / IEA, 2010).

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- The region's oil dependency will increase from 57.5% to 66.4%;
- The region will need between $7 trillion and $9.7 trillion (in constant 2006 dollars) of cumulative investment in the energy sector during this period, of which 60% will be in electricity generation, transmission, and distribution.[2]

More specifically, security of supply has become a key economic and political concern for China, which had to ration natural gas and oil supplies in 2010 because of unexpected delays in imports. In 2008, India abandoned a deal to build an Iran-Pakistan-India gas pipeline—over which discussions were conducted for more than 13 years—citing security issues and Pakistan's unwillingness to penalize supply disruptions. Japan buys nearly 90% of its oil from the Middle East, making it vulnerable to disruptions of even a few days in the Strait of Hormuz or in shipping routes from the Middle East.[3]

Furthermore, rising demand for fossil fuels from China and India is already having a profound impact on the energy world. It is behind the recent global resurgence in resource nationalism.[4] Such demand is also a factor in higher energy prices and in the changing patterns of greenhouse gas emissions, energy trade, and energy geopolitics. India's and China's growing energy intake and the resulting regional competition for increasingly scarce energy sources have significant security, environmental, economic, and political implications for the region and the world. For example, the region's dwindling reserves of oil and gas are insufficient to satisfy growing demand. China, Japan, and India account for 19.3% of the world's oil demand yet control only 1.5% of the world's oil reserves.[5]

In addition to being international and external, energy security threats may be domestic and internal. Laborers of India's public sector petroleum company Oil and Natural Gas Corporation, Limited (ONGC) went on a three day strike in early 2009, shutting down the Hazira plant that processes oil and gas from offshore operations and causing shortages of compressed natural gas

2. Asian Development Bank (ADB), *Energy Outlook for Asia and the Pacific* (Manila: ADB, 2009).

3. See Malavika J. Bambawale and Benjamin K. Sovacool, "China's Energy Security: The Perspective of Energy Users," *Applied Energy* 88:5 (May 2011), pp. 1949–56; and Benjamin K. Sovacool, ed., *Routledge Handbook of Energy Security* (London: Routledge, 2011).

4. Vlado Vivoda, "Resource Nationalism, Bargaining, and International Oil Companies: Challenges and Change in the New Millennium," *New Political Economy* 14:4 (December 2009), pp. 517–34.

5. British Petroleum (BP), *BP Statistical Review of World Energy 2011* (London:BP, 2011).

used for public transportation. Large parts of China had to confront energy shortages in 2010 because of a combination of weather and infrastructure factors: difficulty of transporting coal in the snow, less hydropower output amid freezing temperatures, and reduced coal supplies from Shanxi Province stemming from mine closures. Japanese planners had to shut down about one-fifth of the country's nuclear power plant capacity in 2009 after a series of earthquakes cracked reactor vessels and cooling towers, to say nothing of the impact of the Fukushima nuclear disaster in March 2011.

These examples illustrate the interconnected nature of energy security concerns, showing how they cross scales (international and domestic) and sectors (electricity, transport, and extractive industries). How are these issues perceived by energy users in China, India, and Japan? What explains differences in perceptions, if any, both within and between these countries? This study answers these questions by exploring how a sample of government, industry, civil society, and academic energy users from the three Asian countries perceive energy security threats and dimensions. Its primary source of data is a four-part survey distributed in three languages (English, Chinese, and Japanese) to 830 respondents in China, India, and Japan. We find that traditional notions of "energy security" have their limits and do not capture the complexities of how Indian, Chinese, and Japanese respondents view energy security challenges. Rather than conceiving of energy security only in terms of security over access to fuel, our survey advances a broader notion of energy security encompassing technology, fuels, trade, behavior, institutions, the environment, and education. The findings of our survey, in which 16 dimensions of energy security were perceived as being at least "somewhat important," advance the need for policy makers and scholars to utilize a broader conceptualization of energy security encompassing technology, fuels, trade, behavior, institutions, the environment, and education.

We acknowledge that there are major differences in these countries' energy profiles in terms of level of development, resource endowment, and access to energy fuels. On the one hand, Japan is a developed country with universal access to electricity, high levels of automobile ownership, and a notoriously poor endowment of fossil fuels. On the other hand, China and India are developing countries with low but growing access to electricity and automobile ownership yet with relatively large fossil fuel resource endowments. These three countries were selected because they are the largest energy consumers in Asia, meaning that the energy security challenges they face will likely be more severe than those faced by other countries that consume less. In addition, the three countries are crucial cases for analyzing the potential for increased regional energy cooperation and for strengthening the regional energy governance architecture. Consequently, the survey results are significant for understanding energy security concerns within and among these three countries, as well as for anticipating future energy policy direction, both domestically and regionally.

RESEARCH METHODS

China, India, and Japan, along with other Asian countries, face some interrelated energy policy and technology challenges. Although not an exhaustive list, these include: (1) imbalances between regional supplies of energy fuels and booming demand for energy services; (2) urbanization and population growth; (3) large amounts of energy poverty, defined as lack of access to electricity and dependence on solid fuels for household energy needs and inequitable access to those electricity networks that do exist; (4) potentially devastating impacts from climate change on communities with little resilience to cope with them; (5) shortages of water needed for thermoelectric power stations; (6) increased vulnerability to volatile oil prices; (7) massive subsidies for fossil fuels that distort energy markets; and (8) the ever-present risk of nuclear weapons proliferation and accidents connected to atomic energy.[6] Because scant data on perceptions of these energy security risks within our three countries existed in the peer-reviewed literature, we began by designing and testing a survey that asked respondents to rank the following 16 dimensions of energy security:

- Securing a supply of fossil fuels and uranium;
- Bolstering trade in energy fuels and commodities;

6. See Asia Pacific Energy Research Center (APERC), *Energy Security Initiative: Some Aspects of Oil Security* (Tokyo: APERC / Institute for Energy Economics, 2003); Vijay Modi, Susan McDade, Dominique Lallement, and Jamal Saghir, *Energy Services for the Millennium Development Goals* (Geneva: United Nations Development Program [UNDP], World Bank, and Energy Sector Management Assistance Program, 2005); World Economic Forum, *The New Energy Security Paradigm* (Davos: World Economic Forum / Cambridge Energy Research Associates, 2006); United Nations Environment Program, *Freshwater Under Threat: South Asia Vulnerability Assessment* (Geneva: UN, 2008); Eshita Gupta, "Oil Vulnerability Index of Oil-importing Countries," *Energy Policy* 36:3 (March 2008), pp. 1195–1211; Alexander E. Farrell, Hisham Zerriffi, and Hadi Dowlatabadi, "Energy Infrastructure and Security," *Annual Review of Environment and Resources* 29:1 (November 2004), pp. 421–69.

- Minimizing depletion of domestically available fuels;
- Providing predictable and clear price signals;
- Enabling affordably priced energy services;
- Providing equitable access to energy services;
- Decentralizing away from large-scale, conventional, centralized sources of energy to those distributed and smaller in scale;
- Lowering energy intensity (energy use per unit of gross domestic product [GDP]);
- Researching and developing (R&D) new energy technologies;
- Ensuring transparency and participation in project siting and decision-making;
- Offering energy education and information;
- Preserving land and forests;
- Enhancing the availability and quality of water;
- Minimizing air pollution;
- Responding to climate change / adaptation;
- Reducing greenhouse gas emissions / mitigation.

These dimensions of energy security were distilled from a meta-survey of 90 peer-reviewed articles[7] and were formulated into survey questions tested with two focus groups consisting of 15 experts.

We relied on a targeted survey, rather than a simple review of policy statements or simulations of energy market behavior, for multiple reasons. First, we wanted the views from actual energy consumers, those who use energy at the work place and in the home, rather than the more abstract perceptions of politicians or academics. No such data existed, so a survey was designed to collect it.

Second, we chose a survey because it is the most appropriate research tool for testing specific hypotheses quickly, with research results relatively independent of the researcher's own preconceptions, over a large population.[8]

7. For a discussion of these articles in greater detail, see Benjamin K. Sovacool and Marilyn A. Brown, "Competing Dimensions of Energy Security: An International Review," *Annual Review of Environment and Resources* 35:1 (November 2010), pp. 77–108.

8. See Gary King, Robert O. Keohane, and Sidney Verba, *Designing Social Inquiry: Scientific Inference in Qualitative Research* (Princeton, N. J.: Princeton University Press, 1994); Alexander L. George and Andrew Bennett, *Case Studies and Theory Development in the Social Sciences* (Cambridge, Mass.: Harvard University Press, 2004); and Johnson R. Burke and Anthony J. Onwuegbuzie, "Mixed Methods Research: A Research Paradigm Whose Time Has Come," *Educational Researcher* 33:7 (October 2004), pp. 14–26.

Surveys such as ours are useful for studying the perceptions of large numbers of people and are less time consuming than telephone polls or research interviews. Data collection and transcription are also easier, with entries automatically logged in a computer file rather than having to be translated and coded.

Third, we relied on a targeted, purposive sampling strategy, which means that respondents were chosen to represent four different types of perspectives: academia, the private sector, government, and civil society.[9] Targeted surveys offer a rich, cost-effective vehicle for generating unique data to investigate national policy and politics while generating highly reliable and valid data.[10]

However, we must also note that since our sample included 73% of respondents with at least an undergraduate degree as well as an array of government officials, businesspersons, employees of non-governmental organizations (NGOs), and university employees, this selection represents particular perceptions of energy security; our results cannot be generalized to entire populations. As Table 1 and Figure 1 reveal, some other biases exist within the sample as well. Surveys were more difficult to distribute in India, meaning Indian responses account for less than one-quarter of respondents, whereas respondents from Japan represented almost half of the sample. Almost half of the respondents in our sample worked for the private sector, and more than 60% were aged 18 to 35. All of these characteristics are proportionately higher than what an unbiased sample would represent. Our survey also possibly suffers from self-selection bias,[11] that is, only those who already deem energy security to be important (or those unhappy with energy security in their country) would conceivably take the time to complete it.

Our structured questionnaire consisted mainly of multiple choice questions. As Table 1 reveals, the survey was made available online to respondents across all three countries through a survey hosting website. An additional 400 surveys were distributed by hand through colleagues in Delhi, India; Beijing and Shanghai, China; and Tokyo, Japan, respectively. Of these 400

9. Yvonna S. Lincoln and Egon G. Guba, *Naturalistic Inquiry* (London: Sage Publications, 1985).

10. Glenn Beamer, "Elite Interviews and State Politics Research," *State Politics & Policy Quarterly* 2:1 (Spring 2002), pp. 86–96. See also Lewis A. Dexter, *Elite and Specialized Interviewing* (Evanston, Ill.: Northwestern University Press, 1970); David Richards, "Elite Interviewing: Approaches and Pitfalls," *Politics* 16:3 (September 1996), pp. 199–204; and John Scott, "Modes of Power and the Re-conceptualization of Elites," *Sociological Review* 56:1 (May 2008), pp. 25–43; Michael Woods, "Rethinking Elites: Networks, Space, and Local Politics," *Environment and Planning A* 30:12 (December 1998), pp. 2101–19.

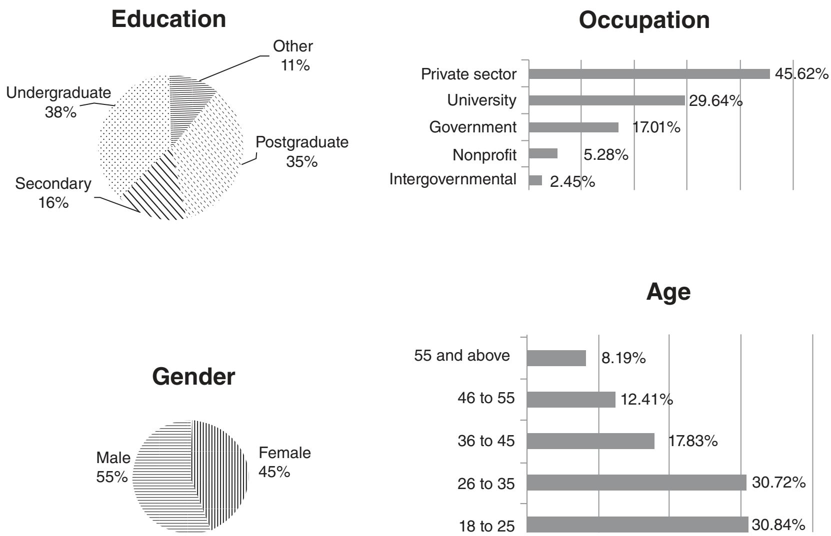
11. Thomas D. Cook and Donald T. Campbell, *Quasi-Experimentation: Design & Analysis Issues for Field Settings* (Boston: Houghton Mifflin Co., 1979).

TABLE 1. Summary of Energy Security Survey Distribution

Country	*Language(s)*	*Distribution*	*Respondents*	*% Total*
Japan	English and Japanese	Electronic (online) and print	346	41.7
China	English and Chinese	Electronic (online) and print	312	37.6
India	English	Electronic (online) and print	172	20.7
Total			830	100

SOURCE: By authors.

FIGURE 1. Demographic Characteristics of Our Energy Security Survey Sample



SOURCE: By authors.

NOTE: Education and gender figures expressed in percentage, 100% = 830 respondents. "University" = those working at colleges, universities, schools, and academic institutions; "private sector" = working in electricity supply, transport, industry, business, and for-profit organizations; "government" = working for local, state, and national governments as well as national institutes and regulatory agencies; "nonprofit" = those working in civil society and NGOs; "intergovernmental" refers to organizations such as the World Bank or Asia Pacific Economic Cooperation (APEC).

printed surveys, 366 were completed between January and July 2010 and 464 out of 466 online surveys were finished over the same period, for a total of 830 surveys completed and an overall response rate of 95.8%. This unusually high response rate may be attributed to repeated requests from the distributors of the printed survey urging respondents to complete it and the fact that almost all online respondents completed the survey after they started it. It is impossible to tell how many respondents never elected to complete the online survey in the first place. Data on the characteristics on non-respondents were not collected. A copy of the survey in English is provided in Appendix 1.

Figure 1 provides an overview of the demographic characteristics of respondents, though we must note that (a) the sample size of the survey is not proportional to national population size, (b) the results have not been weighted to match national demographic profiles, and (c) 32 respondents did not provide their country of residence when completing the survey online. Distribution of the survey was purposive, not random, and directed at ensuring a mix of respondents from different sectors, so that a minimum of 30 respondents for each country came from academia, the private sector, government, or civil society. These included government officials, businesspersons, NGO employees, and university employees, none of whom were necessarily experts in the field of energy. Those who chose to respond did so only based on their willingness to participate; they were not compensated. To be eligible, a person needed only (a) consider one of our three countries their home and (b) consume and use energy there.

The survey consisted of four parts with 19 total questions. The first part collected demographic information about respondents, including their country of residence, nationality, age, level of education, gender, occupation sector, name of employer, and job title. The second part asked participants to rate 16 dimensions of energy security according to a five-point Likert scale:[12]

1. Extremely unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Extremely important

We call this method of questioning "rating." The third part asked respondents to choose the five most important dimensions of energy security from the list of 16 and rank them in order of importance from first to fifth. We call this method of questioning "ranking." The final part was open-ended, asking respondents to add any energy security dimension that they thought was missing in the survey and instructing them to rate it on the Likert scale.

12. Rensis Likert, "A Technique for the Measurement of Attitudes," *Archives of Psychology* 22:140 (1932), pp. 1–55.

RESULTS

The survey results for China, India, and Japan are presented in Table 2 according to the average ratings for each energy security dimension. Table 2 reveals that perceptions of energy security in China and India sway toward "traditional" energy security issues such as supply security. Perceptions in Japan increasingly emphasize the importance of dimensions that have recently become more salient (pollution, R&D, etc.), although the security of the fossil fuel supply is still pertinent. Table 3, which shows the average rankings for each energy security dimension, all but confirms this. In all three countries, respondents ranked the security of the fossil fuel supply as the first and second most important issues across all dimensions. Notably, rated and ranked responses differ *within* the sample, yet environmental concerns (such as water and air pollution) were listed high in both sets of ratings and rankings.

More specifically, for China, a secure supply of fossil fuels is rated most highly across all dimensions, followed by minimizing the destruction of land, water, and air. The lowest rated dimension is decentralized energy systems, followed by promotion of trade in energy products, technologies, and exports. In terms of first and second most highly ranked dimensions, 48% of respondents ranked a secure supply of fossil fuels as first or second, and 33% pointed to minimization of depletion of domestically available energy fuels. Surprisingly, there was only a minimal difference in ratings in China across different occupation groups. The government employees showed a difference in the pattern of responses, but unfortunately their sample size is too small to draw conclusive results. When asked an open-ended question on what dimensions may have been missed, there was a wide variety of responses. However, a common theme emerged around reduction of wastage and consumption, minimizing pressure on land and forests, improving energy efficiency, and reducing emissions.

For Japan, the most highly rated dimension is minimizing air pollution, followed by R&D. The lowest rated dimension is decentralized systems, followed by transparency in participation. In terms of first and second highest ranked dimensions, 44% ranked security of the fossil fuel supply as the first or second most important; 24% ranked greenhouse gas mitigation. Open-ended responses include several mentions of renewable energy, but a variety of ideas emerged including nuclear energy and cooperation and diplomacy among nations, along with educating the public and suppliers about energy-related issues. Occupational differences exist—among university employees, low energy intensity emerged as the highest rated dimension, whereas among those in the private

TABLE 2. Ratings of Energy Security Dimensions for China, India, and Japan

	China			India			Japan		
Dimension	*Mean %*	*Number*	*Standard Deviation*	*Mean %*	*Number*	*Standard Deviation*	*Mean %*	*Number*	*Standard Deviation*
Have a secure supply of oil, gas, coal, and/or uranium	4.82	311	1.22	4.86	170	1.01	4.42	345	0.78
Promote trade in energy products, technologies, and exports	3.99	310	1.21	4.57	171	1.23	4.14	345	0.79
Minimize depletion of domestically available energy fuels	4.57	309	1.06	4.61	169	1.05	4.37	344	1.01
Have stable, predictable, and clear price signals	4.27	306	1.23	4.47	168	1.03	4.27	339	0.92
Have affordably priced energy services	4.21	310	0.90	4.67	168	0.91	4.34	342	0.88
Have small-scale, decentralized energy systems	3.62	304	1.02	4.17	169	0.87	3.99	341	1.03
Have low energy intensity	4.44	305	1.01	4.52	168	0.98	4.36	345	1.12
Conduct R&D on new and innovative energy technologies	4.68	304	1.02	4.83	167	1.03	4.50	345	0.77
Assure equitable access to energy services to all of its citizens	4.36	306	1.04	4.49	168	1.02	4.11	345	0.78
Ensure transparency and participation in energy permitting, siting, and decision-making	4.21	299	0.98	4.58	167	1.01	4.00	322	0.67
Inform customers and promote social and community education about energy issues	4.04	298	0.97	4.74	167	0.99	4.11	333	1.04
Minimize the destruction of forests and degradation of land and soil	4.79	299	1.21	4.82	165	1.18	4.48	332	0.98
Provide available and clean water	4.75	304	1.02	4.89	166	1.01	4.35	340	0.87
Minimize air pollution	4.76	308	1.05	4.80	165	0.99	4.57	339	1.03
Minimize the impact of climate change (i.e., adaptation)	4.54	304	1.14	4.59	166	0.98	4.23	341	1.01
Reduce greenhouse gas emissions (i.e., mitigation)	4.62	306	1.12	4.76	165	0.99	4.36	342	0.94

SOURCE: By authors.

NOTE: Based on an importance scale from 1 to 5 (5 = extremely important, 1 = extremely unimportant).

TABLE 3. Rankings for China, India, and Japan (% of Respondents Ranking a Dimension First or Second in Importance)

	China			India			Japan		
Dimension	*Mean (%)*	*Number*	*Standard Deviation*	*Mean (%)*	*Number*	*Standard Deviation*	*Mean (%)*	*Number*	*Standard Deviation*
Have a secure supply of coal, gas, oil, and/or uranium	48	311	11.1	40	170	11.6	41	344	7.7
Promote trade in energy products, technologies, and exports	15	310	9.9	4	170	10.1	10	344	7.2
Minimize depletion of domestically available energy fuels	33	308	7.7	13	169	6.7	15	344	7.5
Have stable, predictable, and clear price signals	13	306	8.2	8	168	8.2	4	341	7.6
Have affordably priced energy services	13	309	8.9	20	169	8.6	12	339	8.4
Have small-scale, decentralized energy systems	7	304	10.1	8	169	10.3	4	341	9.3
Have low energy intensity	16	305	8.3	10	168	11.2	9	344	8.1
Conduct R&D on new and innovative energy technologies	30	304	8.5	25	167	10.4	22	345	7.4
Assure equitable access to energy services to all of its citizens	13	306	9.2	8	168	8.8	6	344	8.2
Ensure transparency and participation in energy permitting, siting, and decision-making	15	300	9.1	5	169	9.1	2	321	7.1
Inform consumers and promote social and community education about energy issues	17	299	8.9	21	169	8.8	5	333	4.2
Minimize the destruction of forests and the degradation of land and soil	21	298	8.8	9	165	8.7	14	333	8.3
Provide available and clean water	26	304	10.1	20	166	10.0	9	341	5.5
Minimize air pollution	28	308	11.2	15	164	11.1	14	339	5.9
Minimize the impact of climate change (i.e., adaptation)	18	304	12.3	8	165	9.8	5	342	6.1
Reduce greenhouse gas emissions (i.e., mitigation)	17	306	10.4	8	165	9.9	24	342	5.8

SOURCE: By authors.

sector and self-identified housewives, it is merely average. The highest rated for these latter two groups is minimizing air pollution. Housewives are also the group giving the highest rating to climate-change adaptation and mitigation.

For India, the availability of water and a secure supply of fossil fuels were the two dimensions with the highest ratings, followed closely by R&D. As in China and Japan, the lowest rated dimension was decentralized systems. In terms of first and second most highly ranked dimensions, a secure supply of fossil fuels was also the most highly ranked dimension with 40% of responses, followed by R&D with 25%. There were variations in the ratings across occupation categories in India. A secure supply of fossil fuels was not so important for those working in the non-profit or NGO sectors. For them, the degradation of land and availability of water were most important. For the private sector, participation in siting decisions was more important than for non-profit participants. R&D was most important for the private sector but did not rate among the top three for government workers. Open-ended responses about adding an energy security dimension varied considerably, across issues such as renewable energy, population control, public transportation, and rural availability.

DISCUSSION

Five key findings emerge from our study:

- the cross-country difference in assigned importance to all 16 dimensions of energy security;
- the overall importance of all energy security dimensions among respondents in China, India, and Japan;
- the difference between perceptions assigned to the security of fossil fuels supply in different countries and their actual reliance on imports;
- the importance assigned to pollution-related energy security dimensions in all the countries;
- the relatively low importance assigned to the existence of small-scale, decentralized energy system in all three countries. We discuss each of these in turn.

First, perceptions of the importance of all 16 dimensions of energy security are higher in India than in Japan, while China outperforms Japan in only four dimensions. What explains this phenomenon? One explanation could be that Japan is far more economically developed than either country, with higher levels of public education about energy-related issues. This might make the general population more interested in emerging threats to energy security as opposed to traditional ones. China and India are developing countries that have only recently become large consumers and importers of energy. A significant share of their populations, particularly in India, lacks access to electricity. Thus, perceptions of energy security lack the maturity that may come as new generations assume important roles in government, the private sector, higher education, and the media.

Second, with the exception of the low rating for the availability of small-scale, decentralized energy systems in China, all other ratings for the three countries are at a "somewhat important" or "extremely important" level. This indicates that all energy security dimensions are perceived as important in China, India, and Japan and shows that energy security is a salient issue area. Given such perceived importance, the level of politicization of various dimensions of energy security in the region is high. Tensions between China, India, and Japan exist across a number of dimensions, particularly with respect to the security of fossil fuel supply.

Third, perceptions do not reflect the reality of fossil fuel import dependence in the three countries. Table 4 shows fossil fuel import dependence for China, India, and Japan. What is striking about this table is that Japan relies on imported fossil fuels far more than China and India—both in terms of share in overall demand and overall volumes. Indeed, Japan imports more fossil fuels by volume than China and India combined. Yet, perceptions do not reflect this, and respondents in China and India rated the security of supplies as far more important than did respondents in Japan.

Why are respondents in Japan less concerned about the security of fossil fuel supply than those in China and India? Besides the general maturity level regarding energy security issues discussed above, there are three further plausible explanations. The fact that China imports more oil than India and Japan provides a strong rationale for the Chinese to be anxious about the security of oil supplies. After all, oil is the most traded source of energy in the world, and the international oil market is highly imbalanced when compared to the natural gas and coal markets. Energy security concerns most often arise because of fears over the security of imported oil supplies and the transportation routes through which this oil passes. Moreover, China has only recently emerged as a large oil importer. In fact, the country was a net oil exporter until 1992 but is now the world's second largest oil importer. Such rapid transformation and the continued demand for more imported oil (from often unstable regions) reaching China via U.S.-dominated sea lines of communication (SLOCs) together explain why Chinese respondents may have ranked the security of supply as the

TABLE 4. Fossil Fuel Import Dependence (2010)

	China	*India*	*Japan*
Oil	52.64% (225.6 mt)	74.98% (116.6 mt)	96.73% (195.0 mt)
Natural gas	11.21% (11.0 mtoe)	17.77% (9.9 mtoe)	94.71% (80.6 mtoe)
Coal	–5.07% (–86.9 mtoe)	22.15% (61.5 mtoe)	99.60% (123.2 mtoe)
Total	6.68% (149.7 mtoe)	38.46% (178.0 mtoe)	97.17% (398.8 mtoe)

SOURCE: BP, *Statistical Review of World Energy 2011* (London: BP, 2011).
NOTE: mt = million tons; mtoe = million tons of oil equivalent.

most important dimension. The same rationale also applies to India, although to a lesser extent. Finally, it is important to note that much of Japan's oil imports also passes through U.S.-dominated SLOCs. However, Japan has a security alliance with the U.S. and is therefore less concerned about the security of its fossil fuel supplies than the Chinese and the Indians.[13]

Fourth, the three pollution-related energy security dimensions (minimization of land, water, and air pollution) were among the top ranked by importance in all three countries. In fact, available and clean water was the top ranked dimension in India, and minimizing air pollution held the same spot in Japan. In China, the importance of the three pollution-related energy security dimensions was ranked only behind the security of supplies. This finding is significant as it shows that respondents in the three countries are aware that they do not use energy in an environmentally responsible way. As a result, energy-related pollution is a fact of life. Rapidly increasing growth of fossil fuel use in the region is also already having a profound impact on global climate change, and public opinion in the three countries indicates that individuals are aware of this.

Fifth, the importance of having small-scale, decentralized energy systems was the lowest ranked dimension in China, India, and Japan. The minor importance assigned to this dimension in all of the countries surveyed could stem from the fact that respondents may not have understood the exact meaning of this particular dimension, which relates to democratizing energy production at peoples' homes and offices (through, say, solar panels or distributed generation) rather than at remote power plants and refineries. In addition, the provision of energy services may be perceived to be the responsibility of central governments and too important to be decentralized. In effect, energy security is likely perceived as "high

13. Vlado Vivoda and James Manicom, "Oil Import Diversification in Northeast Asia: A Comparison Between China and Japan," *Journal of East Asian Studies* 11:2 (May 2011), pp. 223–54.

politics" in all three countries, similar to border security, and thus something not to be delegated to local levels.

POLICY IMPLICATIONS AND CONCLUSION

Several important policy implications stem from our findings. Given the perceptions of energy security in China, India, and Japan uncovered by our survey, clear dangers are emerging about future competition for supplies of fossil fuels and the problem of increasing land, water, and air pollution. Energy security has emerged as a critical issue in the broader Asia-Pacific region. Many countries in the region, including China and India, are developing nations with rapid economic growth that is accompanied by an increasing demand for energy. The spectacular recent economic growth in the Asia-Pacific region has spurred a vast expansion in the need for energy services and also in the demand for the fuels that help to supply these services. The rising consumption of energy in the Asia-Pacific region, particularly in China, has major consequences for geopolitics, financial and energy markets, and pollution, both regionally and globally.[14] Concern about adequate energy supplies expressed in our survey, especially among these three major consumers, has the potential to transform power competition in the Asia-Pacific region from its current bounded forms into open confrontation.

Consequently, our findings speak to the perception of the need, among our respondents at least, to strengthen the existing energy security governance infrastructure in the Asia-Pacific region. It is in the region's interest that energy competition is kept under control and that a cooperative, binding mechanism to tackle competition and growing energy-related pollution is established. The imperative for energy security in such a vulnerable strategic region as the Asia-Pacific is paramount for global stability and development. The priority of this challenge for the region is no accident: it is the world's fastest growing energy consumer. What is worrying is the region's absence of cooperation on energy security.[15] Beyond the non-binding "2007 Cebu Declaration on Energy Security"

14. Flynt Leverett and Jeffrey Bader, "Managing China-U.S. Energy Competition in the Middle East," *Washington Quarterly* 29:1 (Winter 2005–06), pp. 187–201.

15. See Jaewoo Choo, "Northeast Asia Energy Cooperation and the Role of China and Japan," in *Energy and Security Cooperation in Asia: Challenges and Prospects*, eds. Christopher Len and Alvin Chew (Stockholm: Institute for Security and Development Policy, 2009), pp. 41–60; and Vlado Vivoda, "Evaluating Energy Security in the Asia-Pacific Region: A Novel Methodological Approach," *Energy Policy* 38:9 (September 2010), pp. 5258–63.

as part of the East Asia Summit, and a number of bilateral agreements, there is an absence of regional commitments to enhance energy cooperation. Therefore, it is imperative that the governments of China, India, and Japan all reevaluate their respective energy policies and explore how regional energy security cooperation can be enhanced, in order to reduce their nations' vulnerability to energy supply (or demand) disruptions and reduce energy-related pollution.

Given the cross-country discrepancy in the perceived importance of energy security dimensions, with the importance of all energy security dimensions perceived higher in India than in Japan, a public education campaign is needed not only in India but also in China. If the perceptions from our respondents are indicative of broader public views on energy security, the public deserves assurances that China and India need not be overly concerned with traditional energy security issues. This is particularly so given that Japan is more reliant (yet less concerned in terms of survey responses) on imported fossil fuels than either of the others. The public in China and India need to be educated about the benefits of regional energy security cooperation and assured that no imminent physical threats loom to the security of imported supplies of fossil fue.

APPENDIX 1. The Energy Security Survey

SECTION 1

1. Please tell us about yourself:
    a. Level of education: ☐ Postgraduate ☐ Undergraduate ☐ Secondary ☐ Other
    b. Age: ☐ 18 to 25 ☐ 26 to 35 ☐ 36 to 45 ☐ 46 to 55 ☐ 55 and above
    c. Gender: ☐ Male ☐ Female
    d. Country of residence:
        ☐ United States
        ☐ Brazil
        ☐ Russia
        ☐ China
        ☐ India
        ☐ Kazakhstan
        ☐ Papua New Guinea
        ☐ Saudi Arabia
        ☐ Singapore
        ☐ Japan
        ☐ Germany
    e. Nationality: ____
    f. Type of Occupation:
        ☐ Private sector / industry / business / for-profit organization
        ☐ Non profit, non-governmental organization / civil society
        ☐ Government / national institute / regulatory agency
        ☐ University / school / academic institution
        ☐ Intergovernmental organization
    g. Name of Primary Employer (optional): __________________________
    h. Job Title (optional): ____

SECTION 2

2. When you think about energy security for your country of residence in the next five years, how important is it . . .

	Extremely Important	*Somewhat Important*	*Neither Important Nor Unimportant*	*Somewhat Unimportant*	*Extremely Unimportant*
. . . to have a **secure supply of oil, gas, coal, and/or uranium**	☐	☐	☐	☐	☐
. . . to promote **trade** in energy products, technologies, and exports	☐	☐	☐	☐	☐
. . . to **minimize depletion** of domestically available energy fuels	☐	☐	☐	☐	☐
. . . to have **stable, predictable, and clear price signals**	☐	☐	☐	☐	☐
. . . to have **affordably priced energy services**	☐	☐	☐	☐	☐
. . . to have **small-scale, decentralized** energy systems	☐	☐	☐	☐	☐
. . . to have **low energy intensity** (i.e., the unit of energy required per unit of economic output)	☐	☐	☐	☐	☐
. . . to conduct **research and development** on new and innovative energy technologies	☐	☐	☐	☐	☐
. . . to assure **equitable access** to energy services to all of its citizens	☐	☐	☐	☐	☐

(Continued)

SECTION 2. *(Continued)*

	Extremely Important	*Somewhat Important*	*Neither Important Nor Unimportant*	*Somewhat Unimportant*	*Extremely Unimportant*
. . . to ensure **transparency and participation** in energy permitting, siting, and decision-making	☐	☐	☐	☐	☐
. . . to inform consumers and promote social and community **education** about energy issues	☐	☐	☐	☐	☐
. . . to minimize the destruction of forests and the degradation of **land** and soil	☐	☐	☐	☐	☐
. . . to provide available and clean **water**	☐	☐	☐	☐	☐
. . . to minimize **air pollution**	☐	☐	☐	☐	☐
. . . to minimize the impact of **climate change** (i.e., adaptation)	☐	☐	☐	☐	☐
. . . to reduce **greenhouse gas emissions** (i.e., mitigation)	☐	☐	☐	☐	☐

SECTION 3

3. Given the 16 dimensions of energy security discussed here, select the five that you think are most important for your country of residence, and rank them from 1 (the most important) to 5 (5th most important), without allowing for ties. Please rank only five dimensions:

- ☐ Secure supply of oil, gas, coal, and uranium
- ☐ Bolstering trade
- ☐ Minimizing rates of depletion
- ☐ Predictable and clear price signals
- ☐ Affordably priced energy services
- ☐ Decentralization and small-scale supply
- ☐ Low energy intensity
- ☐ Research and development
- ☐ Equitable access
- ☐ Transparency and participation in siting and decision-making
- ☐ Education and information
- ☐ Preservation of land
- ☐ Availability and quality of water
- ☐ Minimal air pollution
- ☐ Responding to climate change / adaptation
- ☐ Reducing greenhouse gas emissions / mitigation

SECTION 4

Did we miss any dimension that you consider important for the energy security of your country of residence in the next five years? Please enter below (or if we didn't, then leave blank)

____

If you did provide an answer, when you think about energy security for your country of residence in the next five years, how important is this above dimension?

☐ Extremely Important

☐ Somewhat Important

☐ Neither Important nor Unimportant

☐ Somewhat Unimportant

☐ Extremely Unimportant