India's Energy Security

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Introduction

India faces a number of energy dilemmas.

As a rapidly growing economy, India has seen an average growth of 7-8 percent over the last decade. India will need to maintain growth and development in order to ensure stability as demonstrated by the defeat of the previous Bharatiya Janata Party (BJP)-led National Democratic Alliance (NDA) government, which was fueled by the "India Shining" motto failing to resonate with the masses.

India's 1.1 billion people account for 17 percent of the world's population while holding less than 0.5 percent of the world's hydrocarbon resources. India depends on unclean coal for more than half of its energy needs. It also relies on imports for over 70 percent of its oil consumption of which two-thirds comes from the Middle East. Half of its gas consumption is also imported.

Finally, the lack of a centralized energy policymaking authority and inefficient state of India's energy bureaucracies have deterred much needed foreign investment into India's energy sector and prevented the formation of a coherent energy policy. Not surprisingly Indian Prime Minister Manmohan Singh has described energy security as being second only to food security. India's energy security situation diverges from the United States and Japan in several respects. (See Table 1).

Table 1

Energy mix – United States vs. Japan vs. India, 2005

	U.S			Japan			India		
	Mtoe	Ptnec	Ptwec	Mtoe	Ptnec	Ptwec	Mtoe	Ptnec	Ptwec
Coal	575.4	25%	20%	121.3	23%	4%	212.9	55%	7%
Oil	944.6	40%	25%	244.2	47%	6%	115.7	30%	3%
Natural Gas	570.1	24%	23%	73	14%	3%	33	8%	1%
Hydropower	60.6	3%	9%	19.8	4%	3%	21.7	6%	3%
Nuclear	185.9	8%	30%	66.3	13%	11%	4	1%	1%
Total	2336.6	100%	22.17%	524.6	100%	4.98%	387.3	100%	3.68%

Mtoe - Million tonnes oil equivalent

Ptnec - Percentage of total national energy consumption

Ptwec - Percentage of total world energy consumption

Source: "Consumption by fuel," BP Statistical Review of World Energy June 2006, 41.

The United States, Japan and India are the world's first, third and fifth largest-energy consumers, respectively, with India's energy consumption one-sixth that of the United States. In the United States and Japan, close to half of their energy consumption is met by oil and a quarter by coal and natural gas. In contrast, India's energy consumption is skewed toward coal with a third from oil.

India's oil and gas reserves are one-fifth that of the United States. The United States, Japan and India are the world's first, third and sixth largest oil consumers, respectively with India's oil consumption one-eighth that of the United States and half that of Japan. (See Table 2).1 All three states are among the top ten oil importers.

Strategies – multi-pronged

India pursues a holistic approach toward meeting its energy needs that attempts to integrate commercial, economic and development needs with geopolitical, military and strategic considerations. While India remains dependent on coal for the majority of its energy needs, transportation bottlenecks and health and environmental concerns from coal usage have prompted India to adopt a multi-pronged approach toward meeting its energy needs (see Table 3). This includes diversifying the types of energy it utilizes, including increasing consumption of oil, natural gas, nuclear power and renewable power, as well as improving energy efficiency and conservation. With respect to oil and gas, India has diversified sources by increasing domestic exploration and production and importing from numerous regions, as well as protecting itself against oil price volatility with the development of strategic petroleum reserves, and investing in equity oil. India has also attempted to secure supply-chain resources by expanding and upgrading its oil and gas pipelines, railway infrastructure and tanker and refinery capacity.

Table 3

India's multi-pronged energy strategy

[1] *CIA – The World Factbook – Rank Order*, June 19, 2007, https://www.cia.gov/library/publications/the-world-factbook/docs/rankorderguide.html.

Nuclear power	India has 16 nuclear power plants although nuclear energy accounts for only 3 percent of India's energy consumption (3779MW). An additional seven reactors are under construction with proposals for 24 more, generating 20,000MW of power by 2020. Plans for second-stage plutonium-based fast-breeder reactors and third-stage thorium-based reactors.
Renewables	India's wind, small hydroelectric and biomass sources have the potential to generate 80,000MW. India currently produces 4,300MW of wind energy per year, making it Asia's largest and the world's fifth largest wind energy producer, with a projected added capacity of 8000MW by 2012. India is the eighth largest consumer of hydroelectricity with the potential to produce 150,000 MW of energy. India is increasing research and production of non-edible oil seeds such as jatropha and karanja for biofuels.
Energy efficiency, conservation & the environment	India's eleventh Five-Year Plan has pledged to increase energy efficiency by 20 percent by 2016-17 through improving automobile efficiency, expanding public transport, electrification of railways away from diesel and encouraging biodiesel and coal-to-liquid projects. There are over 300 CNG stations and over 300,000 vehicles running on CNG in India with plans to have all commercial vehicles switch to CNG within five years. Five percent ethanol blend currently in use by Indian railways.

Strategic Petroleum Reserves	India intends to construct a reserve of five million tonnes or 15 days of imports in Visakhapatnam, Mangalore and Padur by 2011, managed by Indian Strategic Petroleum Reserves Ltd (ISPRL), a subsidiary of IOC.
Supply chain	GAIL looking to add 4000km of pipeline to its current 6000km network by 2012 as part of establishing national gas grid. India currently has two LNG import terminals in Hazira and Dahej. Kochi and Dhabol LNG processing facilities will be operational by 2009. India currently has 2.25m bpd refining capacity at 17 facilities, one of which is wholly owned by a private company, Reliance Industries. Indian government has unveiled plans to expand India's refinery capacity by 62% to 4.84m bpd over the next 5 years to surpass Singapore as Asia's leading refined product exporter.2 Reliance is adding a 580,000 bpd refinery to its current 660,000 bpd refinery in Jamnagar, making it India's largest and the world's largest by 2008 at 1.2 million bpd and the world's only export-oriented refinery.3

India's energy challenges

Energy policymaking fractured

Despite numerous reforms, India faces numerous energy challenges. Foremost among them is the decentralized and fractured structure of India's energy bureaucracy, which has resulted in the lack of a coherent energy policy. A plethora of ministries and political parties weigh in on

[2] Siddharth Srivastava, "India expands refinery capacity," *Asia Times Online*, February 23, 2007.
[3] Energy Information Administration, *Country Analysis Briefs: India*, January 2007, 4.

India's energy policy along with India's six integrated national oil and gas companies, the Energy Coordination Committee and the nine-member Power and Energy Division of India's Planning Commission, which is chaired by the prime minister (see Table 4).

Table 4

India's energy institutions (selected)

India
Policy-making bodies
Planning Commission of India Power and Energy Division Energy Coordination Committee
Ministry of Coal
Ministry of Power
Ministry of Petroleum and Natural Gas
Department of Atomic Energy
Ministry of Nonconventional Energy Sources
Ministry of Heavy Industries and Public Enterprises
Ministry of Commerce and Industry
Ministry of Finance
Ministry of External Affairs
Ministry of Environment and Forests
Ministry of Railways

Ministry of Shipping
Ministry of Road Transport and Highways
Ministry of Water Resources
Ministry of Science and Technology
National Oil Companies
Indian Oil Corporation
Oil India Limited
Gas Authority of India Limited
Oil & Natural Gas Corporation
Bharat Petroleum
Hindustan Petroleum

Power distribution reform and subsidies on refined oil products

India's inefficient energy bureaucracy has been most visibly manifested in the power distribution sector where there is a need to curb theft, add additional capacity, attract private investment and reduce transmission and distribution losses. Shortages of coal, which is the source of 75 percent of India's electricity generation, have also led to more than half of India's power plants running under capacity. The Electricity Act of 2003 intended to unbundle and privatize India's state electricity boards into generation, transmission and distribution companies. Nonetheless, with the need to increase India's power generating capacity from 130,000MW to 400,000MW by 2030

through investments of $100 billion, Prime Minister Manmohan Singh's pledge to provide "power for all by 2012" remains elusive.4

The government replaced the Administered Price Mechanism on oil products with the new Market Determined Price Mechanism in 2002, which allowed private oil companies to establish retail outlets. Nonetheless, the government's cross-subsidization of retail prices for "politically sensitive" oil products, including gasoline, diesel, kerosene and cooking gas, has led to the misuse of certain products such as the use of diesel adulterated with kerosene. In the absence of subsidies provided to the state-owned companies, private sector companies have to purchase crude at rising international prices and sell refined oil products domestically at below market prices in order to remain competitive with state-owned retailers, which has prompted Indian refiners to become more export-oriented to stem losses from selling fuels locally.

Stagnant domestic production and inability to attract oil majors

While domestic oil exploration activities have been stepped up, India's sedimentary basins are still under-explored; by some estimates more than 80 percent of India's hydrocarbon potential is still to be explored5 although major oil and gas discoveries have been made in the Krishna-Godavari basin off the coast of Andhra Pradesh, as well as the Cambay basin in Gujarat, Mumbai High basin and Mahanadi basins, and in Rajasthan, India's northeast, the Arabian Sea and Bay of

[4] Kumar Amitav Chaliha, "Indian Electricity: Miles to go," *The KWR International Advisor*, August 2007 Volume 8 Edition 3.
[5] Siddharth Srivastava, "Big boys absent as India offers oil, gas licences," *Asia Times Online*, September 20, 2006.

Bengal.6 The government has announced plans to invest Rs 2.7 trillion ($660 billion) in the oil and gas sector during the period of the 11th five-year plan (2007-12).7

India's state companies dominate India's energy sector with the Oil & Natural Gas Corporation responsible for over three-quarters of India's crude oil and natural gas production, 10 of India's 17 refineries operated by the Indian Oil Corporation, which also controls three-quarters of the domestic oil transportation network, while the Gas Authority of India Limited pipes 90 percent of the natural gas consumed in India. As India's crown jewels, or navratnas, India's national oil and gas companies are granted preferential status.

The government's attempt to encourage private sector investment in India's energy sector in order to improve infrastructure, gain access to foreign technologies and fuel exploration and production of India's domestic energy resources has met with mixed success. The government's New Exploration Licensing Policy (NELP), which was formulated in 1999 and permitted foreign energy companies to hold 100 percent equity ownership in oil and gas projects has resulted in contracts for 110 oil and natural gas concessions in the first five rounds and the sixth round awarded another 52 exploration blocks. However, 110 of the 165 bids in the sixth round came from the public sector.8 The government is considering replacing the annual bidding for exploration blocks with a year-round bidding process. The major international oil companies have remained reluctant to bid for India's exploration assets given the difficult bureaucratic and regulatory environment, the belief that bidding remains biased towards India's national oil

[6] Nonetheless, major finds have turned out to be lower that initially projected; For instance, ONGC reduced its projection in the KG basin from 21tcf to 2tcf while Gujarat State Petroleum Corp reduced the projection on their find from 20tcf to 1.38tcf – Siddharth Srivastava, "Exit Iran's oil minister, and a pipeline too," Asia Times, August 17, 2007.
[7] Siddharth Srivastava, "Indian energy firms lay out big plans," *Asia Times Online*, June 2, 2007.
[8] Energy Information Administration, *Country Analysis Briefs: India*, January 2007, 3.

companies, and India's unappealing geology, which has prompted India's own oil companies to venture abroad.

Sino-Indian energy competition

Another source of concern for India's energy security is the much publicized competition for equity oil and gas assets between China and India. The Sino-Indian energy relationship is in many ways an extension of their longstanding and complicated political relationship, which has oscillated between periods of rivalry and friendship.

Both states have competed for energy assets in Angola, Ecuador, Kazakhstan, and Burma and in every one of these cases China has won, not just by offering a higher bid than India, but also by adopting a more strategic and holistic approach that integrates financial incentives with aid, infrastructure projects, diplomatic enticements and arms packages. In many cases, India's inability to comprehend the growing importance of the non-commercial aspects of energy deals has led to its defeat by China in acquiring energy assets. In 2004, China's Export-Import Bank extended $2 billion in soft loans to Angola, which led Angolan company Sonangol to support CNPC's bid over that of ONGC for a stake in an offshore block.

While there have been sporadic instances of cooperation, by and large cooperation has been the exception rather than the rule in Sino-Indian energy interactions (see Table 5). Chinese companies have found more utility in forming joint ventures with major Western companies than aligning themselves with their Indian peers. China's and India's joint bids for energy assets have been limited to states that face high levels of political risk such as Sudan and Iran or are marginal players in terms of oil and gas resources such as Columbia and Syria. In many ways the limited cooperation between China and India in the energy sphere is a reflection of the mutual suspicions

in their political relationship. A further source of Sino-Indian energy animosity emanates from both countries' relations with third parties. Notably, China has voiced reservations over the United States-India nuclear agreement while China's support for Pakistan's nuclear program is a source of contention in Sino-Indian energy relations.

Table 5

Sino-Indian cooperation vs. competition

Competition				
Asset	India's bid	China's bid	Winner	Date
Sonangol – 50% stake, offshore block 18 (Angola)	ONGC – $310 million	Sinopec – $725 million	China	Nov-04
PetroKazakhstan (Kazakhstan)	ONGC-Mittal – $3.9 billion	CNPC – $4.18 billion (Initial bid - $3.6 billion)	China	Aug-05
EnCana Corp (Ecuador)	ONGC – $1.4 billion (Bid Withdrawn)	Andes Petroleum (CNPC, CNOOC) – $1.42 billion	China	Sep-05
South Atlantic Petroleum – 45% stake (Nigeria)	OVL – $2 billion (Bid withdrawn)	CNOOC – $2.3 billion	China	Jan-06

Cooperation				
Asset	Sino-Indian bid		Date	
Greater Nile Oil Project (Sudan)	OVL – 25% ($750 million), CNPC – 40% ($441 million)		OVL – March 2003, CNPC – 1996	
Petro-Canada – 37% (Syria)	$573 million (OVL-CNPC – Himalaya Energy)		Dec-05	
Omimex de Colombia Ltd – 50% (Columbia)	$850 million (OVL-Sinopec – Mansorovar Energy Columbia Ltd)		Aug-06	
Yadavaran oil field (Iran)	OVL – 29%, Sinopec – 51%		Sep-06	

China and India's growing overseas energy interests also have implications for their defense and national security policies. Notably, the fear that China's oil imports could be disrupted in the event of a conflict remains prevalent among China's military and political establishment, especially as 90 percent of China's oil imports come by sea and 80 percent transit through the Strait of Malacca, which is vulnerable to piracy, terrorist attacks and U.S. patrols. This has led to a plethora of initiatives, including China's development of ports and overland links to bypass chokepoints, which has been characterized as a "string of pearls" strategy, improving relations with states adjacent to potential chokepoints in Southeast Asia and West Asia and ambitions to develop a blue water naval capability. China's desire to secure sea-lines

of communication along the Indian Ocean has led to fears in India over China's encroachment into its backyard. Some Indian strategists have also viewed China's "string of pearls" strategy to develop alternative routes to transport oil and gas imports through port facilities in Pakistan (Gwadar), Bangladesh (Chittagong) and Burma (Sittwe, Coco, Hianggyi, Khaukphyu, Mergui, Zadetkyi Kyun) as part of a wider Chinese policy to encircle India.

Growing dependence on imported oil

Coupled with concerns over China's growing naval presence, the fact that 90 percent of India's oil imports come by tanker has given India a greater stake in ensuring the security of sea-lanes. The Indian Navy has established a Far Eastern Naval Command (FENC) off Port Blair on the Andaman Islands as well as a monitoring station in Madagascar to increase its forward naval presence from the Strait of Malacca to the Strait of Hormuz. India's joint naval exercises with the Japanese, U.S., Singaporean, Indonesian and Thai navies in the South and East China Seas, and joint exercises with Oman, Iran and France in the Gulf of Oman, Gulf of Aden and Arabian Sea have also demonstrated India's attempt to extend its security perimeter. While China and Pakistan develop the port at Gwadar, which is 400km from the entrance of the Strait of Hormuz, and upgrade the Trans-Karakoram Highway linking China and Pakistan to Central Asia, Iran and India have agreed to jointly develop the Iranian port at Chabahar as well as the road linking the port to Afghanistan and Central Asia.

India's growing oil and gas imports, two-thirds of which come from the Middle East have also made it more vulnerable to instabilities in supplier states. In 2004-5, India's top five sources of oil imports were Saudi Arabia (25 percent), Nigeria (15.7 percent), Kuwait (11.9 percent),

Iran (10 percent) and Iraq (8.7 percent).9 OVL holds interests in 25 oil and gas projects in 16 countries although most of India's equity oil imports come from its stake in the GNPOC (Greater Nile Petroleum Operating Company) in Sudan and the Sakhalin-1 project in Russia.10 OVL's estimated equity production in 2006 (120,000 bpd) is less than a quarter of ONGC's total production (490,000 bpd) and less than 5 percent of India's total oil and gas imports (2.71 million bpd).11 Nonetheless, the Indian government has committed to acquire 60 million tons of equity oil overseas by 2025.12 With respect to natural gas imports, Qatar is providing India with LNG under a 25-year contract signed in 2004 and India is also looking to import 1.25 million tonnes of LNG from Algeria by 2009.

Energy diplomacy

India's pursuit of equity oil has also led it to forge strategic relationships with supplier countries such as Saudi Arabia, Russia, and Venezuela, where energy assets are controlled by state and national oil companies. For instance, India hosted Iranian President Mohammad Khatami, Saudi King Abdullah and Russian President Vladimir Putin as its Chief Guest during its Republic Day celebrations in 2003, 2006 and 2007, respectively. During Brazilian President Lula's visit to India in June 2007, ONGC and Petrobras signed agreements to gain access to exploration blocks in each other's countries, as well as Brazil sharing its expertise on biofuels and deepwater exploration. Indian President Pratibha Patil's tour of Latin America in April 2008, which was

[9] Tanvi Madan, *The Brookings Foreign Policy Studies Energy Security Series: India*, (Washington, DC: Brookings Institution, November 2006), 11.
[10] Energy Information Administration, Country Analysis Briefs: India, January 2007, 3.
[11] "Rpt Preview-India's ONGC Q3 to grow 6 pct on foreign oil output," *Reuters*, January 30, 2007; "ONGC makes 10 oil, gas finds in 2005-6," *The Press Trust of India Limited*, September 19, 2006.
[12] Siddharth Srivastava, "India, China work out new energy synergies," *Asia Times Online*, September 26, 2006.

her first overseas visit as president, served to strengthen goodwill between India and Latin America.

While not on the same level as China, India's engagement with Africa has also increased in recent years, as demonstrated by India hosting the first India-Africa Summit in April 2008. Trade with the region has increased from $967 million in 1990 to $30 billion in 2006/7 and in February 2008, India announced a 60 percent increase in aid to Africa over the next financial year to 800 million rupees ($20 million). Indian investments in Africa have also not incurred the wrath that Chinese investment in the region has seen on undermining local industries and the environment. India's 2 million-strong overseas Indian population in Africa, as well as its provision of troops to UN peacekeeping operations on the continent has also helped to strengthen relations with Africa.

In the Middle East, India is the second largest trading partner with the Gulf Cooperation Council with which it is negotiating a free trade agreement. The presence of 1000 Indian soldiers in the UN Peacekeeping force in southern Lebanon (UN Interim Force in Lebanon – UNIFL), has also generated goodwill toward India in the Middle East. India's 150 million-strong Muslim population and significant expatriate population in the region have also helped to ensure cordial relations between India and the Middle East.

India has also stepped up efforts to access energy resources in Russia. OVL holds a 20 percent stake in Sakhalin-1, making it India's largest investment in an overseas venture. India has also expressed interest in Sakhalin-3 and the Vankor fields in eastern Siberia. Russia is constructing two nuclear reactors at Kudankulam in Tamil Nadu and pledged to construct another four after the Nuclear Suppliers Group lifts restrictions on India. Growing India-Russia energy cooperation prompted former Indian Petroleum Minister Mani Shankar Aiyar to state that

"in the first half-century of Indian independence, Russia has guaranteed our territorial integrity, and in the second half it may be able to guarantee our energy security."

Nonetheless, China has generally been more successful in terms of pursuing energy diplomacy on the world stage. While China has either resolved or shelved its border disputes, India has active conflicts on almost all of its borders with neighboring states. The ongoing violence in India's northeast with sporadic attacks on pipelines, half of India's 28 states being exposed to Naxalite insurgency including five states that account for 85 percent of India's coal resources (Andhra Pradesh, Chhattisgarh, Orissa, Jharkand, West Bengal), and India's poor relations with natural gas-rich Bangladesh have prevented it from fully exploiting its proximity to a region rich in energy resources.

For instance, while OVL and GAIL have a 30 percent stake in Burma's A-1 and A-3 blocks in the Shwe field in the Bay of Bengal, discussions over the construction of a gas pipeline from Burma through Bangladesh have been stalled as a result of tensions between India and Bangladesh. This has forced GAIL to propose the more expensive option of constructing a longer 1,500km pipeline that would bypass Bangladesh through the Siliguri Corridor. The proposed pipeline has been threatened by an agreement between Rangoon and Beijing to supply China with 6.5 tcf of natural gas via a 900km pipeline from the A-1 block. Burma's change of heart on the gas pipeline to India was fueled by Beijing's support for Rangoon at the UN Security Council in January 2007 with Russia and China's joint veto on a U.S.-sponsored resolution condemning Burma's human rights record.

In Central Asia, India is at a geographic disadvantage as the presence of unfriendly and unstable countries – Pakistan and Afghanistan – between India and Central Asia has slowed progress on Indo-Central Asian cooperation in the economic, transportation and energy spheres.

Progress on the proposed 2,000km Turkmenistan-Afghanistan-Pakistan-India (TAPI) or Trans-Afghan gas pipeline has been impeded by surging violence in Afghanistan and in Pakistan's Baluchistan province and questions over whether Turkmenistan has sufficient gas to meet India and Pakistan's needs given its competing energy agreements and its own domestic consumption needs.

Areas of friction

While China has been the subject of significant criticism regarding it engagement with pariah regimes, India has not been free from blame. The most visible sign of this has been frictions between India and the United States over a proposed Iran-Pakistan-India (IPI) natural gas pipeline from Iran's South Pars field, which brings it into conflict with the Iran-Libya Sanctions Act of 1996 and pending Iran Counter-Proliferation Act of 2007.13 India's energy needs and regional ambitions have brought it into confrontation with India's improving relationship with the United States and its global ambitions. With the world's second-largest natural gas reserves Iran is vital to meeting India's energy needs as that India's gas demand is expected to grow faster than any other part of India's energy market. Iran and India have also coordinated a common policy toward securing sea-lanes in the Persian Gulf and accessing resources and markets in Central Asia.14

In Burma, New Delhi has moved from voicing its opposition to the military junta's crackdown on pro-democracy activists to a more pragmatic policy of engagement with the regime since 1993, fueled by India's desire to gain access to Burma's energy resources and

[13] Under this foreign companies making an investment of more than $20 million in Iran's energy sector are subject to U.S. sanctions.
[14] India has also completed a deal to import 7.5 million tons of liquefied natural gas annually from Iran over a 25-year period. In exchange for Iranian gas, India is investing in Iran's ports and energy infrastructure.

Southeast Asia's markets as part of its "Look East" policy, as well as balancing China's influence in the region and obtaining Rangoon's support in countering insurgent groups in India's northeast. As part of this policy, there have been a numerous exchanges of senior-level officials, India-Burma trade has expanded from $87 million in 1990 to $569 million in 2005,15 and India has also sold numerous weapons platforms to Burma at "friendship prices."16

Nonetheless, the restrained U.S. criticism of India's engagement with Burma compared to U.S. criticism of China suggests that the United States may tolerate India's engagement with these regimes as a reflection of the growing strategic partnership between India and the United States.17 Indian engagement with these pariah regimes may in fact offer a potential "third way" to deal with these regimes in contrast to the Chinese policy of "aid without conditions" and Western policy of sanctions and isolation. For instance, India's cordial relationship with both Iran and the United States makes New Delhi an ideal candidate to meditate on the issue of Iran's nuclear program in a similar capacity as China has done with the six-party talks on the Korean peninsula. India's improving relationship with the military junta in Burma also offers a means to balance Chinese influence in Burma, as well as pushing for democratic reforms, albeit through official channels and in a less confrontational way.

Another point of contention in the U.S.-India energy relationship is the issue of climate change. India is the world's fifth largest producer of greenhouse gases with its emissions standing at 4 percent of the United States, 15 percent of Japan and 4 percent of global emissions.18 India has rejected proposals to impose caps on carbon emissions given its

[15] Sudha Ramachandaran, "India gains little from courting Myanmar," *Asia Times*, January 20, 2007.
[16] India's sale to Burma of it India's Advanced Light Helicopter, which is made with components from European countries has highlighted the friction in India's relationship with Burma.
[17] The fact that the scale of Indian investment in these regions is much less than that of China and Indian oil companies are not provided as much government support in the form of generous subsidies and loans as the Chinese NOCs also appears to restrain U.S. criticism of Indian engagement with pariah states.
[18] "China and India set to make common cause on global warming," *Hindustan Times*, June 4, 2007.

implications for India's growth and poverty alleviation initiatives although it is open to technologies that curb carbon emissions.

Finally, India's exclusion from the International Energy Agency has fueled the belief in New Delhi that it is being dictated energy policy rather than having a role in the global energy policymaking structure. This has led to the creation of alternative, sometimes inclusive and ad hoc energy forums.

Potential for Cooperation

Nonetheless, there exist a number of areas of Indo-U.S. cooperation in the energy sphere, especially in the area of the United States providing India with expertise and technology on improving its efficiency. In general, technology transfer has been more successful between the United States and India than between the United States and China given India's more developed intellectual property right protections, and cordial relationship between both states in contrast to the mutual suspicion in the Sino-U.S. relationship. Japan, as a leader in energy efficiency, conservation and technologies also has much to offer India in the field of energy security. For instance, at the East Asia Summit in January 2007, Japan offered $2 billion in aid to help developing countries in the region adopt greener, more energy-efficient technologies.

The most notable issue of United States-India energy cooperation has been on the nuclear issue with the United States-India nuclear agreement being justified as a means to reduce India's dependence on oil, including imported oil from pariah regimes.19 In reality nuclear power is no substitute for oil and gas, especially given that nuclear power is of limited importance to India's growing transportation sector and still significant agricultural sector. Nuclear power is unlikely

[19] Under the agreement, the United States has agreed to assist India's civilian nuclear program in exchange for India opening 14 of its 22 nuclear reactors to international inspection.

to solve India's energy shortages for the foreseeable future given that it is starting from such as low base. Nonetheless, nuclear power does offer a potential solution to addressing environmental concerns from burning fossil fuels.

The United States has also engaged in an Energy Dialogue with India since May 2005. The United States along with Japan and India are also engaged in several multilateral energy dialogues such as the Asia-Pacific Partnership for Clean Development and Climate, the International Partnership for the Hydrogen Economy, and the Carbon Sequestration Leadership Forum. India and Japan have also signed onto the U.S.-led FutureGen initiative, which aims to develop the first clean coal power plant.

Japan and India reside in a region that holds only 3.5 percent of the world's proven oil reserves but consumes 40 percent of world's oil with the world's second, third, fifth and sixth largest oil importers, namely Japan, China, South Korea, and India.20 As such, India and Japan, along with other major energy consuming countries in Asia can cooperate on addressing shared concerns to their energy security such as developing regional strategic petroleum reserves, collective bargaining to address the Asian premium on imported oil, encouraging joint development of disputed energy-rich territories, and improving energy conservation and efficiency.

Even the protection of sea-lines of communication, may be seen as a form of confidence building rather than a source of confrontation between states. The joint response by the navies of Australia, India, Japan, and the United States following the 2004 tsunami, coupled with the joint naval exercises between the United States, India and Japan in the Pacific Ocean in April 2007 and "Malabar 07" naval exercises involving the navies of the three countries as well as Australia

[20] Bo Kong, *An Anatomy of China's Energy Insecurity and its Strategies*, (Springfield, VA: Pacific Northwest Center National Laboratory, December 2005), 12.

and Singapore in the Bay of Bengal in September 2007 illustrate the growing naval cooperation in the region. Expanding such initiatives as the Regional Cooperation Agreement on Anti-Piracy in Asia (ReCAP), the Proliferation Security Initiative (PSI), Regional Maritime Security Initiative (RMSI), and Container Security Initiative (CSI) into more permanent, inclusive forums could assist in this process.

Potential for further trilateral cooperation

Both Japan and the United States have a significant role to play in meeting India's energy security needs. Both states can invest in India's upstream and downstream oil and gas sectors, upgrade India's power transmission sector, offer expertise on improving energy efficiency and conservation, assist India's civilian nuclear power program, and facilitate India's participation in international energy forums. Tokyo and Washington can also wield their diplomatic and economic strength to promote stability along India's periphery, which in turn can fuel energy cooperation within the region. For instance, the U.S. proposal for a regional power grid from Kazakhstan to India to integrate the economies of South and Central Asia as part of the State Department's "Greater Central Asia" strategy can help to build momentum on regional energy cooperation. Meanwhile, Japan's role as Asia's leading and the world's second-largest provider of foreign aid and growing international peacekeeping role can also help to bring stability to countries that are either important transit points for shipping energy resources to India such as Afghanistan or rich in energy resources themselves such as Nepal.

Table 2
Oil and gas reserves and consumption – US vs. Japan vs. India, 2005

	United States			Japan			India		
		Share of world	Rank		Share of world	Rank		Share of world	Rank
Proven oil reserves (barrels)	29,300,000,000	2.4%	13	59,000,000	0.0%	74	5,900,000,000	0.5%	20
Oil consumption (bpd)	20,655,000	24.6%	1	5,360,000	6.4%	3	2,485,000	3.0%	6
Oil production (bpd)	6,830,000	8.0%	3	125,000	0.2%	49	784,000	0.9%	22
Oil imports	13,150,000		1	5,449,000		2	2,090,000		8
Proven gas reserves (tcm)	5,451,000,000,000	3.0%	6	39,640,000,000	0.0%	66	1,100,000,000,000	0.6%	24
Gas consumption (bcm)	633,500,000,000	23.0%	1	81,100,000,000	2.9%	7	36,600,000,000	1.3%	21
Gas production (bcm)	525,700,000,000	19.0%	2	2,957,000,000	0.1%	49	30,400,000,000	1.1%	21
Gas imports	120,600,000,000		1	81,230,000,000		3	2,630,000,000		37

Source: BP Statistical Review of World Energy June 2006.
CIA Worlld Factbook, https://www.cia.gov/library/publications/the-world-factbook/rankorder/2173rank.html