A REPORT OF THE CSIS CHAIR FOR SOUTHEAST ASIA STUDIES AND THE ENERGY AND NATIONAL SECURITY PROGRAM

Sustainable Energy Futures in Southeast Asia

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50 YEARS | CHARTING OUR FUTURE

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EXECUTIVE SUMMARY

Southeast Asia will be the next big growth engine in Asia. Indonesia, Malaysia, the Philippines, Thailand, and Vietnam, with a population of 525 million and a combined GDP of $2.8 trillion (when measured by purchasing power parity), are expected to grow almost 6 percent between now and 2030, according to the Asian Development Bank. For years, they have been eclipsed by China and India, but now their combined GDP is catching up with India and they could overtake Japan in less than two decades. For U.S. firms, these five members of the Association of South East Asian Nations—hereafter the ASEAN-5—are a trade, energy, and environment story.

Potential sales of billions of dollars of energy equipment produced by U.S. companies are at stake in the major economies of the region. They are expected to import as much as $16 billion worth of energy products over the next few years to power their economic growth. But unless the United States launches new initiatives to snare sizeable shares of this investment, U.S. companies are unlikely to be major players in all this trade.

To support the rapid economic growth of the ASEAN-5, their installed energy capacity will need to increase 20 to 40 percent, adding between 168 and 192 gigawatts of power, according to estimates by U.S. energy companies. Demand is already outstripping production in most of the five and will soon do so in all of them. Further, onshore oil and coal resources are dwindling after decades of exploitation and minimal investment, driving the ASEAN-5 to import increasing amounts of energy and seek new domestic sources.

As the economies of the region grow, the ASEAN-5 are burning increasing amounts of hydrocarbons, including vast amounts of coal, to fire their power plants. These countries, particularly Indonesia and Vietnam, are rapidly becoming a major source of greenhouse gas emissions, adding to the region's global environmental footprint. Turning more toward cleaner-burning natural gas, both piped and liquefied, to fire power plants could help reduce the emission of greenhouse gases in the short to medium term and offset dwindling oil and coal reserves.

Natural gas is not a sufficient path to achieve energy independence and sustainable development, however, as all the ASEAN-5 nations have recognized. They will also need to bolster renewable energy capacity and take a serious look at nuclear power. For renewables, this means resources like hydropower and geothermal energy that some of the ASEAN-5 have already incorporated heavily into their energy mix, and newer technologies like solar, wind, and biomass.

The ASEAN-5 will need to import most, if not all, of the equipment to achieve these energy targets. In the past, U.S. companies would likely have been major suppliers of this equipment, but today that is no longer guaranteed. As recently as 2004, the United States was Southeast Asia's largest trading partner, with two-way trade reaching $192 billion. U.S. trade with the region has kept growing since then, but it is rapidly losing market share to China. Today, the United States only ranks as Southeast Asia's fourth-largest trading partner.

Some of this shift is due to the growing role of China and its neighbors in the global supply chain, which has left U.S. companies behind. But some of it is also the result of an explosion of trade agreements within Asia, most of which exclude the United States. It therefore behooves the U.S. government to explore other venues, such as the Asia Pacific Economic Cooperation (APEC) forum and the Trans-Pacific Partnership (TPP) trade talks, to cut tariffs and knock down non-tariff barriers hobbling U.S. firms in the region.

The United States continues to be the top foreign investor in Southeast Asia with $165 billion invested, but the roles of China, Japan, and South Korea are rapidly increasing. U.S. companies continue to play an important role in oil and gas development in the region, but countries are increasingly looking to China to equip their new coal-fired power plants. U.S. firms are becoming less important in the region because they cannot compete with China, which offers much better credit and financing terms, even though these countries admit that U.S. equipment will often last longer, be more efficient, and burn more cleanly.

The ASEAN-5 governments have all developed plans for how they intend to meet their future energy needs. These plans include significant spending to boost their power generation facilities, upgrade their energy distribution infrastructure, and invest in smart grid technology. These projects present lucrative opportunities for U.S. energy companies that could, given the right financing packages, compete with other foreign firms that are already actively pursuing investment opportunities in the region.

But before U.S. firms will invest their own capital in energy projects they will need to be reassured by a strong commercial and legal infrastructure, secure rule of law, and the potential for stable returns on investment in the ASEAN-5. For example, the largest economy in the grouping, Indonesia, would need to guarantee contract sanctity and not press to reopen negotiations after a contract has been signed, as has happened too often in the past.

The ASEAN-5 straddle the sea lanes through the Strait of Malacca and the South China Sea, across which China, Korea, and Japan import most of their hydrocarbons from the Middle East. Much of the U.S. rebalance toward Asia has focused on military engagement, but increased business and economic ties are equally important for many leaders in Southeast Asia. The energy environment and policies of the ASEAN-5 have giant implications not only for the global environment, but also for the U.S. companies vying for a share of the billions of dollars in energy equipment these countries will import in the years ahead.

Recommendations

For ASEAN-5 Policymakers

- Reduce or cut altogether subsidies on energy. These subsidies deprive energy utilities and government budgets of revenue that could be used to upgrade energy infrastructure.
- Work to ensure a strong investment climate, which will entice more energy companies to invest in ASEAN-5 energy infrastructure.
- Cooperate with the United States and others in regional economic groupings such as APEC and the TPP trade negotiations to reduce tariffs and non-tariff barriers on energy and environmental goods and services.

- Find ways to boost the efficiency of coal power plants, which will produce energy savings and decrease rapidly growing greenhouse gas emissions.
- Boost energy efficiency and savings by introducing energy standards for buildings, appliances, and automobiles, developed in cooperation with international manufacturers.
- Share expertise to promote renewable energy development through a mixture of fiscal and non-financial incentives including preferential grid access, feed-in tariffs, tax breaks and holidays, and guaranteed access to credit.
- Continue exploring the construction of a trans-ASEAN gas pipeline and power grid.
- Strengthen dispute resolution mechanisms within governments sharing the Mekong River's resources, to resolve differences over building dams on the river to produce energy.
- Work toward a more stable diplomatic and military environment in the South China Sea, whose islands and potential oil and gas reserves are disputed by Brunei, China, Malaysia, the Philippines, Taiwan, and Vietnam. This will be necessary before hydrocarbons in these disputed waters can be fully exploited.

For U.S. Policymakers

- Provide increased resources to support the Department of Energy's cooperation with the ASEAN-5.
- Boost funding for the Export-Import Bank so it can help U.S. energy and environmental companies compete in Southeast Asia by financing foreign buyers of capital goods and services produced by U.S. companies.
- Support increased financing and risk insurance by the Overseas Private Investment Corporation for small and medium-size companies selling energy goods and services in Southeast Asia.
- Increase funding for the Lower Mekong Initiative to promote sustainable development in the poorer countries of the region.
- Explore supporting more energy projects in the region through the Millennium Challenge Corporation's Green Prosperity Project.
- Support the implementation of cleaner coal technologies in the near-term, as the region is likely to continue investing heavily in coal.

LIST OF ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AESIEAWP	Association of the Electricity Supply Industry of East Asia and the Western Pacific
AIPA	ASEAN Inter-Parliamentary Assembly
APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Center
ASEAN	Association of Southeast Asian Nations
ASEAN-5	Indonesia, Malaysia, Philippines, Thailand, Vietnam
B5	Blend of 95 percent gasoline and five percent biofuel
bcf	Billion cubic feet
bkWh	Billion kilowatt hours
btu	British thermal units
CIA	Central Intelligence Agency
CO2	Carbon dioxide
DOE	U.S. Department of Energy
E5	Blend of 95 percent gasoline and five percent ethanol
EIA	U.S. Energy Information Administration
EIU	Economist Intelligence Unit
Ex-Im	Export-Import Bank of the United States
EWG	APEC Energy Working Group
FiT	Feed-in tariff
FTAAP	Free Trade Area of the Asia-Pacific
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
GE	General Electric
GW	Gigawatt
HAPUA	Heads of ASEAN Power Utilities/Authorities

IEA	International Energy Agency
IFC	International Finance Corporation
IMF	International Monetary Fund
kgoe	Kilogram of oil equivalent
kWh	Kilowatt hour
LMI	Lower Mekong Initiative
LNG	Liquefied natural gas
MCC	Millennium Challenge Corporation
MoIT	Vietnam Ministry of Industry and Trade
MRC	Mekong River Commission
MW	Megawatts
OECD	Organization for Economic Co-operation and Development
OPIC	Overseas Private Investment Corporation
PPA	Power purchase agreement
PPP	Purchasing power parity
Rpp	Refined petroleum products
Short ton	2000 lbs.
SREP	Small Renewable Energy Power Program
tb/d	Thousand barrels per day
tcf	Trillion cubic feet
tmb	Thousand million barrels
TPP	Trans-Pacific Partnership
USAID	United States Agency for International Development
WTO	World Trade Organization

1 ENERGY LANDSCAPES OF THE ASEAN-5

Southeast Asia plays a crucial role in the global economy and offers U.S. companies important opportunities for trade and investment. The 10 countries of the Association of Southeast Asian Nations, or ASEAN, have a gross domestic product (GDP) that totals more than $3 trillion (when measured by purchasing power parity, or PPP) and a combined population that stands at more than 620 million. ASEAN competes globally as the United States' fourth largest trading partner; U.S. companies invest more than $165 billion in ASEAN, a third more than they invest in China and 10 times more than in India.

This paper studies the energy environment in the five largest Southeast Asian nations: Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. The population of these five countries is 539 million, their GDP totals $2.8 trillion (when measured by PPP), and their two-way trade in goods with the United States stood at $141 billion in 2011.[1] For the purposes of this study, we will call them the ASEAN-5.

The Current and Future Energy Mix

The economies of the ASEAN-5 are projected to grow 5.8 percent annually between 2012 and 2030, according to the Asian Development Bank.[2] The actual growth will depend at least in part on whether the global economy resumes growing, commodity and fuel prices stabilize, and alternatives to the use of oil and coal flourish. A lower projection is likely if global economic growth remains anemic, commodity and fuel prices stay weak, and trade protectionism increases. Under either scenario, energy consumption of the ASEAN-5 is projected to grow, albeit at different speeds, to power the region's economic growth. Under the higher projections, it will increase an average of 6.4 percent a year until 2025 and under the lower, an average of 5 percent. To achieve these growth rates, installed energy capacity will need to increase 20–40 percent, adding 168–192 gigawatts. Coal and gas are projected to account for 80–85 percent of these capacity additions.[3]

The ASEAN-5 countries supply much of their own energy and also export energy products to the world market. Coal is a cheap and abundant source of energy in several of the ASEAN-5, especially Indonesia and Vietnam, and will retain a large share of the region's energy mix. Coal is

1. Central Intelligence Agency (CIA), *World Factbook*, https://www.cia.gov/library/publications/the-world-factbook/index.html; United States Census Bureau, *Foreign Trade in Goods by Country*, http://www.census.gov/foreign-trade/balance/.

2. United Nations, *Population: World Population Prospects: The 2008 Revision*, http://esa.un.org/unpp/index.asp; *ASEAN 2030 background paper on country perspectives*, cited in Asian Development Bank, "Aspirations for a 'RICH' ASEAN," 35, http://www.adbi.org/files/2012.03.30.proj.material.asean.2030.highlights.2.pdf.

3. General Electric, *GE Energy Global Strategy & Planning, 2012 Scenarios*, January 12, 2012.

used to produce electricity for manufacturing as well as household uses. Petroleum, particularly subsidized diesel fuel, is used for transportation and some power plants. Additionally, natural gas exploration and production is rapidly changing the energy landscape in Southeast Asia. Gas-fired power plants have been the predominant source of electricity generation in Thailand and Malaysia since the 1990s and are now springing up across the rest of the region as Southeast Asia coalesces around an energy mix that is more heavily reliant on this abundant and relatively clean fuel.

Each of the ASEAN-5 is looking to incorporate renewables into its energy mix. While Indonesia and the Philippines have vast untapped geothermal energy resources, Thailand and Vietnam are eyeing the hydropower potential of neighboring Laos. By contrast, nuclear energy carries a stigma among many Southeast Asians and suffered a setback after Japan's 2011 earthquake and tsunami. While some of the ASEAN-5 anticipate nuclear energy becoming part of their energy mix, others have shelved plans for nuclear power plants for the foreseeable future.

Infrastructure and Investment

A wide array of policy decisions will determine how each of the ASEAN-5 countries is able to meet its growing energy demands with these diverse energy sources. Currently, more than 170 million people in East Asia and the Pacific still do not have access to electricity and nearly half of all households still cook using solid fuel.[4] A longstanding lack of investment in existing production and infrastructure, coupled with the slowdown of the global economy, has limited the region's ability to increase production to respond to growing demand. However, the ASEAN-5 can be expected to invest between $14 billion and $16 billion between 2012 and 2025, according to GE estimates.[5]

The role that U.S. companies can play in the development of the region's energy infrastructure will depend on both "pull" and "push" factors. The "pull" factors will be the most important, including the level of infrastructure investment by the ASEAN-5 governments and the regulatory environment and incentive structures they put in place. In addition, a strong commercial and legal infrastructure, rule of law, and stable returns in the ASEAN-5 will play an important role in enticing investment from U.S. companies. But the level of investment from the U.S. side can also be influenced in part by "push" factors, such as how much the U.S. government promotes trade in energy products and services and helps finance exports.[6]

To meet future energy needs, the ASEAN-5 governments have plans that include substantial infrastructure spending to upgrade and expand distribution and transmission as well as electricity generation capacity. Energy-efficient building materials and investments in smart-grid technology, which uses real-time information from substations, transformers, and switches both to balance electricity distribution efficiently and to integrate distributed generation and renewables seamlessly into the power grid, will affect energy demand and the ability of the region's emerging power grid to provide enough energy to fire Southeast Asia's rapid economic growth. Smart-grid technology requires heavy up-front investment in infrastructure, but it increases the efficiency of electric-

4. International Bank for Reconstruction and Development, *One Goal, Two Paths: Achieving Universal Access to Modern Energy in East Asia and the Pacific*, 2011, http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2011/09/28/000356161_20110928014207/Rendered/PDF/646690PUB0one000Box361543B00PUBLIC0.pdf, 1.

5. General Electric, *Global Strategy & Planning*.

6. Peter Evans, "ASEAN 5 Energy Landscape: The Next Decade 2011–2025," presentation at the Southeast Asia Energy Roundtable at the Center for Strategic and International Studies, March 8, 2012.

ity usage in a national grid and decreases carbon emissions created through electricity generation. U.S. companies will also have opportunities to enter the market by providing such efficient energy equipment and services.

This investment will create tremendous opportunities for both domestic and foreign companies, including those from the United States. The policies of the U.S. government and investments by American companies can play a significant role in helping the ASEAN-5 achieve a cleaner and more efficient growth path. Given the right outreach and financing packages, U.S. energy companies could compete with foreign companies that are already aggressively pursuing market opportunities throughout the region.

To understand the region's economic health, as well as the opportunities for U.S. companies and the foreign policy goals of the U.S. government, it is imperative to develop a composite picture of energy supply and demand in the ASEAN-5 nations. But such a picture cannot be obtained without first understanding each nation's energy landscape and the policies influencing it. Before addressing how global and regional bodies and factors are influencing energy use in the ASEAN-5 and what Southeast Asian and U.S. policymakers could do to improve the energy environment, we will briefly examine the domestic energy landscape in each country.

Indonesia experienced a 255 percent population increase between 1960 and 2010 and is now the world's fourth-most-populous country. It has the largest economy in Southeast Asia and the world's 16th largest economy by nominal GDP.[7] Indonesia weathered the 2008 global economic crisis well because of its raw material exports and strong domestic consumer demand. Its archipelago of 16,000 islands makes transport and energy distribution difficult. Indonesia's real GDP is expected to grow at a 6.9 percent annual rate over the next five years.[8]

Malaysia is a middle-income country that depends heavily on manufacturing and resource extraction.[9] It has some of the most developed infrastructure in Asia, and its GDP is predicted to grow between 5.5 and 6 percent over the next few years. Malaysia has the third-largest economy in ASEAN and sits on the Strait of Malacca, giving it a strategic location along a vital sea route for energy trade between the Pacific and Indian oceans.

The Philippines withstood the 2008 financial crisis better than many of its neighbors due to its economy's minimal exposure to international financing, lower export dependency, and steady domestic consumption.[10] Government spending on infrastructure, however, has not matched the country's increasing energy demand. The country's location on the eastern edge of the South China Sea has several implications for Philippine energy security, including contentious overlapping claims with China over potential fossil fuel–rich areas. Roughly 80 percent of the country's oil imports pass through the Strait of Malacca and the South China Sea.[11]

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7. CIA, "Indonesia," *World Factbook*, https://www.cia.gov/library/publications/the-world-factbook/geos/id.html.

8. International Monetary Fund (IMF), *World Economic Outlook Database*, http://www.imf.org/external/pubs/ft/weo/2012/01/weodata/index.aspx.

9. Asia Pacific Energy Research Center (APERC), *APEC Energy Overview 2010* (Singapore: Asia-Pacific Economic Cooperation (APEC) Secretariat, 2011), 100, http://www.ieej.or.jp/aperc/2010pdf/Overview2010.pdf.

10. CIA, "Philippines," *World Factbook*, https://www.cia.gov/library/publications/the-world-factbook/geos/rp.html.

11. "PHL oil imports not from conflict-ridden countries—DOE," *GMA News Online*, February 22, 2011, http://www.gmanetwork.com/news/story/213679/economy/

Key Variables Influencing Each Country's Energy Choices

A Snapshot of the ASEAN-5 Economic Group, Population, and Energy Use

	Population (July 2012 est.)	GDP in U.S. Dollars, at Official Exchange Rate (2011 est.)	Economic Growth Rate	GDP Composition by Sector (2011 est.)	Urbanization Rate (Annual Rate of Change, 2010–15 est.)	Energy Use Per Capita (kgoe[a] 2009)	Energy per GDP (in 2005 PPP[b] $) kgoe, 2009	Carbon Dioxide Emissions (million metric tons)
Indonesia	248,216,193	$834.3 billion Per capita: $4,700	2009: 4.6% 2010: 6.1% 2011:6.4%	Agriculture: 15%; Industry: 46%; Services 39%	1.7%	851	4.3	414.9
Malaysia	29,179,952	$247.6 billion Per capita: $15,600	2009: -1.6% 2010: 7.2% 2011: 5.2%	Agriculture: 12%; Industry: 40%; Services 48%	2.4%	2391	5.2	149.6
Philippines	103,775,002	$216.1 billion Per capita: $4,100	2009: 1.1% 2010:7.6% 2011: 3.7%	Agriculture: 12%; Industry: 33%; Services 54 %	2.3%	424	7.9	72.0
Thailand	67,091,089	$345.6 billion Per capita: $9,700	2009: -2.3% 2010: 7.8% 2011:0.1%	Agriculture: 13%; Industry: 34%; Services: 53%	1.8%	1504	4.8	254.9
Vietnam	91,519,289	$123.6 billion Per capita: $3,300	2009: 5.3% 2010: 6.8% 2011: 5.8%	Agriculture: 22%; Industry: 40%; Services: 38%	3%	745	3.7	98.3

Source: CIA, *World Factbook*; U.S. Energy Information Administration (EIA), *International Energy Outlook 2011*, September 19, 2011, http://www.eia.gov/forecasts/ieo/index.cfm.

a. Kilograms of oil equivalent.

b. Purchasing power parity.

Thailand has the second largest economy in Southeast Asia, after Indonesia, and is the fourth-richest country in the region according to GDP per capita. Thailand has a well-developed infrastructure, free-enterprise economy, pro-investment policies, and strong export industries.[12] It is heavily dependent on exports and is one of the world's top exporters of rice. Thailand's real GDP is expected to grow at a 5.3 percent annual rate over the next five years.[13]

Vietnam is the world's thirteenth-most-populous country and its economy is still led by state-owned enterprises despite the communist government's economic reforms.[14] Vietnam joined the World Trade Organization in 2007 and became part of Trans-Pacific Partnership trade negotia-

phl-oil-imports-not-from-conflict-ridden-countries-doe.

12. CIA, "Thailand," *World Factbook*, https://www.cia.gov/library/publications/the-world-factbook/geos/th.html.

13. IMF, *World Economic Outlook Database*.

14. CIA, "Vietnam," *World Factbook*, https://www.cia.gov/library/publications/the-world-factbook/geos/vm.html.

tions in 2010. Agriculture's share of economic output has declined while industry's share grew from 36 to 40 percent between 2000 and 2011.[15] The country has had some of the world's highest levels of economic growth, 7 percent annually since 2000, but the global recession, subsidized credit for state-owned enterprises, and a large trade deficit have hurt its export-focused economy in recent years.[16]

Resource Overview of the ASEAN-5

The structure of primary energy use is shifting among the ASEAN-5 nations. The maturation of oil production fields, the lack of investment in them, and the emergence of abundant natural gas and coal resources have altered the structure of primary energy use away from oil and toward coal and gas in recent years.

While there has been more focus on renewables and gas energy, coal is still the main source of energy. The ASEAN region, led by Indonesia, is a net coal exporter. Through 2030, coal will have the fastest growth rate (7.7 percent annually) owing to the rapid expansion of coal-fired power generation across the region.[17] Growth in electricity consumption will outpace economic growth, with installed capacity projected to grow by 20–40 percent.[18] Coal and gas will constitute 80–85 percent of capacity additions, with $14–16 billion expected to be spent on power plants over the next 15 years.[19]

Renewables form only around 20 percent of total energy sources in the ASEAN-5 countries; the majority of energy comes from gas and coal. Of the renewable energy mix, hydropower dominates, with wind and geothermal following closely behind. Overdependence on fossil fuels to meet growing energy demand is a significant energy security issue for the ASEAN-5. The impact of climate change is also increasingly being felt via rising sea levels and the increasing frequency of severe weather. These effects could negatively impact the relatively buoyant economies of the region, and calls to tackle them could put pressure on governments to end persistent fossil-fuel subsidies in some countries in the years to come.

The unrealized potential for renewables in the region is significant albeit diverse when measured by country on a per-capita or per-GDP basis. According to the International Energy Agency, "Indonesia . . . has the highest total realisable potential for renewables across all sectors; in per-capita terms, Malaysia has the largest renewable electricity potential; and Vietnam shows the highest potential for renewable electricity in terms of its level of economic development."[20]

In recent years, some ASEAN governments have successfully pushed to create policies to spur renewable energy investment and use. Several countries have set medium- to long-term targets for renewable energy. Thailand has led the way in setting targets and creating incentives with feed-in tariffs (FiTs) for renewables, but other countries such as Indonesia have put FiTs in place, too.

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15. Ibid.
16. Ibid.
17. Energy Data and Modeling Center, "The 3rd ASEAN Energy Outlook," February 2011, 2, http://www.energycommunity.org/documents/ThirdASEANEnergyOutlook.pdf.
18. Evans, "ASEAN 5 Energy Landscape."
19. Ibid.
20. International Energy Agency (IEA), "Executive Summary," *Deploying Renewable Energy in Southeast Asia: Trends and Potentials*, 2010, http://www.iea.org/Textbase/npsum/renew_seasiasum.pdf.

Financial incentives such as FiTs will not spur renewable energy, however, if ASEAN countries do not first overcome other significant barriers such as administrative hurdles, market access barriers, grid access problems, fossil fuel subsidies, and sociocultural factors. These barriers need to be overcome to help increase investment in renewables and reduce dependence on fossil fuels. Non-financial support has been provided in the form of standard power purchase agreements; preferential arrangements for small generators; and information support in Malaysia, Indonesia, and Thailand.[21]

A Country-by-Country Look at Energy

Indonesia

Resource Wealth

Indonesia's size and natural resources make it a major player in the international energy scene. Its indigenous oil, gas, and coal reserves contribute to domestic growth and to its foreign exchange earnings.

Table 1. Resource Wealth of Indonesia

Resource	Consumption (2010)	Production (2010)	Proven Reserves (2010)	Export	Import
Oil	1357 tb/d[a]	1029.91 tb/d	4.2 tmb[b]	415.224 tb/d (Crude Oil & RPP[c], 2008)	665.776 tb/d (Crude Oil & RPP, 2008)
Natural Gas	1.46 tcf[d]	3.406 tcf	106 tcf	1.457 tcf	0
Coal	54,228.207 thousand short tons[e]	370,378.82 thousand short tons	6,094.680 million short tons	316,151.72 thousand short tons	1.102 thousand short tons
Nuclear Energy	N/A	-	-	-	-
	Net Electricity Consumption 2010	Net Electricity Generation (2010)			
Non-Hydro renewables		8.561 bkWh[f]			
Hydroelectricity		11.325 bkWh			
Total Renewables	19.886	19.886 bkWh	-		

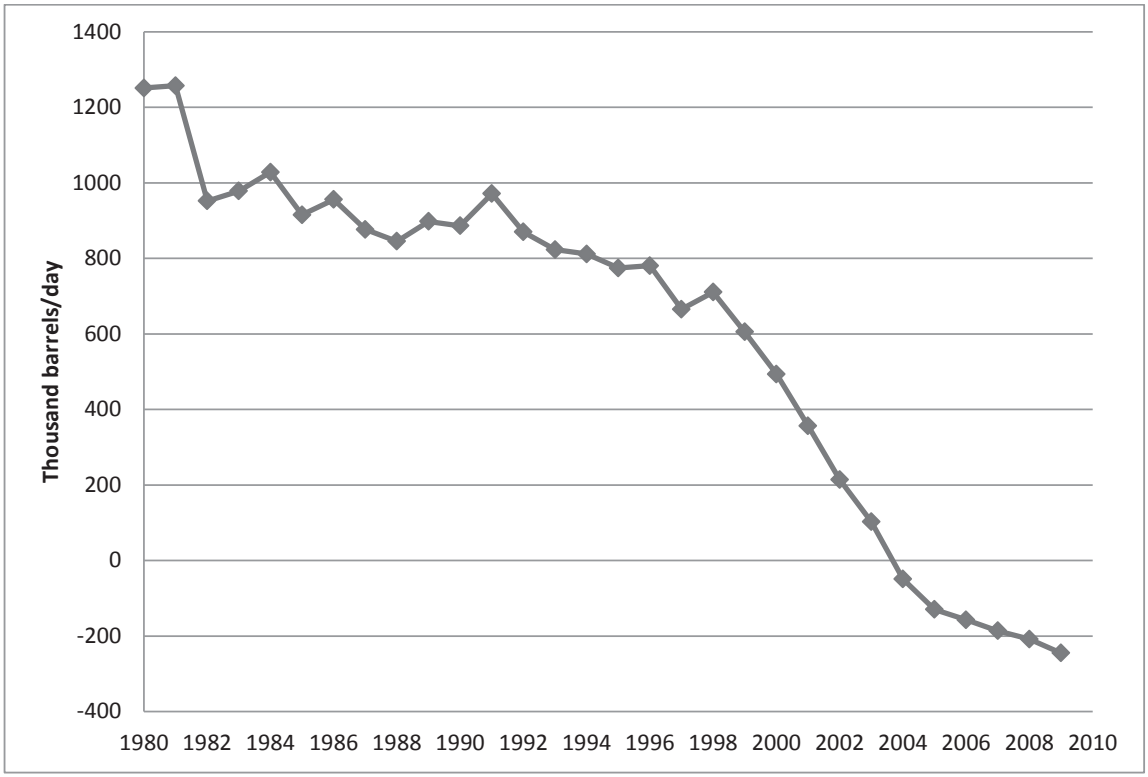
Source: U.S. Energy Information Administration (EIA), *International Energy Statistics*, http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm.

a. Thousand barrels per day. b. Thousand million barrels. c. Refined petroleum products.
d. Trillion cubic feet. e. 2000 lbs. f. Billion kilowatt hours.

21. Norton Rose, "Renewable Energy in Asia Pacific," http://www.nortonrose.com/files/renewable-energy-in-asia-pacific-pdf-3mb-29339.pdf; Ren21, "Renewables 2011: Global Status Report," 2011, http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR2011.pdf.

Despite being a net total energy exporter, Indonesia's oil consumption has increased, but neither its production nor refining capacity has risen to meet the growing demand.

Figure 1: Petroleum Net Exports and Imports in Indonesia



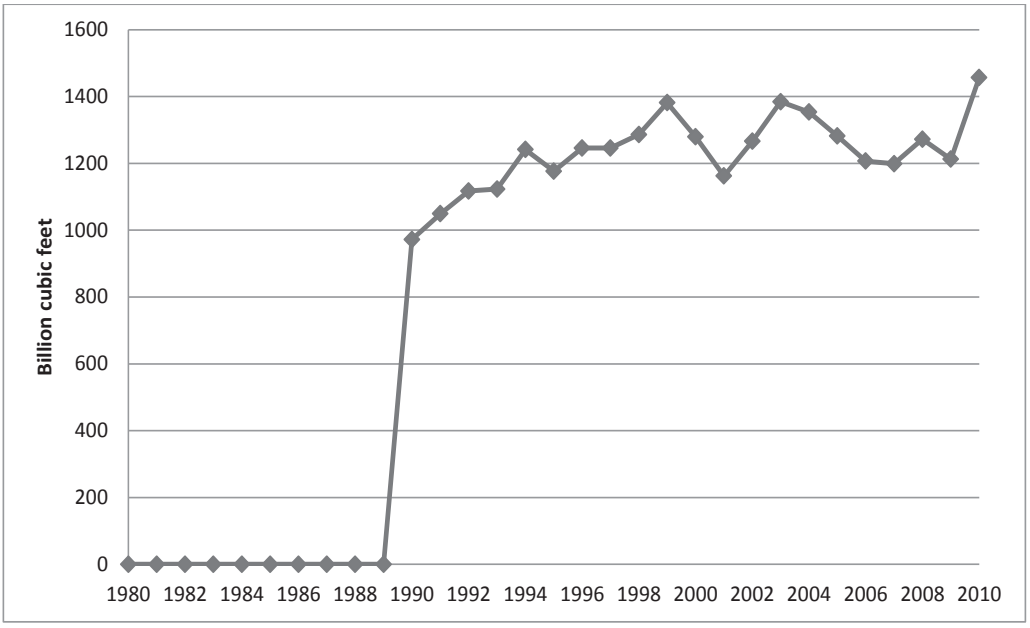
Source: U.S. Energy Information Administration (EIA), *International Energy Statistics*, accessed August 2012, http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm.

Natural gas exports have steadily grown in the last decade owing to increased proven natural gas reserves resulting from heightened investment in unconventional gas resources. Indonesia is the world's sixth-largest net exporter of natural gas,[22] with destinations including Japan, Singapore, Taiwan, and South Korea.[23] However, the Indonesian government has expressed interest in reducing the amount of gas it exports so it can meet its own rising domestic demand.[24]

Coal is also a major export; Indonesia is currently the world's second-largest coal exporter, behind Australia. China, Japan, and Taiwan are the major destinations of its coal. Indeed, Indonesia was China's largest coal supplier in 2010.[25] The coal export market is expected to remain strong through at least 2014.[26]

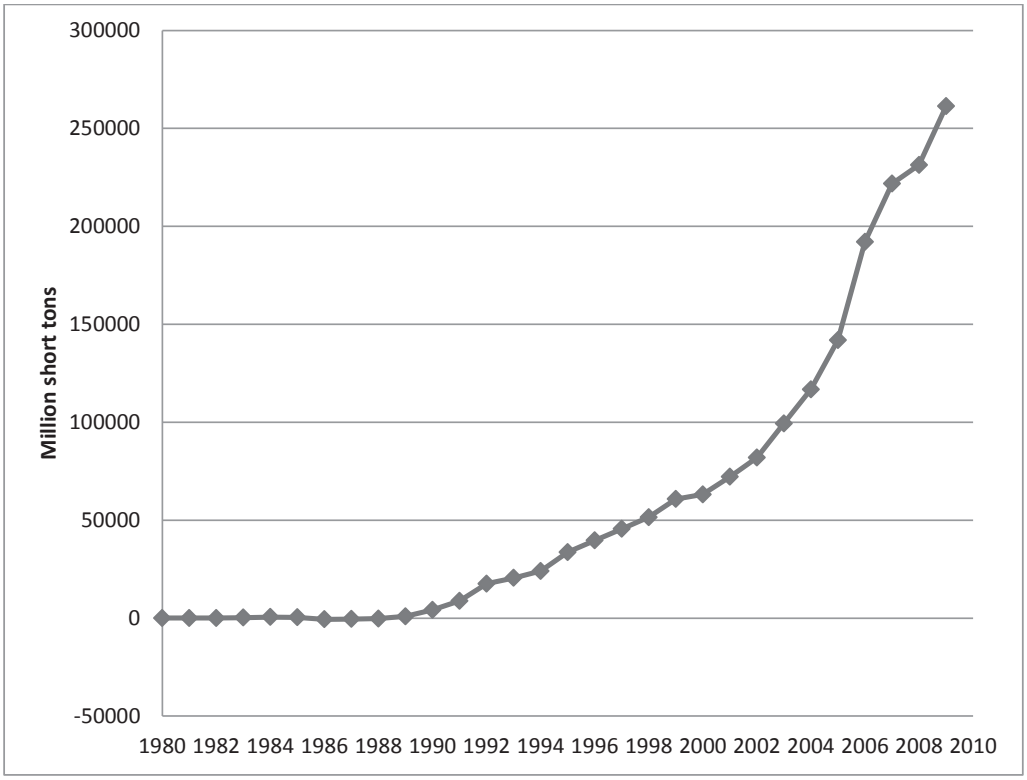
22. U.S. Energy Information Administration (EIA), "Country Analysis Brief: Indonesia," May 2011, http://205.254.135.7/countries/cab.cfm?fips=ID.
23. Ibid.
24. Ibid.
25. EIA, "Indonesia."
26. "Coal Sentiment Stoked by 2 New Reports," *Jakarta Globe*, September 26, 2011, http://www.thejakartaglobe.com/business/coal-sentiment-stoked-by-2-new-reports/467915.

Figure 2: Natural Gas Net Exports and Imports in Indonesia



Source: EIA, *International Energy Statistics*.

Figure 3: Coal Net Exports and Imports in Indonesia



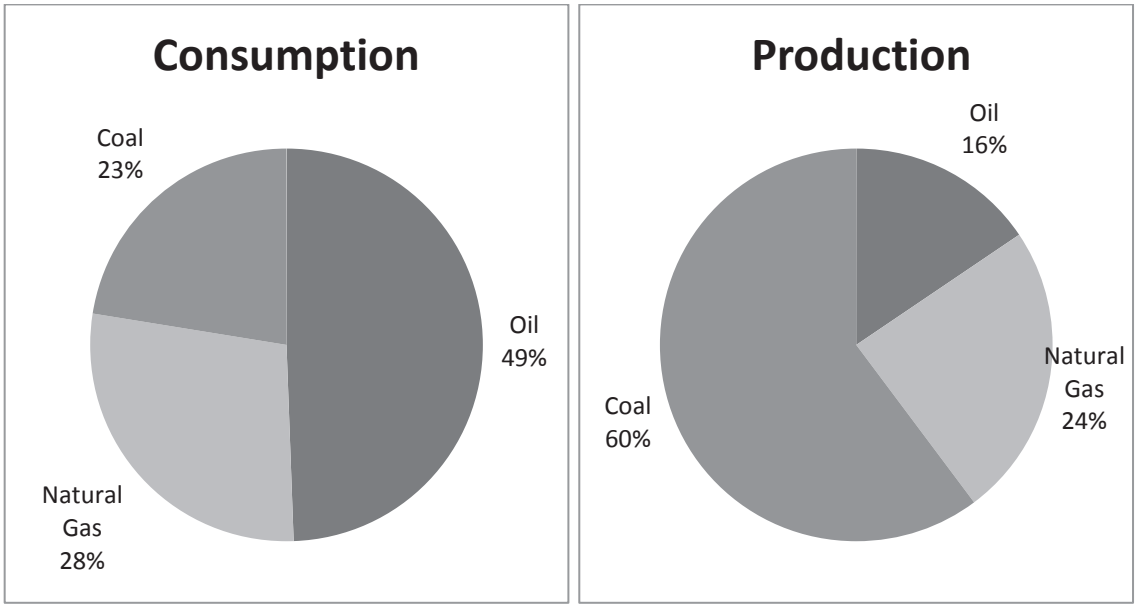
Source: EIA, *International Energy Statistics*.

Indonesia will need to focus more on renewable energy, which at the moment accounts for only 5.2 percent of electricity generation. The country has ample geothermal potential and could meet up to 40 percent of its energy needs from fully exploiting its geothermal and other renewable energy sources.[27] Indonesia is experiencing an ongoing domestic debate over the safety of nuclear power in such a seismically active country.[28] The government does not consider nuclear energy a vital component in the country's future energy mix.

Demand Picture

Successful economic development and increases in the standard of living have brought concomitant increases in household electricity usage and gasoline consumption. From 1999 to 2008, the country's total primary energy consumption grew by almost 50 percent.[29] Indonesia has had an average rate of energy consumption growth of about 7 percent per year for the last decade.[30] In 2008, Indonesia produced 11.935 quadrillion British thermal units (btu) of total primary energy and consumed only 5.8.4 quadrillion btu.[31]

Figure 4: Energy Consumption and Production in Indonesia



Source: EIA, *International Energy Statistics*.

27. "Renewable Energy's Slow Road in Indonesia," *Jakarta Globe*, August 27, 2011, http://www.thejakartaglobe.com/opinion/renewable-energys-slow-road-in-indonesia/461950.

28. "Asian Nations Closely Monitor Japan's Nuclear-Plant Problems," *Wall Street Journal*, March 14, 2011,
http://online.wsj.com/article/SB10001424052748704027504576198290858783636.html.

29. EIA, "Indonesia."

30. ASEAN Inter-Parliamentary Assembly (AIPA), "Indonesia's Country Report – Encouraging Clean Energy Initiative," 2010, http://www.aipasecretariat.org/wp-content/uploads/2010/06/Ec-Indonesia-Clean-Energy.pdf.

31. EIA, "Indonesia."

Capacity growth has lagged behind increasing demand. Indonesia remains dependent on oil and, in 2009, oil made up 44 percent of its energy mix.[32] Indonesia became a net importer of oil (both crude and refined products) in 2004 due to insufficient investments and declining oil production along with rising domestic demand.[33] After several decades of declining production at existing oil fields and new exploration failing to keep pace, the government has looked to increase domestic coal consumption and reduce dependence on gas and oil.[34]

Domestic gas consumption has nearly doubled since 2004.[35] This is driven in large part by the industrial sector, which currently is the largest domestic consumer of gas, although future demand will be driven by the power sector as it switches from oil to gas.[36] To date, the majority of the increased production of coal has been exported; moving forward, however, coal is expected to play an increasingly important role in providing energy for Indonesia's manufacturing and extractive sectors.[37]

Indonesia suffers from underperformance in the energy sector caused by mismanagement and low investment. [38] Net electricity demand in 2009 was estimated to be 131.5 billion kilowatt hours (bkWh).[39] The government plans to increase the country's electrification rate from 74 percent of households in October 2011[40] to 90 percent by 2020[41] and 93 percent in 2025.[42] Electricity demand is expected to increase by 9.5 percent per year, or 7,800 megawatts (MW), for the next two decades, requiring a total yearly investment of $11.4 billion to meet demand.[43]

Policies Shaping Indonesia's Potential Trajectory

Energy efficiency is one of the three main policy priorities of the government. Yet Indonesia's policy of subsidizing electricity and gas for vehicles does not provide incentives for conservation and saps budget resources that could be spent to increase the country's renewable-energy capacity.

32. AIPA, "Indonesia's Country Report."

33. EIA, "Indonesia."

34. Shell Oil, "Oil and Gas Potential in Southeast Asia," presentation at the Southeast Asia Energy Roundtable at the Center for Strategic and International Studies, March 8, 2012.

35. EIA, "Indonesia."

36. Shell Oil, "Oil and Gas Potential."

37. Ibid.

38. Economist Intelligence Unit (EIU), "Country Report: Indonesia," December 2011, http://store.eiu.com/product.aspx?pid=50000205&gid=1810000181&pubid=60001006

39. EIA, "Total Electricity Net Generation (Billion Kilowatthours)," *International Energy Statistics,* http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=2&pid=2&aid=12.

40. PT Perusahaan Listrik Negara, Laporan Tahunan 2011 Annual Report, 3, http://www.pln.co.id/dataweb/AR/ARPLN2011.pdf.

41. Jeffrey H. Haeni, Collin Green, and Edi Setianto, "Indonesia Energy Sector Assessment," November 22, 2008, http://indonesia.usaid.gov/documents/document/Document/400/USAID_Indonesia_Energy_Assessment, 27.

42. AIPA, "Indonesia's Country Report."

43. Nur Farida Ahniar and Iwan Kurniawan, "US$11.1 Bn Needed to Supply Electricity," trans. Bonardo Maulana, *VIVAnews*, December 8, 2010, http://us.en.vivanews.com/news/read/192738-us-11-1-bn-needed-to-supply-electricity.

In 2010, fuel subsidies were 8 percent of total government budget expenditures.[44] The parliament blocked efforts by the government in early 2012 to cut energy subsidies.[45]

Although the government would like to reduce its dependence on fossil fuels, the present energy mix reflects a strong dependence on carbon-based energy. The government faces unique challenges to further exploit each energy resource, though long-time investors in developing fossil fuels in Indonesia are now being joined by counterparts eager to help exploit renewables.[46]

Despite a recognized need to diversify into more renewable energy sources, the government's existing policy incentives and/or policy implementation processes are insufficient to attract significant investment in geothermal and other renewable energy technologies to bolster energy security. However, Jakarta is considering additional incentives that could help increase renewable energy supplies going forward.

The current FiT is attractive compared to the tariff for conventional fossil sources, but it does not differentiate among types of renewables. For example, although the FiT is considered sufficient for a mini-hydropower developer, it is not sufficient for most biomass, biogas, and landfill power developers, owing to the greater challenge in securing reliable feedstock and other barriers. Other challenges for geothermal and other renewable producers are the multilayered approval process they face involving both central and local authorities and the often-substantial distances from potential plants to the existing electricity grid, which could make investment unattractive even with a new FiT.

In 2010, the government released its more ambitious Vision 25/25, a plan to attain a mix of 25 percent renewable energy by 2025 through the diversification of energy sources. Vision 25/25 is very ambitious and some observers believe the government will not be able to meet its renewable energy targets because of the barriers to untapped geothermal, hydropower, and other renewables discussed above.

Beyond the challenges of subsidies and achieving ambitious renewable energy goals, the government has enacted regulations that have been seen to discourage investment and exploration by international oil and gas companies. A 2009 directive requires that 35 percent of international companies' operations be run with "domestic content," or equipment and labor that are sourced locally.[47] Indonesia's inability to provide sufficient human capital and equipment to meet this threshold puts foreign operators at risk of penalties. More onerous is the government's tendency to periodically call for the renegotiation of production sharing contracts with upstream oil and gas producers, chilling the investment environment.[48]

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44. "Fuel Subsidy Policy in Indonesia," presentation at IISD Conference on "Increasing the Momentum of Fossil-Fuel Subsidy Reform: Developments and Opportunities" at the Republic of Indonesia Ministry of Finance Fiscal Policy Office, October 14–15, 2010, 14, http://www.globalsubsidies.org/files/assets/ffs_gsi-unepconf_sess2_askolani.pdf.

45. Vikram Nehru, "Yudhoyono on the Ropes," *The Diplomat: ASEAN Beat*, April 8, 2012, http://the-diplomat.com/asean-beat/2012/04/08/yudhoyono-on-the-ropes/.

46. "Indonesia Green Power Steams Ahead as Economy Booms," *Jakarta Globe*, July 22, 2011, http://www.thejakartaglobe.com/business/indonesia-green-power-steams-ahead-as-economy-booms/454597.

47. Office of the United States Trade Representative, *2011 National Trade Estimate Report on Foreign Trade Barriers*, 2011, 187, http://www.ustr.gov/webfm_send/2710.

48. Ririn Radiawati Kusuma, "Oil and Gas Firms Balk at Plan to Redraw Contracts," *Jakarta Globe*, July 21, 2011, http://www.thejakartaglobe.com/naturalresources/oil-and-gas-firms-balk-at-plan-to-redraw-contracts/454431.

Malaysia

Resource wealth

Malaysia is well endowed with both conventional and renewable energy resources.[49]

Table 2. Resource Wealth of Malaysia

Resource	Consumption (2010)	Production (2010)	Proven Reserves (2010)	Export	Import
Oil	523.913 tb/d[a]	664.827 tb/d	5.8 tmb[b]	503.702 tb/d (Crude Oil & RPP[c], 2008)	398.431 tb/d (Crude Oil & RPP, 2008)
Natural Gas	1.145 tcf[d]	2.718 tcf	83 tcf	1129.727 bcf[e] (2009)	103.826 bcf (2009)
Coal	21322.009 thousand short tons[f]	2644.445 thousand short tons	4.409 million short tons	90.390 thousand short tons (2009)	18767.953 thousand short tons (2009)
Nuclear Energy	N/A				
	Net Electricity Consumption 2010	**Net Electricity Production 2010**			
Non-Hydro Renewables		-			
Hydro-electricity		9.335 bkWh[g]			
Total Renewables	9.336 bkWh	9.335 bkWh			

Source: EIA, *International Energy Statistics*.

a. Thousand barrels per day. b. Thousand million barrels. c. Refined petroleum products. d. Trillion cubic feet. e. Billion cubic feet. f. 2000 lbs. g. Billion kilowatt hours.

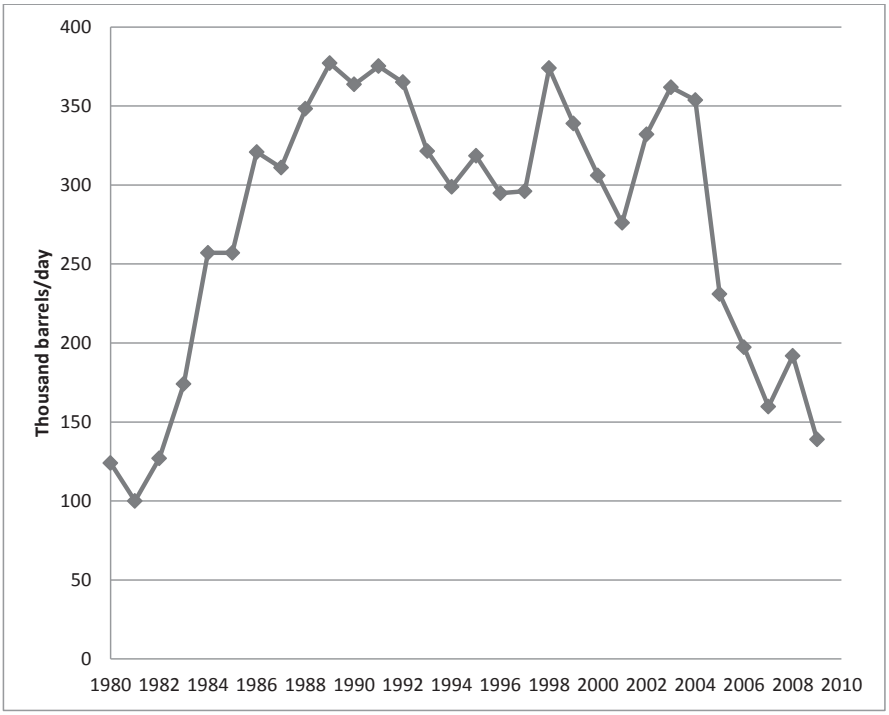
The country has domestic oil reserves and exports crude oil to Australia, India, Japan, South Korea, Singapore, and Thailand. However, its oil fields, mainly off the coast of peninsular Malaysia, are aging and production has been declining since 2004.[50] Malaysia continues to export crude oil to Singapore for refining and reimports refined products for domestic use. This reliance has been decreasing in recent years as the government has boosted investment in domestic refining capacity.[51]

49. APERC, *APEC Energy Overview 2010*, 100.

50. U.S. Energy Information Administration (EIA), "Country Analysis Brief: Malaysia," December 14, 2011, http://205.254.135.7/countries/cab.cfm?fips=MY.

51. International Energy Agency (IEA), "Chapter 16: ASEAN-4 Country Profiles," *World Energy Outlook 2009* (Paris: International Energy Agency, 2009), 607, http://www.worldenergyoutlook.org/media/weowebsite/2009/WEO2009.pdf.

Figure 5: Petroleum Net Exports and Imports in Malaysia



Source: EIA, *International Energy Statistics*.

In the future, the country's energy exports will increasingly be dominated by natural gas production, as Malaysia has the tenth-largest natural gas reserves in the world and the fourth-largest in the Asia Pacific.[52] According to the government, these reserves could last for 24 years.[53] In 2010, the country was the third largest exporter of liquefied natural gas (LNG) in the world, after Qatar and Indonesia, accounting for 10.3 percent of the world's exports.[54] Malaysia's large natural gas reserves, combined with increasing production in recent years, suggest that the country will maintain a large share of the global natural gas market for years to come.[55]

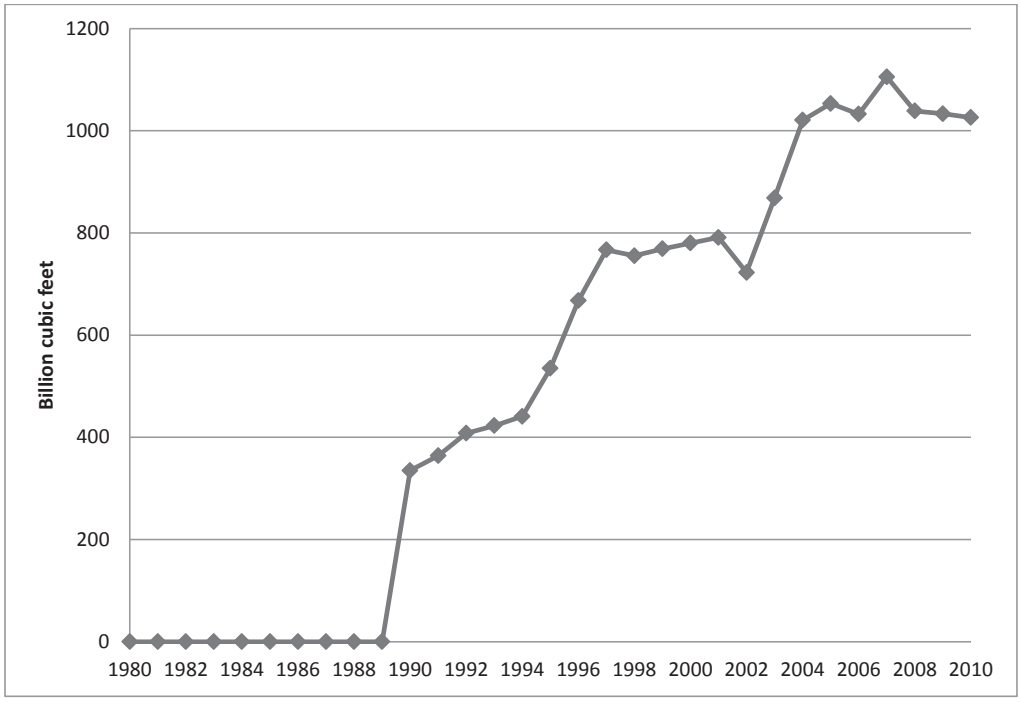
52. EIA, "Malaysia."

53. "Petronas Has 'Major' Oil, Gas Discoveries Off Malaysia," *Jakarta Globe*, February 14, 2011, http://www.thejakartaglobe.com/bisworld/petronas-has-major-oil-gas-discoveries-off-malaysia/422661.

54. "Qatar accounts for 25.5pc of global LNG exports," *Zawya*, June 20, 2011, http://www.zawya.com/story.cfm/sidZAWYA20110620033407/Qatar%20accounts%20for%2025.5pc%20of%20global%20LNG%20exports.

55. EIA, "Malaysia."

Figure 6: Natural Gas Net Exports and Imports in Malaysia



Source: EIA, *International Energy Statistics*.

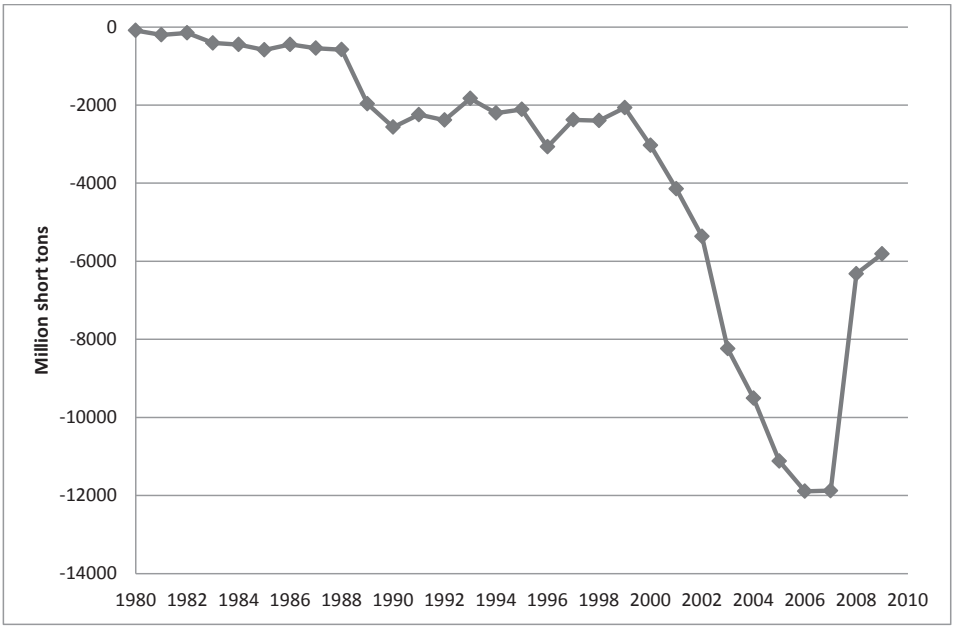
On the other hand, Malaysia is a net coal importer, purchasing as much as 90 percent of the coal it uses. About 72 percent of these coal imports come from Indonesia, 13 percent from Australia, and 12 percent from South Africa.[56] Malaysia has steadily increased the proportion of its electricity generated from coal, from less than 1 percent in 1980 to 30 percent in 2010.[57] Since coal is the second largest energy source for electricity production in Malaysia, this reliance on imported coal is significant. While Malaysia does have domestic coal deposits, most of these are deep in the interior of the states of Sabah and Sarawak and are of inferior quality to imported coal.[58]

56. "Malaysia's coal imports double in a year," *Hellenic Shipping News*, April 4, 2011, http://www.hellenicshippingnews.com/News.aspx?ElementId=60b2c44a-3cdb-44c4-bd5a-d448e78e912e.

57. EIU, "Malaysia: Energy Report," June 22, 2011, http://www.eiu.com/index.asp?layout=ib3Article&article_id=1198265104&pubtypeid=1142462499&country_id=1600000160&category_id=775133077.

58. IEA, "Chapter 16: ASEAN-4 Country Profiles," 609.

Figure 7: Coal Net Exports and Imports in Malaysia



Source: EIA, *International Energy Statistics*.

Renewable energy currently forms a relatively small part of power generation with the majority coming from hydropower and a small amount from solar and wind. Hydropower accounts for 9.4 percent of Malaysia's electricity production and the government has expressed a desire since 2001 to promote the use of renewable energy as part of its national energy strategy.[59] However, a lack of political will and urgency has delayed implementation.

Demand Picture

In 2008, Malaysia produced 3.798 quadrillion btu of total primary energy and consumed only 2.612 quadrillion btu.[60] If the economy continues to grow at an annual rate of 5.5–6 percent over the next few years as is projected, however, energy demand in Malaysia is set to increase substantially: the country's energy production will need to increase by 80 percent over the next 10 years.[61]

As of October 2010, Malaysia was an energy self-sufficient country and a net energy exporter. Oil and natural gas exports accounted for about 30 percent of its total exports in 2010.[62] However, because domestic energy demand has escalated sharply in recent years, Malaysia is expected to become a net oil importer after 2015.[63]

59. East Asia Summit/Energy Cooperation Task Force, "Malaysia," *Bio-fuel Database in East Asia*, http://www.asiabiomass.jp/biofuelDB/malaysia/contents003.htm, accessed October 2012.

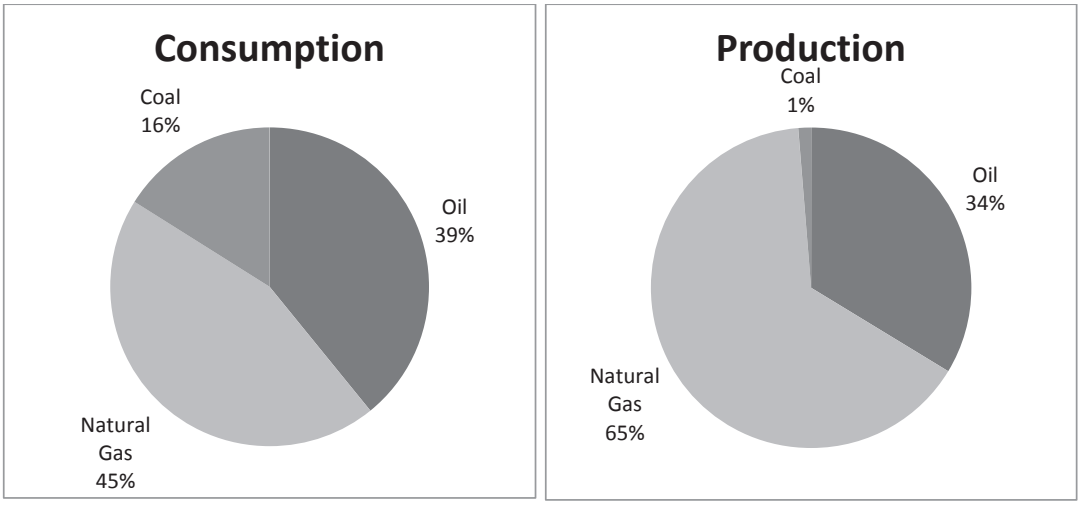
60. EIA, "Malaysia."

61. EIU, "Malaysia."

62. Malaysia Ministry of Trade and Industry, "Exports by major products, 2010," October 2011, http://www.miti.gov.my/cms/content.jsp?id=com.tms.cms.article.Article_73bbf8fc-c0a81573-10311031-bf35aba5.

63. IEA, "ASEAN-4 Country Profiles," 581.

Figure 8: Energy Consumption and Production in Malaysia



Source: EIA, *International Energy Statistics*.

Net electricity demand in 2009 was estimated to be 95.02 bkWh. Net generation was roughly 99.11 bkWh in 2009.[64] The largest share of energy and electricity demand in Malaysia comes from industry and transportation. Residential and commercial consumption accounts for only 17.6 percent of the total.[65]

Policies Shaping Malaysia's Potential Trajectory

Since the early 2000s, Malaysia has launched some policy initiatives to protect the environment and promote green technology and, in 2009, it announced a voluntary plan to reduce the country's carbon footprint by as much as 40 percent by 2020.[66] However, its increasing reliance on coal imports may impede such initiatives.

Nevertheless, to cut carbon emissions, Malaysia has made policy changes in three main areas: energy efficiency, renewable energy, and solid-waste management systems. The government created a FiT and other incentives for investments in renewable energy.[67] Malaysia's three leading green energy sources are natural gas, hydropower, and non-hydro renewables. The country began to emphasize a green energy future in the eighth Malaysia Plan (2001–2005), which identified renewable energy as the "fifth fuel" in the energy supply mix.[68]

To increase oil production and remain a net energy exporter in the face of growing domestic demand, Prime Minister Najib Razak implemented a series of new energy policies in 2010. These

64. EIA, "Malaysia."

65. EIU, "Malaysia."

66. "Malaysia to reduce carbon footprint by 40% by 2020," *Bernama*, April 9, 2010, http://www.mysinchew.com/node/37489.

67. Economic Planning Unit, Department of the Prime Minister of Malaysia, *Tenth Malaysia Plan 2011–2015,* 2010, http://www.pmo.gov.my/dokumenattached/RMK/RMK10_Eds.pdf.

68. Malaysia Ministry of Energy, "Renewable Energy Development in Malaysia," conference presentation, April 26, 2010, http://www.egnret.ewg.apec.org/meetings/egnret34/Malaysia%20RE%20Development%20by%20Ministry%20of%20Energy.pdf.

included providing capital allowances and a reduction of the tax rate from 38 percent to 25 percent for energy companies that explore deeper and less profitable oil wells.[69] In addition, oil produced and exported from such fields is exempt from normal export duties. To meet domestic demand for petroleum products and reduce reliance on Singapore for oil refining, the Malaysian government has also invested in increasing domestic refining capacity in recent years.[70]

The government made a major shift toward natural gas in the eighth Malaysia Plan, which announced a move away from oil to gas for electricity generation. However, the government has also pushed to export much of its gas, and given that gas subsidies are set to be cut, gas prices and energy prices will rise. Fuel subsidies currently reduce the cost of electricity paid by the consumer by about 74 percent.[71] Under the tenth Malaysia Plan (2011–2015), the government plans to slash electricity subsidies and adopt market-based energy pricing by 2015 in an effort to improve energy efficiency and discourage waste.[72] Gas prices will be revised every six months to move gradually toward market prices and will adjust the price of electricity accordingly.[73]

Nuclear energy faced much political opposition from the 1980s to the early 2000s, but this began to change after about 2003. The government devised a national nuclear policy in 2010 and created the Malaysian Nuclear Power Corporation to facilitate the construction of nuclear power plants.[74] Malaysia paused its nuclear program after Japan's Fukushima disaster, but Malaysia's anti-nuclear sentiment is also tied to anxieties surrounding an episode of environmental and radioactive contamination that arose during the refining rare earth minerals in the early 1990s.[75]

Overall, Malaysia's policy target is to have over 2,000 MW of electricity produced from renewable energy sources by 2020, including a third from solar and another third from biomass by 2030. The tenth Malaysia Plan included calls for increased efforts to develop alternative energy sources such as solar, wind, and biofuels and to explore the possible use of nuclear energy. The new Renewable Energy Plan includes long-term renewable energy targets to 2050 and the introduction of a FiT for renewable electricity. The FiT program is comprehensive and differentiates tariffs by technology. It adds 2 percent to the average electricity price, but government rules prevent this increase in electricity cost from being passed on to low-income consumers.

The government has also moved to address other policies to promote renewables, including legally obligating utilities to purchase renewable electricity, streamlining local procedures for producers, ensuring that implementation includes constant monitoring and progress reporting, and

69. Ellen Ng, "Malaysia plans tax breaks for oil, new investments," Associated Press, November 30, 2010, http://www.businessweek.com/ap/financialnews/D9JQCAVO0.htm.

70. IEA, "ASEAN-4 Country Profiles," 607.

71. Francis Xavier Jacobs, "Energy Efficiency Initiatives in Malaysia," presentation for the EU Expertise Transfer Sessions (ETS) in Green Technology in Kuala Lumpur, June 2, 2010, 45, http://eumcci.com/component/docman/doc_download/74-fransis; Economic Policy Unit, Department of the Prime Minister of Malaysia, "Energy Pricing and Manufacturing Competitiveness in Malaysia," conference presentation, September 19, 2011, 3, http://www.highroadstrategies.com/downloads/HRS-Malaysia-Presentation.pdf.

72. Economic Planning Unit, *Tenth Malaysia Plan.*

73. Ibid.

74. K. Pragalath, "'We don't want to go nuclear,'" *Free Malaysia Today,* May 9, 2012, http://www.freemalaysiatoday.com/category/nation/2012/05/09/%E2%80%98we-don%E2%80%99t-want-to-go-nuclear%E2%80%99/.

75. Md. Nasrudin, Md. Akhir, and Aurangzaib Alamgir, "The sixth fuel: Nuclear energy for Malaysia," *Bulletin of the Atomic Scientists*, May 31, 2011, http://www.thebulletin.org/web-edition/op-eds/the-sixth-fuel-nuclear-energy-malaysia.

crucially, installing a renewable energy fund manager. Companies that use energy from renewable biomass, mini-hydroelectric plants, or solar power are eligible for "Pioneer Status," which grants a tax exemption of 100 percent on statutory income for ten years or an investment tax allowance of 100 percent on qualifying capital expenditures incurred within five years. Companies can also obtain higher exemptions or allowances if their activities are in certain "promoted areas."

The government has also implemented a Small Renewable Energy Power Program (SREP) through which small producers that generate power from renewable sources can access the national grid. SREP developers can sell renewable power from biomass, biogas, municipal solid waste, solar, small hydropower, and wind to utilities through the Renewable Energy Power Purchase Agreement, which gives plants a license to sell to the national grid system for a period of up to 21 years. In addition, SREP producers get a ten-year tax holiday.

One major challenge renewables face is that the burden of costs to access the national grid rests with the producers. This can result in unprofitably high costs for sources located far from the current grid. Renewable energy plants also enjoy no preferential access to the grid.[76]

Philippines

Resource Wealth

The Philippines has relatively limited indigenous fossil energy reserves and it is estimated that by the end of 2012 the country will import about 45 percent of its energy supply, primarily in the form of coal and petroleum products.[77] The Philippines is, however, well endowed with renewable resources; its solar, wind, biomass, and ocean resources have an estimated theoretical power generation potential of more than 250,000 MW.[78]

The Philippines' maturing oil production has meant that it must import a significant amount of oil to meet demand. The country imported 33.9 percent of the oil it used in 2010[79] and about 85 percent of its imports came from the Middle East (Saudi Arabia, United Arab Emirates, Iraq, Qatar, and Oman).[80] The Philippines rarely imports gas because it has sufficient domestic supplies to meet its meager demand, which is used almost exclusively for power generation.[81] The country's electricity is currently supplied primarily by natural gas (32 percent in 2008), followed by coal-fired power plants (26 percent).[82]

76. Rose, "Renewable Energy," 60.
77. APERC, *APEC Energy Overview 2010*, 141.
78. Ibid.
79. Philippines Department of Energy, "The Philippines, 2010 Energy Sector Accomplishment Report," October 19, 2011, 2, http://www.doe.gov.ph/EnergyAccReport/2010%20-%20Energy%20Sector%20Accomplishment%20Report.pdf.
80. Philippine Department of Energy, "Philippine Energy Situational Report," 2009, http://www.doe.gov.ph/cc/AMR%20Philippine%20Energy%20Situation.pdf.
81. Philippine Department of Energy, "2010 Energy Sector," 3; Shell Oil, "Oil and Gas Potential."
82. APERC, *APEC Energy Overview 2010*, 142.

Table 3. Resource Wealth of the Philippines

Resource	Consumption (2010)	Production (2010)	Proven Reserves	Export	Import
Oil(tb/d)[a]	310 tb/d	33.112 tb/d		29.118 tb/d (Crude Oil & RPP[b], 2008)	337.244 tb/d (Crude Oil & RPP, 2008)
Natural Gas	0.101 tcf[c]	0.121 tcf	3.48 tcf	0	0
Coal	18,193.7 thousand short tons	7,165.0 thousand short tons	348.3 billion short tons	1,420.9 thousand short tons	12,449.5 thousand short tons
Nuclear Energy	N/A				
	Net Electricity Consumption	**Net Electricity Production**			
Non-hydro renewables		9.5 bkWh[d]			
Hydroelectricity		7.7 bKWh			
Total Renewables	17.2 bkWh	17.2 bKWh			

Source: EIA, *International Energy Statistics*.

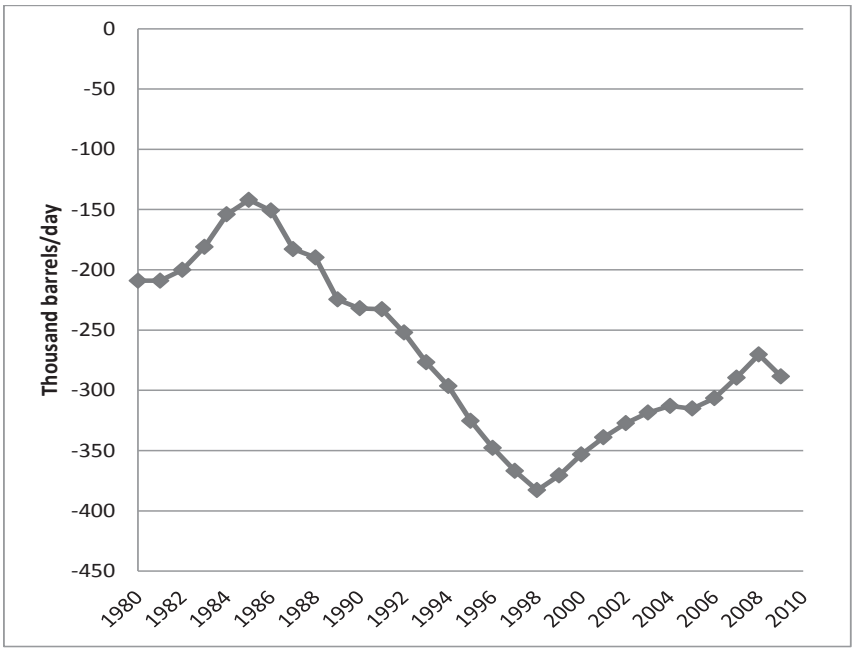
a. Thousand barrels per day. b. Refined petroleum products. c. Trillion cubic feet. d. 2000 lbs.
e. Billion kilowatt hours.

The Philippines has limited domestic coal reserves and must import 75.4 percent of its domestic coal requirements.[83] Imported coal constituted 9.1 percent of the country's overall energy supply in 2009, but the Philippines anticipates that coal will play a pivotal role in its future and is looking to offset its dependence on imports by increasing indigenous coal production.[84]

The Philippines has significant hydropower potential and is the second largest producer of geothermal power in the world behind the United States. Its untapped geothermal resource potential is estimated at 2,600 MW.[85] Geothermal energy provided 15.1 percent of the total electricity-generation mix in 2010.[86] Biomass meets a large part of primary energy needs, though not electricity generation. Geothermal, hydro, biomass, and wind power all have the significant potential to be developed further.[87] The Philippines' energy-related carbon dioxide (CO_2) emissions were the lowest among Southeast Asian countries included in the World Bank's 2010 World Development Report.[88]

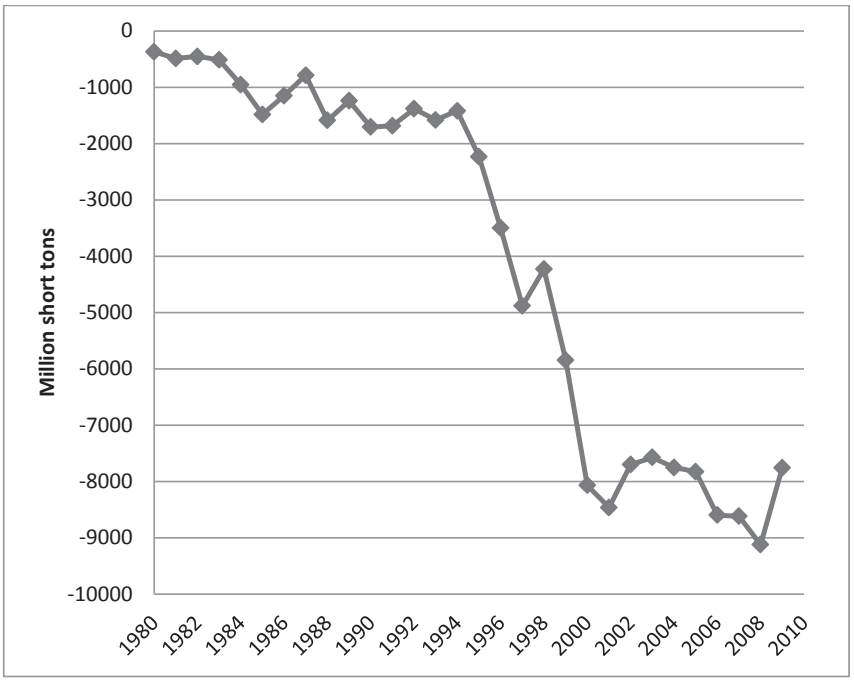
83. Ibid.
84. Shell Oil, "Oil and Gas Potential."
85. APERC, *APEC Energy Overview 2010*, 142.
86. Philippine Department of Energy, "2010 Energy Sector," 4.
87. OECD and IEA, *Deploying Renewable Energy*.
88. World Bank, "World Development Report 2010: Development and Climate Change," http://siteresources.worldbank.org/INTWDR2010/Resources/5287678-1226014527953/WDR10-Full-Text.pdf.

Figure 9: Petroleum Net Exports and Imports in the Philippines



Source: EIA, *International Energy Statistics*.

Figure 10: Coal Net Exports and Imports in the Philippines



Source: EIA, *International Energy Statistics*.

The South China Sea, which the Philippines borders, has significant possible reserves of oil and natural gas. But investment in the exploration and production of these reserves is difficult because of the overlapping claims by China, Taiwan, Brunei Darussalam, Malaysia, the Philippines, and Vietnam. The U.S. Geological Survey estimates that the nine petroleum systems that are wholly or partially claimed by more than one claimant in the South China Sea hold nearly 64 trillion cubic feet (tcf) of natural gas and nearly 5 billion barrels of oil.[89]

Despite protests and challenges from China, the Philippines has recently begun to explore for oil and natural gas in the South China Sea. In February 2010 Manila awarded UK-based Forum Energy the production-sharing contract for block SC 72, near the disputed Reed Bank in the Spratly Islands, a move China immediately protested. A Chinese naval vessel nearly rammed the company's exploration vessel operating in the area in March 2011. Nevertheless, explorations continued, and in April 2012 the Philippine oil and natural gas exploration firm Philex announced that block SC 72 holds 4.67 tcf of natural gas.[90] If Philex and Forum Energy could begin producing natural gas from this block, the Philippines could significantly increase its natural gas production. However, a stable investment environment would require resolution of competing territorial claims in the South China Sea or an agreement with China to exploit its resources jointly.

Demand Picture

Despite being or perhaps because it is a net energy importer, the Philippines consumes less energy than any other large Southeast Asian country. In 2008, it produced just 0.535 quadrillion btu of total primary energy and consumed 1.3 quadrillion btu.[91] Between 2009 and 2010, the percent change in its primary energy consumption was only 1.3 percent.

The declining importance of oil in the Philippines' energy-demand picture is reflected in the increased use of coal and natural gas. Natural gas has been the main source of electricity since 2005.[92] Local coal production is projected to rise by 250 percent by 2030. A third of electricity generation comes from renewables and the government's target is to increase this to 40 percent by 2020.[93] Renewables are expected to expand to a capacity of 8,637 MW by 2030. Hydropower will account for 87 percent of this production, with geothermal energy also playing a role.

Unfortunately, the country's electricity supply has stagnated because of a lack of investment in power plants. In 2009, the Philippines generated slightly more electricity than it consumed (58.8 bkWh generated, 51.3 consumed).[94] However, 9.5 million people do not have access to electricity, so there is a significant need for investment in electricity generation to keep up with growing demand.[95]

89. United States Geological Survey, "Assessment of Undiscovered Oil and Gas Resources of Southeast Asia, 2010," *World Petroleum Resources Assessment Project*, June 10, 2010, http://pubs.usgs.gov/fs/2010/3015/pdf/FS10-3015.pdf. (Values represent a 95 percent chance of at least the amount tabulated.)

90. "With bigger reserves than Malampaya, Recto Bank drilling a go," *Rappler*, April 25, 2012, http://www.rappler.com/business/4332-drilling-at-recto-bank-is-a-go,-says-philex.

91. EIA, *International Energy Statistics.*

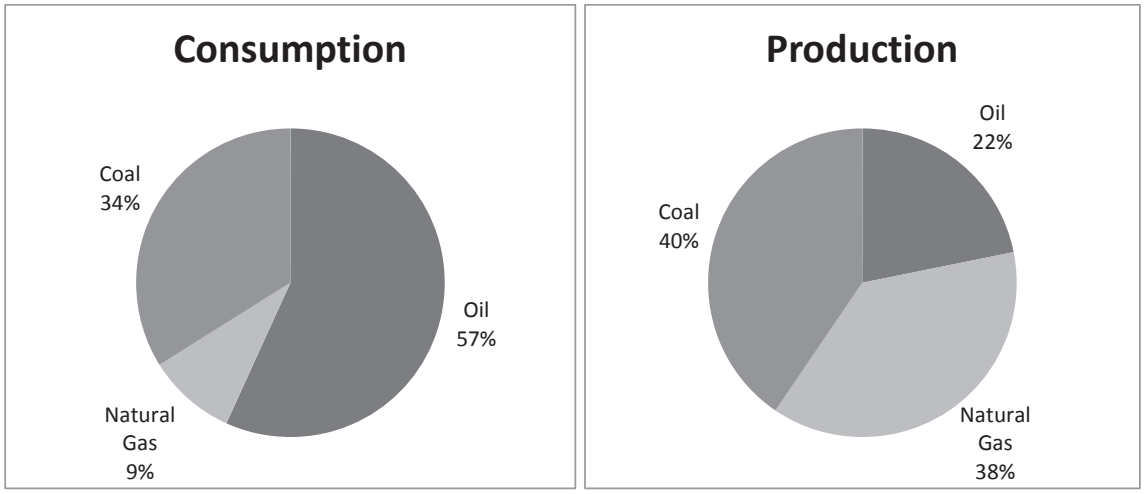
92. EIU, "Country Report: Philippines," December 2011.

93. Ren21, "Renewables 2011."

94. EIA, *International Energy Statistics.*

95. IEA, *Electricity Access Database*, http://www.worldenergyoutlook.org/resources/energydevelopment/accesstoelectricity/.

Figure 11: Energy Consumption and Production in the Philippines



Source: EIA, *International Energy Statistics*.

Policies Shaping the Philippines' Potential Trajectory

The country's rapidly growing demand for energy has prompted the government to look for long-term policies to ensure stability in the coming decades.[96] The three pillars of the Philippine Energy Plan are to ensure energy security, to pursue effective implementation of energy sector reforms, and to implement social mobilization and cross-sector monitoring mechanisms.

Under the Philippine Energy Plan of 2009, the government is targeting a 10 percent reduction in energy demand by the commercial, residential, industrial, transport, and agriculture sectors by 2030. To ensure greater energy security, the government has sought to accelerate the exploration and development of domestic fossil fuels by utilizing the Philippine Energy Contracting Round in June 2011. This process allows companies to bid on the right to explore and develop hydrocarbons in the Philippines, which the government hopes will reduce the country's reliance on imported energy.[97]

Manila has also sought to intensify the development and utilization of renewable and environmentally friendly alternative energy resources and technology by implementing the Renewable Energy Act of 2008. This law provides various fiscal incentives for investment in renewables, including a seven-year tax holiday, tax exemption for carbon credits generated from renewable energy sources, and a 10 percent corporate income tax instead of the standard 30 percent.

Non-fiscal incentives include net metering, granting all renewable-energy suppliers priority in connecting and supplying to the grid and dispatching this power to customers, providing end-users the option to choose renewable energy as their electricity source and contract directly with a renewable energy generator, establishing renewable portfolio standards that require all power generators and distributors to either produce or source 10 percent of their electricity from renew-

96. Philippine Department of Energy, "2009 PEP Highlights," http://www.doe.gov.ph/PEP/default.htm.

97. Deloitte, "Fourth Philippine Energy Contracting Round (PECR 4) 2011," http://www.psg.deloitte.com/NewsLicensingRounds_PH_110511.asp.

ables by 2020, developing a FiT system broken out by type of renewable, and creating a renewable energy market.[98] Renewable-energy producers also enjoy duty-free importation of machinery and equipment, reduced property taxes, no value-added tax on sales of renewable energy, a tax exemption on the sale of carbon credits, a tax credit for domestically sourced capital equipment and services, and easy access to backing from important government institutions such as import–export agencies and development banks.

Other recent measures confirm that Manila is committed to greening the country's power supply and bolstering the renewable energy sector by providing significant incentives to encourage transparency, competition, and private investment into the sector. The government's 2009–2030 Philippine Energy Plan aims to double the country's renewable energy capacity from a 2008 baseline, adding 4.5 gigawatts (GW) by 2013 and totalling 10.6 GW by 2030. It also calls for increasing the production of transport biodiesel to 497.6 million gallons annually by 2030.[99]

Thailand

Resource Wealth

Thailand has limited domestic resources of natural gas, coal (lignite grade), and biomass. Because of this, Thailand is dependent on energy imports to meet its growing energy demand. In 2009, net energy imports accounted for 55 percent of its energy supply. [100]

At the end of 2010, Thailand's proven onshore and offshore hydrocarbon reserves included 245 million barrels of natural gas condensate, natural gas, and lignite.[101] Natural gas dominates the total energy reserves (47 percent), followed by lignite (39 percent). Crude oil and natural gas condensate equal 8 and 6 percent, respectively.[102]

Compared to other nations in Southeast Asia, Thailand has limited oil reserves and imports a large portion of its needs. Thailand has several refineries that refine its crude oil imports.

98. Renewable Energy and Energy Efficiency Partnership, "Philippines: Renewable energy revolutionaries," May 25, 2009, http://www.reeep.org/index.php?assetType=news&assetId=254;
IEA, "ASEAN-4 Country Profiles," 612.

99. Ren21, *Renewables 2011*; Philippine Department of Energy, "2009 PEP Highlights."

100. APERC, *APEC Energy Overview 2011* (Singapore: Asia-Pacific Economic Cooperation (APEC) Secretariat, 2011), 209, http://publications.apec.org/publication-detail.php?pub_id=1291.

101. Energy Data and Modeling Center, Institute of Energy Economics, Japan, *Data Bank*, http://www.ieej.or.jp/edmc/index-e.html.

102. The Energy Policy and Planning Office (Thailand), "Table 1.3-1: Energy Reserves," *Energy Statistics*, December 2010, http://www.eppo.go.th/info/stat/T01_03_01.xls.

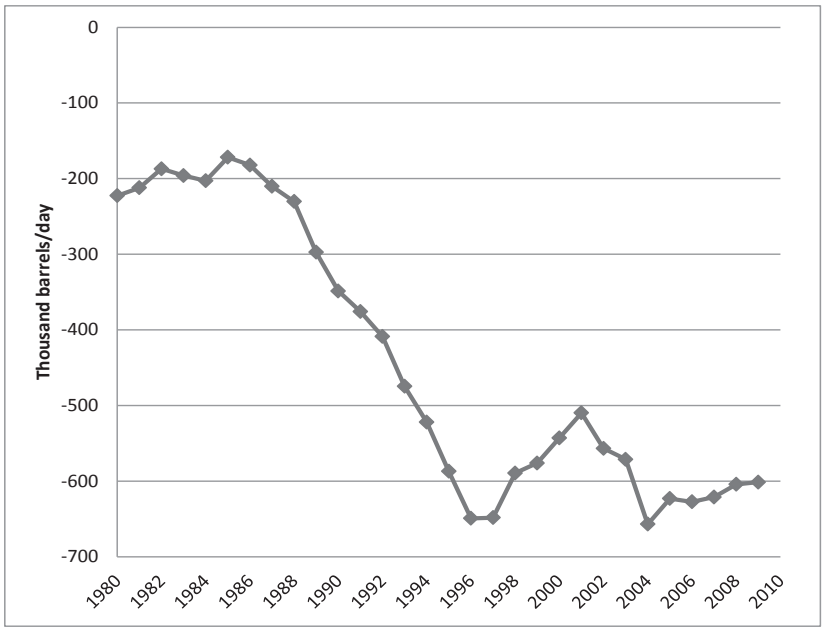
Table 4. Resource Wealth of Thailand

Resource	Consumption (2010)	Production (2010)	Proven Reserves (2010)	Export	Import
Oil	960.2 tb/d[a]	406.8 tb/d	0. 4 tmb[b]	236.1 tb/d (Crude Oil & RPP[c], 2008)	803.9 tb/d (Crude Oil & RPPc, 2008)
Natural Gas	1.6 tcf[d]	1.4 tcf	11.0 tcf	0	0.3 tcf
Coal	38,948 thousand short tons[e]	20,346.5 thousand short tons	1365.8 million short tons	0	18,601.5 thousand short tons
Nuclear Energy	N/A				
	Net Electricity Consumption	**Net Electricity Generation**			
Non-Hydro Renewables		6.0 bkWh[f]			
Hydroelectricity		5.3 bkWh			
Total Renewable	11.3 bkWh	11.3 bkWh			

Source: EIA, *International Energy Statistics.*

a. Thousand barrels per day.
b. Thousand million barrels.
c. Refined petroleum products.
d. Trillion cubic feet.
e. 2000 lbs.
f. Billion kilowatt hours.

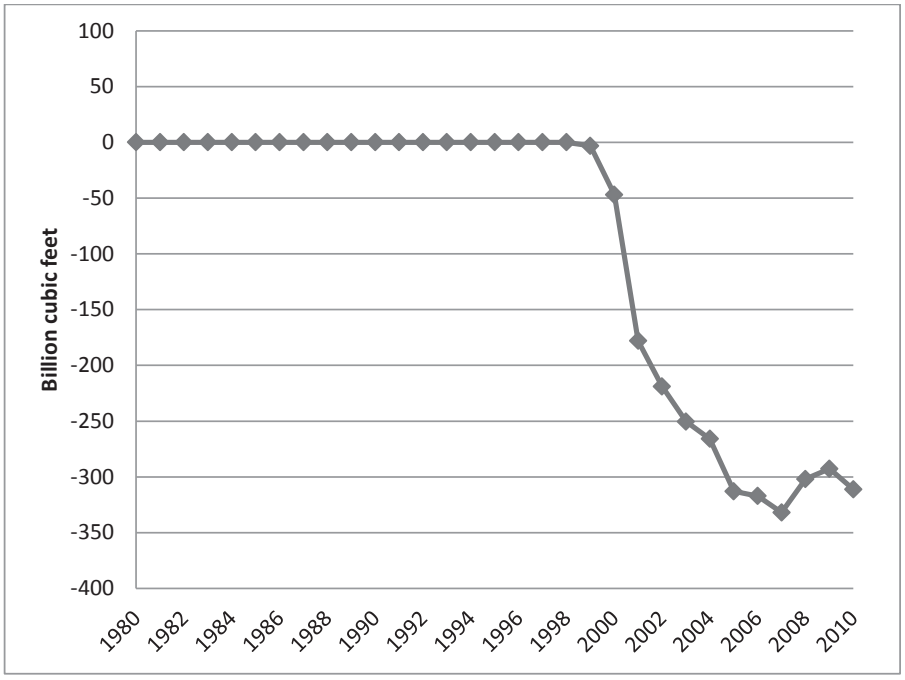
Figure 12: Petroleum Net Exports and Imports in Thailand



Source: EIA, *International Energy Statistics*.

Natural gas, which currently makes up 68 percent of its primary energy mix, has remained the main source of Thailand's indigenous supply.[103] Not surprisingly, there has been a marked shift in energy use from oil to natural gas in recent years. As demand for natural gas increases, however, Thailand will have to rely more on imported natural gas, whether piped or liquefied.[104]

Figure 13: Natural Gas Net Exports and Imports in Thailand

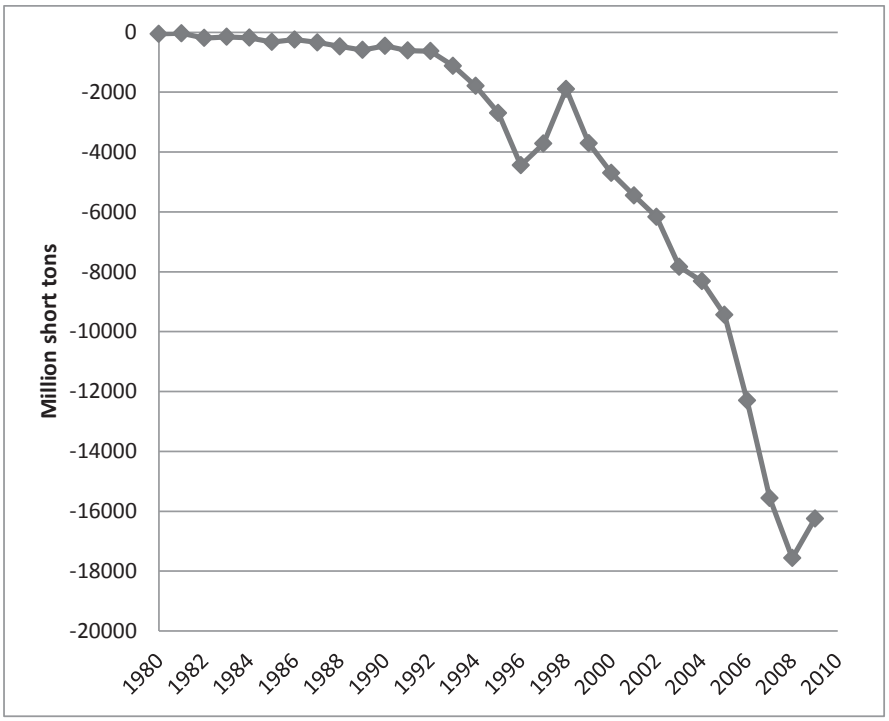


Source: EIA, *International Energy Statistics*.

Thailand significantly increased coal and lignite use between 2005 and 2010. The country's primary electricity production sources are hydropower and lignite coal. Because its coal reserves consist of low-caloric lignite coal, it must import coal for electricity generation and its industrial sector.[105] A majority of its imports come from Indonesia, Australia, and China.[106] The total indigenous electricity production in 2010 was the equivalent of 124,319 barrels of oil per day, down quite significantly from 2005.[107]

103. Shell Oil, "Oil and Gas Potential."
104. Ibid.
105. Ibid.
106. Shayne Heffernan, "Jakarta Coal Companies are Undervalued Berau, Banpu, Bumi," *Live Trading News*, May 1, 2012, http://www.livetradingnews.com/jakarta-coal-companies-are-undervalued-berau-banpu-bumi-54202.htm.
107. Energy Policy and Planning Office (Thailand), "Table 1.1-1: Production, Consumption and Import (net) of Commercial Primary Energy," *Energy Statistics*, http://www.eppo.go.th/info/1summary_stat.htm.

Figure 14: Coal Net Exports and Imports in Thailand



Source: EIA, *International Energy Statistics*.

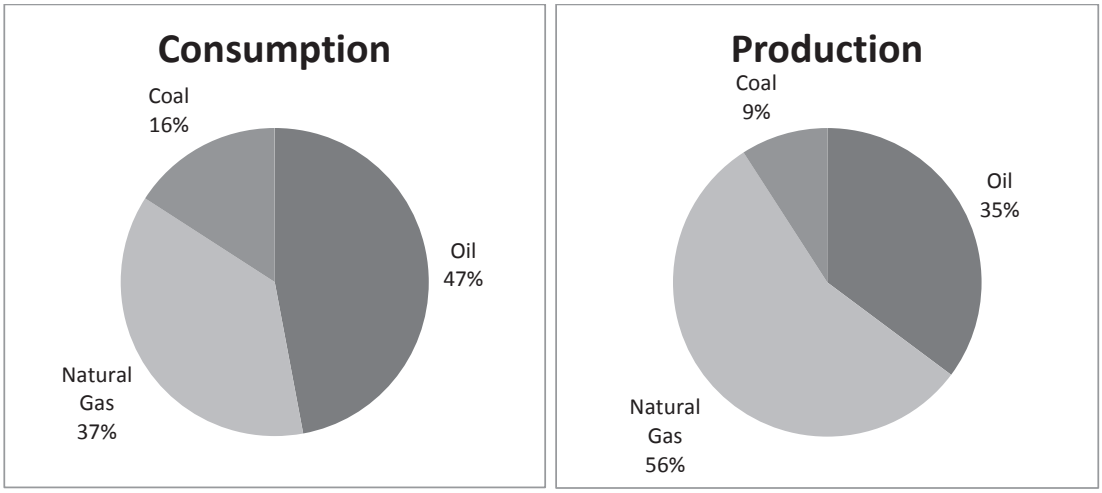
Hydropower is a source of electricity, but it remains a relatively small share of Thailand's energy mix, especially considering its position as a riparian nation in a relatively upstream position in the Lower Mekong River Basin. Its hydroelectric and imported electrical power consumption made up 2 percent of its supply in 2010.[108] Thailand has been importing power from hydropower plants in Laos since 1997, a trend that is expected to continue, and more recently it has begun importing natural gas from Myanmar to fire electricity plants near Bangkok.

Demand Picture

In 2008, Thailand produced 2.1 quadrillion btu of total primary energy and consumed 4.0 quadrillion btu.[109]

108. The Energy Policy and Planning Office (Thailand), "Production, Consumption and Import."
109. EIA, *International Energy Statistics.*

Figure 15: Energy Consumption and Production in Thailand



Source: EIA, *International Energy Statistics*.

In 2010, natural gas was the largest source of energy in Thailand, accounting for 44 percent of total energy consumption. Second were petroleum products (36 percent), around 23 percent of which came from domestically available crude oil sources,[110] followed by coal (12 percent), and lignite (5.5 percent).[111]

Natural gas is used mainly for power generation and fuels Thailand's manufacturing-based economy.[112] The promotion of the use of natural gas in the transportation sector to replace fuel oil, diesel, and gasoline, combined with an increased price for oil, means that Thailand will be increasingly dependent on imported gas, both piped gas and LNG.[113] The government is seeking to diversify and reduce gas to only 40 percent of the energy mix, replacing it with clean coal, nuclear, and imported electricity.[114] Thailand currently has no nuclear facilities and its imports of coal and other resources are essential. The country plans to replace 25 percent of its total energy mix with renewables by 2030.[115]

In 2009, Thailand generated 139.8 bkWh of electricity and consumed 131.9 bkWh, but demand is expected to grow. Based on a February 2010 power demand forecast, the Ministry of Energy's Power Development Plan 2010–2030 predicted that the peak demand in 2030 will be approximately 52,890 MW, 2.4 times higher than it was in 2009. [116]

110. Crude oil production 2010 / petroleum products consumption 2010 = 153,174/652,464 = 0.234762378

111. The Energy Policy and Planning Office (Thailand), "Production, Consumption and Import."

112. Shell Oil, "Oil and Gas Potential."

113. Ibid.

114. Ibid.

115. Ibid.

116. Electricity Generating Authority of Thailand, "Summary of Thailand Power Development Plan 2010–2030," April 2010, 18, http://www.egat.co.th/en/images/stories/pdf/Report%20PDP2010-Apr2010_English.pdf.

Policies Shaping Thailand's Potential Trajectory

Recognizing its increasing dependence on natural gas, Thailand has been actively pursuing energy diversification. Since 2008, the focus of Thailand's energy policy has been to maintain energy prices; intensify energy development, which includes alternative energies to achieve adequate and secure energy supply; push for energy efficiency and preservation in household, industrial, and transportation sectors; and encourage environmentally friendly energy procurement and consumption.[117]

Reducing Thailand's dependence on natural gas and imported oil and promoting alternative energy have long been a focus of policymakers. Bangkok in 2007 introduced tariff incentives for renewable energies based on type. In addition to these tariffs, the government has enacted incentives for renewable energy including a tax holiday scheme, standard power purchase agreements for renewable energy producers, preferential arrangements for small generators, and information support.

Government policy further encouraged increased use of renewable energy in the 15-year Renewable Energy Development Plan launched in 2008. The plan targets an increase in renewable energy's share of the country's energy demand to 19.1 percent by 2016 and 20.3 percent, or 5,600 MW, by 2022. The plan also takes a number of steps to reduce carbon emissions, aiming to achieve a 20 percent reduction by 2022. In addition, Thailand is aiming to become the biofuel regional hub of ASEAN.[118] These efforts are making Thailand a leader in renewable energy efforts in Southeast Asia and will allow the country to reduce its dependence on fossil fuels.

Thailand's policy of purchasing hydropower from and investing in hydroelectric power projects in neighboring countries has implications beyond its borders, particularly on the environment. Thailand has signed three power purchase agreements to import a total of 1,737 MW from Laos: the Nam Theun 2 Project (920 MW), Nam Ngum 2 Project (597 MW), and Theun-Hinboun Expansion Project (220 MW).[119] The government has also instituted a Transmission System Development Plan that aims to increase transmission line capabilities for a more reliable and durable power supply system to receive electric power from domestic independent power projects as well as from neighboring countries.

Bangkok has recognized that it must do more to develop its domestic power generation capacity and therefore mapped out the Power Development Plan as a template for its energy sector until 2030. The plan is a framework for power plant construction and investment that aims to increase capacity from 29,212 MW in 2009 to 44,842 MW by 2020 and 65,547 MW by 2030.[120] Nonetheless, several challenges remain. First, Thailand's heated political environment in recent years has the potential to disrupt the government's energy and environment plans. Second, Thailand is still heavily dependent on natural gas, despite the government's attempts to diversify to alternative energies, particularly biofuel. Third, the country's fuel subsidies place a heavy burden on public finances and threaten fiscal stability. The government utilized a price cap on diesel in mid-2008 to

117. Association of the Electricity Supply Industry of East Asia and the Western Pacific, "Member Country Profile–Thailand," *AESIEAWP Goldbook*, 2011, 208.

118. "Thailand as biofuel regional hub," *The Nation*, September 22, 2011, http://www.nationmultimedia.com/2011/09/22/business/Thailand-as-biofuel-regional-hub-30165877.html.

119. AESIEAWP, "Thailand," 212.

120. Ibid., 210.

help alleviate the impact from the global price increase. More recently, it reintroduced diesel subsidies in December 2010, under which it set the diesel price at about $3.79 per gallon.[121]

Vietnam

Resource Wealth

Vietnam is an energy-rich country and has substantial oil, coal, natural gas, hydropower, and renewable energy potential. Natural gas and crude are found mainly offshore, and its gas reserves are considered more promising than its oil reserves.[122]

Table 5. Resource Wealth of Vietnam

Resource	Consumption (2010)	Production (2010)	Proven Reserves (2010)	Export	Import
Oil	320 tb/d[a]	343.2 tb/d	4.4 tmb[b]	296.1 tb/d (Crude Oil & RPP[c], 2008)	296.5 tb/d (Crude Oil & RPP, 2008)
Natural Gas	0.3 tcf[d]	0.3 tcf[e]	6.8 tcf	0	0
Coal	25,719.1 thousand short tons[f]	49,232.5 thousand short tons	165.3 million short tons	24,676.3 thousand short tons	1,162.9 thousand short tons
Nuclear Energy	N/A				
	Net Electricity Consumption	**Net Electricity Generation**			
Non-Hydro Renewables		0.05 bkWh[g]			
Hydroelectricity		27.4 bkWh			
Total Renewables	27.4 bkWh	27.4 bKWh			

Source: EIA, International Energy Statistics.

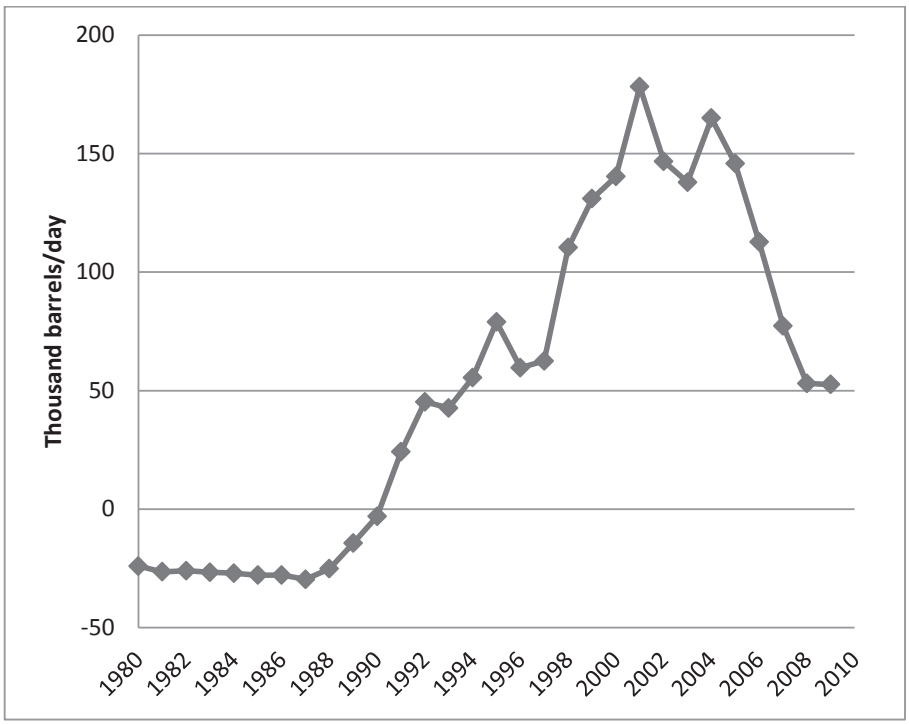
a. Thousand barrels per day. b. Thousand million barrels. c. Refined petroleum products.
e. Trillion cubic feet. f. 2000 lbs. g. Billion kilowatt hours.

Despite a surplus of domestically produced crude oil, the country has little refining capacity. Vietnam currently exports most of its crude oil to Singapore and Japan for refining and then reimports the refined petroleum for domestic use.

121. "Thailand to continue fuel subsidy with oil tax cut," *Reuters*, April 18, 2011, http://www.reuters.com/article/2011/04/18/thailand-economy-subsidy-idUSL3E7FI0JS20110418.

122. APERC, *APEC Energy Overview 2010*, 215.

Figure 16: Petroleum Net Exports and Imports in Vietnam



Source: EIA, *International Energy Statistics*.

Vietnam is endowed with ample coal reserves, mainly in the northern part of the country.[123] This large supply has allowed Vietnam to remain a net coal exporter, particularly to China. But coal production has remained mostly flat in recent years, failing to keep up with demand. While production still far outpaces domestic consumption, this trend is expected to reverse by 2020.[124]

Despite Vietnam's abundance of fossil fuel resources, traditional biomass still dominates household consumption.[125] Low-income households in rural areas rely primarily on wood and agricultural waste for cooking. Because Vietnam is a lower riparian country on the Mekong River, it is simultaneously worried about the consequences of the development of hydropower by upstream countries and interested in harnessing its own hydropower potential. Hydropower is expected to grow substantially and constitute a majority share of Vietnam's renewable energy production. According the Ministry of Industry and Trade, the country has the potential to generate 31,000 MW of electricity from hydropower sources, though these will likely be reduced to 18,000–20,000 MW when socioeconomic and environmental costs are considered.[126] If other countries develop upstream hydropower on the Mekong River, however, Vietnam will be vulnerable to negative changes resulting from the reduced flow of water in the river.[127]

123. Vietnam Ministry of Industry and Trade (MoIT), "Overview of Energy Industry of Vietnam: Roundtable for Viet Nam Investment Promoting," September 30, 2010, 4.

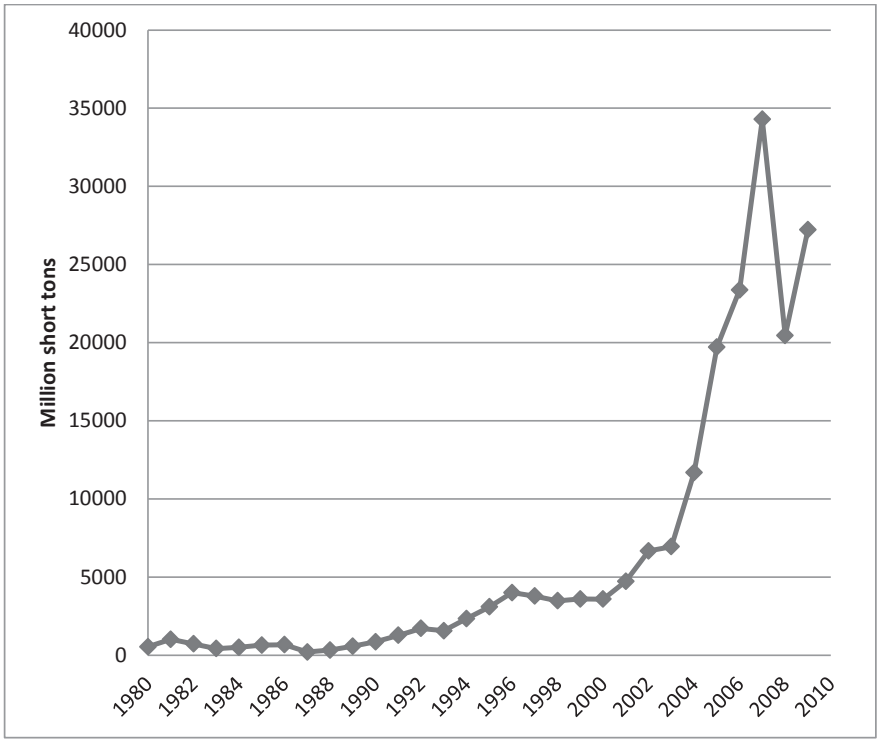
124. MoIT, "Overview of Energy Industry," 24.

125. Shell Oil, "Oil and Gas Potential."

126. MoIT, "Overview of Energy Industry," 4.

127. Dang Kieu Nhan, Nguyen Van Be, and Nguyen Hieu Trung, "Water Use and Competition in the Mekong Delta, Vietnam," *Challenges to Sustainable Development in the Mekong Delta:*

Figure 17: Coal Net Exports and Imports in Vietnam



Source: EIA, *International Energy Statistics*.

Biomass and hydropower dominate Vietnam's renewable energy sources, but the country also has the potential to utilize solar and wind power. Vietnam's solar generation is estimated at 43.9 billion tons of oil equivalent per year, and the country has more than 3,000 kilometers of coastline and other areas well suited for wind generation. Neither of these sources has been tapped in any significant way.[128]

Similar to the Philippines, Vietnam sits astride the South China Sea, which has significant expected oil and natural gas reserves. Vietnam has granted exploration and exploitation rights to international oil and gas companies in what it considers its exclusive economic zone. These include blocks 117, 118, and 119, held by ExxonMobil; block 128, held by ONGC Videsh, India's state-owned exploration company; and block 06-1, in which BP last year divested its interest to a joint venture with Russia's TNK. Also as in the Philippines, Chinese boats have harassed exploration vessels operating in these blocks several times in recent years. In May and June 2011, for example, Chinese naval vessels cut the seismic cables on exploration vessels operating off Vietnam's coast.

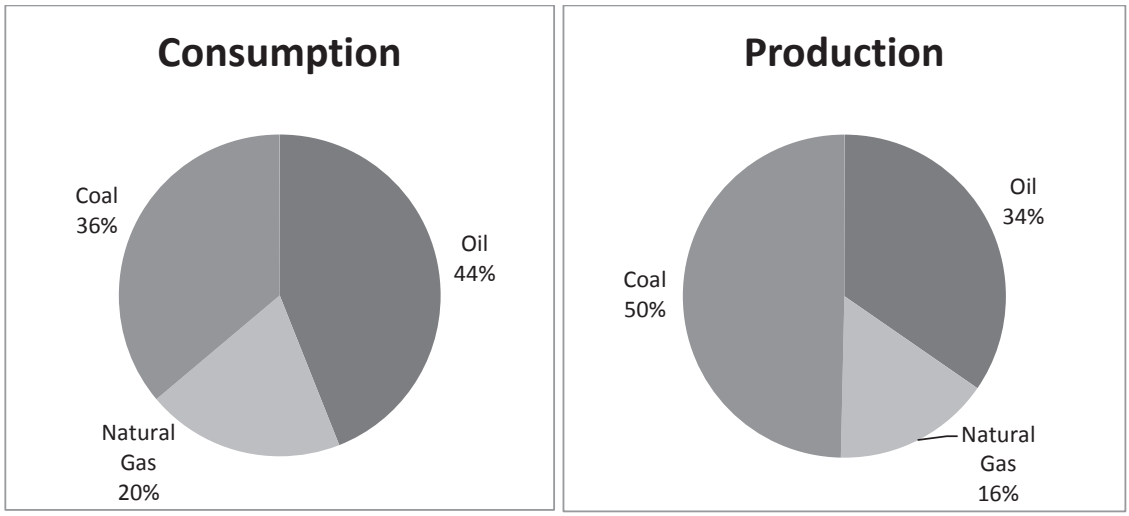
Regional and National Policy Issues and Research Needs, June 13, 2010, http://www.sumernet.org/MekongDeltaMonograph/8Chapter4.pdf.

128. MoIT, "Overview of Energy Industry," 5.

Demand Picture

Vietnam is an energy-rich country, but its energy consumption has increased rapidly in recent years. In 2008, Vietnam produced 1.457 quadrillion btu of total primary energy and consumed 1.605 quadrillion btu.[129] Between 2009 and 2010, its energy consumption increased by 4.5 percent.

Figure 18: Energy Consumption and Production in Vietnam



Source: EIA, *International Energy Statistics*.

Vietnam's energy demand has increased rapidly as the economy has grown, and given its current growth trajectory, the country's energy demands will far outstrip its exploitable energy potential within the next decade.

Because of this rapid economic growth, Vietnam is transitioning from an energy exporter to an energy importer; this is expected to cause hydrocarbon and electricity demand to double during the next 10 years.[130] Industry is one of the largest energy consumers (43 percent in 2009). From 2000 to 2009, the country's energy consumption from industry grew an average of 10 percent per year.[131] Transport consumes 30.4 percent and other sectors use 21.6 percent.[132]

Electricity demand grew at a very rapid 14.3 percent annually between 1990 and 2005.[133] By 2009, Vietnam generated 79.7 bkWh of electricity and consumed 71.6 bkWh,[134] but only 84 percent of Vietnam's population had access to electricity.[135] Vietnam's overall energy surplus is not evenly reflected in its electricity-generating capacity and distribution across all provinces.

129. EIA, *International Energy Statistics.*
130. Shell Oil, "Oil and Gas Potential."
131. APERC, *APEC Energy Overview 2011*, 236.
132. Ibid.
133. APERC, *APEC Energy Demand and Supply Outlook*, 5th ed. (Tokyo: Asia Pacific Energy Research Center, 2009), 55.
134. EIA, *International Energy Statistics*.
135. APERC, *APEC Energy Demand and Supply Outlook*, 55.

While generation in the south is more than sufficient for consumption needs, Vietnam is forced to import electricity from China for use in the north. In 2011, Vietnam was projected to purchase 4.6 bkWh of electricity from China, accounting for 4 percent of its national electricity supply.

Policies Shaping Vietnam's Potential Trajectory

The government has developed long-term visions for a consolidated national energy development program. Vietnam has said it would like to produce 5 percent of its electricity from renewable sources by 2020, but it is primarily promoting the development of domestic coal reserves and offshore natural oil and gas wells.

Hanoi's objective is to attract major foreign companies to invest in large-scale power and clean energy projects and, at the same time, implement energy development strategies that will help energy imports and exports, assist in the development of renewable energy resources, and create a competitive energy market that can complement sustainable practices.

Vietnam's electricity sector is in desperate need of investment. The government's electricity subsidies are one frequently cited reason for lagging development of the country's energy sector: Hanoi does not allow energy companies to charge market prices for electricity, which has created a reluctance to invest. The relatively low prices charged to users do not cover the comparatively high electricity production costs. Others say the government's foreign investment regulations in the energy sector are unattractive, and the country's uncertain legal system discourages investors.

The government limits electricity prices to as low as $0.05/kilowatt hour (kWh), compared to regional prices that range from almost $0.07/kWh in Indonesia to over $0.17/kWh in the Philippines.[136] Since Vietnam Electricity is legally obliged to sell electricity below the market price, it has little incentive to build new power plants and instead invests in areas outside of its core competency, such as tourist projects and hotels. Due at least in part to this pricing structure, Vietnam Electricity was projected to lose $562 million in 2011, and it is unclear whether the government is willing to raise prices in the short term owing to its continued battle to control inflation.[137]

In an attempt to address the inefficiencies created by Vietnam Electricity's monopoly on pricing, transmission, and distribution, Vietnam initiated a pilot program in July 2011 that allows some power-generating companies to sell electricity at market prices.[138] It remains to be seen whether this will entice investment by foreign companies, particularly western ones, which have for years been skeptical of the heavy hand of the state in the country's energy pricing.

Like electricity, coal and gas prices are set at lower-than-market levels. Domestic power plant coal prices are 30 percent lower than domestic market prices and 50 percent lower than export prices. Gas prices are lower than the international standard of $7–8 per million btu. By contrast, the government bases domestic oil prices on international prices, because the country has only one small oil refinery and depends on imports of refined petroleum products.

Hanoi has recognized the country's relatively large realizable potential for renewable energy but finds it challenging to tap renewable energy potential because of the high cost of develop-

136. Joel D. Adriano, "Power Politics in the Philippines," *Asia Times*, June 10, 2008, http://www.atimes.com/atimes/Southeast_Asia/JF10Ae01.html.

137. "Vietnam's major state firms face big losses-paper," Reuters, September 9, 2011, http://uk.reuters.com/article/2011/09/09/vietnam-economy-losses-idUKL3E7K90JW20110909.

138. Ernest Z. Bower, "Hillary Clinton's Asia Sojourn," *Southeast Asia from the Corner of 18th and K Streets*, July 20, 2011, http://csis.org/publication/hillary-clintons-asia-sojourn-0.

ment and deployment. As such, the 2009 Renewable Energy Master Plan gave priority to low-cost renewable-energy sources such as small scale hydropower, sugarcane bagasse, municipal solid waste, geothermal power, wind, rice husk, renewable heat, and bioenergy, as well as off-grid projects related to rural electrification in remote areas.

The government has set a target of increasing the share of energy produced from renewables to 5 percent in 2020, 8 percent by 2025, and 11 percent by 2050. It plans to add 241 MW/year in additional renewable electricity capacity from 2006 to 2015, for a total of or about 2,451 MW, and 160 MW/year from 2016 to 2025, for a total of 4,050 MW.

Hanoi has also set out plans to increase the use of biofuels, especially in the transportation sector. It has set a goal of producing 250,000 tons of ethanol and vegetable oil by 2015, enough for blending 5 million tons of E5 and B5,[139] and 1.8 million tons by 2025. This will satisfy 1 and 5 percent, respectively, of the country's gasoline and oil demand.

Conclusion

While the ASEAN-5 share some rough similarities in their energy environments, their supply and demand profiles and their national energy policies are as diverse as their histories and cultures. The energy mix and demand within each country, and consequently the amount of technology deployed and infrastructure developed, are influenced by its social dynamics, economic conditions, the role of renewables, and domestic policies such as environmental regulations and carbon legislation.

Nonetheless, several trends have emerged from an examination of the domestic energy landscape and policies of each country, including the growing competition between coal and gas, the importance of energy security, the influence of climate and environmental goals, the lack of infrastructure, and the maturation of existing production. But it is not only domestic factors that are shaping the energy trajectories of the region. Because it does not possess the strong manufacturing base necessary to produce the components required to build a full-fledged energy infrastructure, ASEAN is largely dependent on the outside world for needed equipment and capital.[140] The nature of engagement (or non-engagement) by outside actors with the ASEAN-5 through trade, export financing, foreign investment, and technology deployment will invariably shape the energy mix. Yet dynamics within the region itself, such as political risk, institutional capacity, and security objectives, will also direct the nature of foreign engagement.

Chapter 2 will look more closely at this second level of influence: how developments at the global and regional level influence and determine energy use and policies in each country, and how these, in turn, shape the domestic trends mentioned above. We turn now to examine factors such as trade, environment, and energy security dynamics that are shaping the ASEAN-5's energy path forward.

139. A blend of 95 percent gasoline and 5 percent ethanol (E5) or biofuel (B5).
140. Evans, "ASEAN 5 Energy Landscape."

2 THE TRADE, SECURITY, POLICY, AND ENERGY ENVIRONMENT

Each of the ASEAN-5 nations has an energy policy crafted to meet its own needs and goals, but a larger regional and global context greatly affects the course of energy supply in each country. At the global level, for example, a comprehensive trade deal in the World Trade Organization (WTO) has stalled over disputes about the acceptable level of protection for domestic manufacturing industries in the developing world. Unfortunately, an initiative to decrease the barriers to trade in energy and energy-related goods and services has been caught in the cross-fire.

At the regional level, in Asia, the Asia Pacific Economic Cooperation (APEC) organization, the 10-country Association of Southeast Asian Nations (ASEAN), the Mekong River Commission (MRC), and the Trans-Pacific Partnership (TPP) have ambitious goals to liberalize trade and boost regional integration in the energy sector. Some leaders have tried to push trade in green goods and services to the top of the APEC agenda in recent years, but the global economic downturn has made it difficult to justify the transition away from cheaper, albeit dirtier, sources of energy. The need to meet rapidly growing energy demand and the existence of abundant fuel sources in Southeast Asia makes that transition even more difficult. In addition, competing domestic political and commercial interests in the individual ASEAN-5 countries influence regional policy-making and have a long-term impact on the energy landscape in the region. Weak institutional arrangements among ASEAN nations make it difficult to craft a robust regional policy that could create greater institutional and infrastructure connectivity.

Finally, individual powers as well as international financial institutions are deeply involved in helping the ASEAN-5 countries meet their domestic and regional energy demand. The United States and China each have a stake in the region's economic development. Likewise, the World Bank, its International Finance Corporation (IFC) arm, and the Asian Development Bank (ADB) are working to bring increased electricity generation capacity online in such a way that fits with each nation's overall energy policies and long-term economic development goals. This effort includes support for large hydropower dams as well as less tangible goals such as the reorganization of state-owned utilities to encourage more efficient allocation of infrastructure investments.

Global Accords

World Trade Organization

The ASEAN-5 countries are all members of the WTO, which is devoted to helping nations negotiate trade agreements and settle trade disputes. Liberalization of trade in energy and energy-related products and services has largely proceeded outside the WTO multilateral framework, however. Energy and energy services were not dealt with as specific sectors in the round of negotiations concluded in Geneva in 1994 under the General Agreement on Tariffs and Trade (GATT) framework.

The round of WTO negotiations that began in Doha in 2001 did bring some movement in energy trade and investment, even though the Doha round itself foundered first in 2003 and again in July 2008. In response to the emerging international emphasis on addressing climate change; the accession of several energy-rich nations into the WTO, including Saudi Arabia in 2005; and the rapid development of renewable energy sources, the WTO recognized in 2007 that energy and energy-related products and services needed to be addressed more directly. The WTO thus asked the World Energy Council, a U.K.-based international nongovernmental organization, to create a taskforce to develop a platform of rules governing energy trade and investment for inclusion in the next round of trade negotiations. That taskforce delivered its report in September 2009. It recommended that members:

1. Refrain from imposing cross-border taxes on energy products and services;
2. Promote energy investment and foster stable and inviting investment regimes;
3. Cooperate to facilitate the movement and delivery of energy goods and services and energy service personnel; and
4. Promote trade in environmental goods and services.

The report highlighted the need to refrain from hiding behind commitments to reduce greenhouse gas emissions, made under the United Nations Framework Convention on Climate Change, as an excuse to justify the erection of non-tariff barriers to trade. The energy taskforce noted that introducing protectionist measures against environmental goods and services would exacerbate the economic downturn and delay economic recovery.[1]

International Energy Agency

Sixteen members of the Organization for Economic Cooperation and Development (OECD) formed the International Energy Agency (IEA) in 1974 as the world economy reeled from the Organization of Petroleum Exporting Countries' limits on oil exports. The IEA currently has 28 members. Members of the IEA must first belong to the OECD; therefore none of the ASEAN-5 countries is a member.

Nonetheless, the IEA has long worked to establish close relationships with individual nonmember countries, including those in Southeast Asia. The outreach has included capacity-building programs and, with the permission of each country, a formal review of the country's energy policies with recommendations on areas for improvement. Cooperation with Indonesia and Thailand has been the most active. The IEA performed a full country review of Indonesia in 2006 and has held cooperative activities in a number of areas since that time. With Thailand, cooperation began in 2007 and focused on an assessment of how prepared the country would be in the event of oil supply disruptions.[2]

On a regional level, the IEA has also been working formally with the ASEAN Center for Energy since 2002. In 2011, this cooperation was enhanced by the participation of the executive director of the IEA at an ASEAN Ministers of Energy meeting, where a new memorandum of

1. World Energy Council, *Trade and Investment Rules for Energy* (London: World Energy Council, 2009), 15, http://www.worldenergy.org/documents/rules_of_trade_version_180809.pdf.
2. IEA, "IEA-Thailand joint workshop focuses on oil security," October 2, 2012, http://www.iea.org/newsroomandevents/news/2012/october/name,31835,en.html.

understanding was signed on broad areas of cooperation, including energy efficiency, regulation, technology, statistics, and oil emergency response.

Regional Accords

Asia Pacific Economic Cooperation

APEC's 21 member economies account for fully half of global GDP and 44 percent of global trade.[3] APEC was formed in 1989 as a forum for nations in the Asia-Pacific region to facilitate "economic growth, cooperation, trade, and investment" in the region. This grouping sometimes struggles to be relevant because the core interests of its member economies are so disparate and the organization operates through dialogue rather than through binding obligations.[4] But the "shortcoming" of these soft institutional arrangements is also one of the characteristics that often make APEC a valuable venue. Several times since 1989, when the WTO or other institutions have foundered due to inflexible domestic constraints and parochial interests, APEC has served as a venue to make progress toward trade liberalization and measures to address climate change.[5]

The APEC Energy Working Group (EWG), for example, formed in 1990 to help member economies address energy issues. It has improved regional energy security through opening markets, encouraged investments in the energy sector, and increased cooperation on energy standards and harmonization. Energy efficiency and the greening of the energy mix of member economies in recent years have become more important aspects of the energy landscape addressed by the EWG. As APEC member economies now account for 60 percent of world energy use (and greenhouse gas emissions),[6] they are understandably interested in improving their energy security.

The EWG comprises senior officials from each member economy; it has four expert groups (Clean Fossil Energy, Efficiency and Conservation, Energy Data and Analysis, and New and Renewable Energy Technologies) and two task forces (Biofuels, and Energy Trade and Investment) that hold workshops, develop reports, and provide recommendations. The EWG has also initiated programs to help countries evaluate their energy policies and provide advice on improving their policy regulatory framework. Member economies can ask for a team from other economies to review their policies and regulatory framework and provide suggestions on areas for improvement.

The EWG's Energy Data and Analysis Expert Group supervises the Asia Pacific Energy Research Center, which is affiliated with the Institute of Energy Economics in Japan. The center was created in 1996 and reports on the region's energy supply and demand and on member economies' energy policies and best practices.

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3. Asia-Pacific Economic Cooperation (APEC), "Frequently Asked Questions no. 9: How much of the world's trade takes place in the APEC region?" http://www.apec.org/FAQ.aspx.

4. Choe Sang-Hun, "APEC's relevance is under scrutiny," *New York Times*, November 14, 2005, http://www.nytimes.com/2005/11/14/world/asia/14iht-apec.html; Peter Drysdale and Shiro Armstrong, "Does APEC matter?" *East Asia Forum*, November 8, 2009, http://www.eastasiaforum.org/2009/11/08/does-apec-matter/.

5. "Officials: APEC leaders must speak strongly on WTO talks," *New York Times*, November 13, 2005, http://www.nytimes.com/2005/11/13/world/asia/13iht-web.1113apec.html; S. Ramesh, "APEC forum has shown itself to be useful in times of crisis," Channel News Asia, November 20, 2009, http://www.channelnewsasia.com/stories/singaporelocalnews/view/1017284/1/.html.

6. David Fogarty, "Climate takes back seat at APEC, focus on trade," Reuters, November 11, 2009, http://in.reuters.com/article/2009/11/11/idINIndia-43853220091111.

In another instance of APEC serving as a venue to make progress, the organization's economic leaders met in Bogor, Indonesia, in 1994 and tasked their fellow APEC members with achieving the goals of "free and open trade and investment" in the Asia-Pacific by 2010 for industrialized economies and by 2020 for developing economies. The Bogor Declaration included trade in energy and energy-related goods, as well as energy investments.[7] At the subsequent energy ministerial meeting in Jakarta, a report on the "3 Es" (energy security, environmental protection, and economic development) provided a blueprint for how to achieve the Bogor goals in the energy sector.

More recently, APEC senior officials' meetings and leaders' declarations have worked to lower barriers to trade in green energy goods and services and have kept climate change on the global agenda. At an April 2007 meeting of senior APEC officials, before Australia hosted the annual APEC summit, Prime Minister John Howard made the case for giving clean energy and climate change a prominent role at the summit.[8] Energy ministers then met in Darwin in May, and the statement they produced, known as the Darwin Declaration, formalized energy security, clean energy, and climate change atop the APEC energy agenda.[9]

At the leaders' summit in Sydney that September, some observers hoped that the Darwin Declaration would pave the way for an ambitious new approach to climate change. After days of wrangling between Australia and the United States, leaders agreed to a compromise statement affirming the APEC nations' commitment to some post-Kyoto Protocol arrangements to address climate change.[10] Many environmental activists and business leaders were disappointed that the forum was unable to produce concrete emissions-reduction targets or progress toward a compulsory carbon-trading scheme.

Nevertheless, in the Sydney Declaration on Climate Change, Energy Security, and Clean Development, APEC leaders did agree to cooperative actions to address climate change, including actions to support energy efficiency, develop low-emissions technology, encourage alternative and low-carbon energy sources, and open trade and investment. They also established the APEC Peer Review on Energy Efficiency. Eight countries, including Vietnam, Thailand, and Malaysia, underwent peer review of their energy policies between 2009 and 2011. The review documents examine each country's energy policy landscape and make recommendations on how to improve institutions, data collection and analysis, and the energy industry.[11]

Most recently, the U.S. government began planning for the November 2011 APEC summit in Hawaii with the intention of securing a strong agreement to decrease tariffs on environmental goods and services. But the United States and China disagreed about how deeply to cut developing countries' tariffs on environmental goods.[12] By the end of the summit, the Leaders' Declara-

7. "APEC Economic Leaders' Declaration of Common Resolve," November 15, 1994, http://www.trade.gov.tw/App_Ashx/File.ashx?FilePath=../Files/TradeOldFile/13/06/42/94_Leaders+Statement+.pdf.

8. APEC, "Asia-Pacific Economic Cooperation Second Senior Officials' Meeting for the Nineteenth APEC Ministerial Meeting," May 24, 2007, http://aimp.apec.org/Documents/2007/SOM/SOM2/07_som2_summary.pdf.

9. APEC, "2007 APEC Energy Ministerial Meeting," May 29, 2007, http://www.apec.org/Meeting-Papers/Ministerial-Statements/Energy/2007_energy.aspx.

10. "Consensus on climate change elusive for Pacific Rim leaders," *New York Times*, September 3, 2007, http://www.nytimes.com/2007/09/03/world/asia/03iht-apec.1.7359404.html.

11. APERC, *APEC Energy Demand*, 55.

12. Doug Palmer, "No agreement yet on APEC 'green' tech trade plan," Reuters, November 12, 2011, http://www.reuters.com/article/2011/11/12/us-apec-greentech-idUSTRE7AB06Z20111112.

tion outlined a path to cutting tariffs to 5 percent on environmental goods and services, less than Washington had desired.[13] The summit's ministerial statement pledged to rationalize and phase out fossil-fuel subsidies, develop low-emissions economic growth strategies, and promote small and medium enterprises in the green-growth sectors.[14] Throughout 2012, APEC countries will work to create a list of environmental goods and services that "directly and positively contribute to . . . green growth and sustainable development objectives."

Trans-Pacific Partnership

The Trans-Pacific Partnership is a comprehensive free-trade agreement under negotiation between eleven members of APEC. The TPP aspirants include Australia, Brunei, Canada, Chile, Malaysia, Mexico, New Zealand, Peru, Singapore, the United States, and Vietnam. A draft text of the agreement is still under negotiation, but it is expected to include sections devoted to trade in energy goods and services. Of the countries in our study, only Malaysia and Vietnam are currently participating in the TPP negotiations, but the Philippines has expressed interest in joining in the future.

The goal of TPP members is eventually to include all 21 APEC member countries in a region-wide Free Trade Area of the Asia-Pacific, or FTAAP.[15]

ASEAN

The first steps toward energy cooperation within ASEAN were taken in 1986 when the grouping signed the Agreement on ASEAN Energy Cooperation. This document recognized the common interests of ASEAN nations in improving energy security.[16] The ASEAN Center for Energy was subsequently founded in 1999 and is located at the ASEAN Secretariat in Jakarta. The center coordinates the infrastructural, technical, and institutional connectivity efforts of ASEAN on energy issues.

Energy security is a source of concern for ASEAN nations as the infrastructure investment required to keep up with increasing demand and greater rural electrification rates is daunting. Demand for electricity in the region is projected to grow at an annual rate of 4 percent per year through 2030.[17]

The latest implementation plan for ASEAN nations to collectively meet their energy needs in the short- to mid-term is the *ASEAN Plan of Action for Energy Cooperation 2010-2015*, the energy component of the ASEAN Economic Community blueprint for achieving regional economic integration by 2015. The plan of action is divided into seven program areas: the ASEAN Power Grid,

13. Doug Palmer, "APEC leaders commit to green trade liberalization," Reuters, November 14, 2011, http://www.reuters.com/article/2011/11/14/apec-greentrade-idUSN1E7AD01620111114.

14. APEC, "2011 APEC Ministerial Meeting," November 11, 2011, http://www.apec.org/Meeting-Papers/Ministerial-Statements/Annual/2011/2011_amm.aspx.

15. New Zealand United States Council, "A Free Trade Agreement through the Trans Pacific Partnership," http://www.nzuscouncil.com/index.php/section/free_trade_agreement.

16. ASEAN Secretariat, "Agreement On ASEAN Energy Cooperation Manila, 24 June 1986," http://www.aseansec.org/6570.htm.

17. Energy Data and Modeling Center at the Institute of Energy Economics et al., *The Third ASEAN Energy Outlook*, February 2011, http://www.energycommunity.org/documents/ThirdASEANEnergyOutlook.pdf.

the Trans-ASEAN Gas Pipeline, coal and clean coal technology, energy efficiency and conservation, renewable energy, regional energy policy and planning, and civilian nuclear energy. Within each area, the ASEAN Economic Community plan has developed strategies to enhance energy security and sustainability.

The ASEAN Ministers of Energy Meeting held in Brunei Darussalam in September 2011 focused on ways to accelerate physical ASEAN connectivity through the ASEAN Power Grid and the Trans-ASEAN Gas Pipeline.[18] While energy security was a high priority, the ministers also discussed increasing energy efficiency and the use of renewables.[19]

ASEAN Power Grid

The ASEAN Power Grid was conceived in 1997 as part of the ASEAN Vision 2020, which has since been incorporated under the Master Plan on ASEAN Connectivity, finalized in 2010.[20] The power grid is an ambitious attempt to link the power grids of the ASEAN countries together via transmission lines and harmonization of technical and market standards. The benefits of a shared power grid include greater energy security and more opportunities for investment. Load swings or supply disruptions can be addressed with energy generated in neighboring countries, or even outside the ASEAN area, and carried by cross-border transmission lines. Capital-intensive energy generation and transmission infrastructure investments are more economically feasible with access to a larger market of residential, commercial, and industrial energy consumers.[21]

The Memorandum of Understanding on the ASEAN Power Grid recognizes several cross-border issues that ASEAN needs to address before it can create the power grid.[22] First, the ASEAN nations have extremely diverse construction codes and need to work to harmonize their technical specifications, including their ability to enforce compliance with standards. Second, they should harmonize cross-border taxes and tariffs. Third, they need to arrange financing, both public and private, for power grid projects. Fourth, they need to create a unified power market and eliminate market-distorting subsidies. Fifth, they must establish a framework for third-party commercial access to the transmission network.

To achieve these goals, the Heads of ASEAN Power Utilities/Authorities (HAPUA) completed an ASEAN Interconnection Master Plan Study in 2003 and revised it in 2010. The master plan divides ASEAN into sub-regions for the purpose of power generation and power grid interconnec-

18. ASEAN Secretariat, "ASEAN to Accelerate Energy Connectivity," September 21, 2011, http://www.aseansec.org/26630.htm.

19. Rachel Thien and Adam Radhi Brunei-Muara, "Minister: Find cost-effective ways to meet rising energy demands," *Brunei Times*, September 22, 2011, http://www.bt.com.bn/news-national/2011/09/22/minister-find-cost-effective-ways-meet-rising-energy-demands; Ying Chia, "Asean has long-term goal to achieve energy independence," *Brunei Times*, September 21, 2011, http://www.asiaone.com/News/Latest%2BNews/Asia/Story/A1Story20110921-300631.html.

20. ASEAN Secretariat, *ASEAN Plan of Action on Energy Cooperation (APAEC) 2010–2015*, August 14, 2009, http://www.aseansec.org/22675.pdf.

21. John Loh, "A power grid for Asean?" *The Star*, March 10, 2012, http://biz.thestar.com.my/news/story.asp?file=/2012/3/10/business/10889726&sec=business; "Asean Integrated Power Grid Aims To Improve Energy Efficiency," *Business Times*, July 14, 2010, http://businesstimes.com.vn/asean-integrated-power-grid-aims-to-improve-energy-efficiency/.

22. ASEAN Secretariat, "Memorandum of Understanding on the ASEAN Power Grid," http://www.aseansec.org/20918.htm.

tions. The 15 projects that the study identified as feasible components of the ASEAN Power Grid will be completed in planned stages. The projects in the first phase will make bilateral connections within sub-regions. In the second phase, projects will connect sub-regions, and in the third, projects will create an ASEAN-wide power grid.

Six linked grids currently operate between ASEAN nations as part of the ASEAN Power Grid: Thailand–Peninsular Malaysia; Thailand–Laos; Singapore–Peninsular Malaysia; Cambodia–Vietnam; and Thailand–Cambodia. Nine other projects are slated to be commissioned by 2015. The ASEAN Power Grid is projected to be functional for economic exchange and power trading by 2020, although some projects will not be completed until the middle of the next decade.[23]

Table 6. ASEAN Power Grid Existing Linkages

Number	Interconnected Systems	Capacity (MW)
1	Thailand - Peninsular Malaysia	
	Sadao - Bukit Keteri	80
	Khlong Ngae - Gurun	300
2	Thailand - P. Malaysia	
	Roi Et2 - Nam Theu 2	920
	Udon Thani 3 - Nabong	597
	Ubon Ratchathani 2 - Houay Ho	126
	Sakon Nakhon 2 - Theun Hinboun	210
3	Singapore - Peninsular Malaysia	2x200
4	Cambodia - Vietnam	135
5	Thailand - Cambodia (115 kV)	80

Source: Bambang Hermawanto, "Report of the 8th Meeting of APGCC," June 23, 2011, 2, http://www.hapuasecretariat.org/doc2011/Report%208_APGCC.pdf.

The HAPUA identified two projects, the Melaka-Pekanbaru Interconnection (Indonesia–Malaysia–Thailand Growth Triangle) and the West Kalimantan–Sarawak Interconnection (Brunei–Indonesia–Philippines–Malaysia–East ASEAN Growth Area), as priority projects for the completion of the ASEAN Power Grid. Both of these projects receive assistance from the ADB and will boost ASEAN connectivity when they are completed in 2015.[24]

The two projects are expected to cost $5.9 billion, but interconnection will potentially save $662 million in new investment and operating costs by enabling power sharing during peak use periods.[25] New projects could be added (or existing projects canceled) if energy prices increase or energy demand shifts.

23. ASEAN Secretariat, *ASEAN Interconnection Master Plan Study no. 2* (November 18, 2010), 19, http://www.hapuasecretariat.org/doc2011/Vol_I_Executive%20Summary.pdf; "Asean expected to integrate power grids by 2020 for regional power security, says Thai energy expert," *Bernama*, January 28, 2012, http://www.theborneopost.com/2012/01/28/asean-expected-to-integrate-power-grids-by-2020-for-regional-power-security-says-thai-energy-expert/.

24. Ibid.

25. ASEAN Secretariat, *Plan of Action*, 12.

Within the planned ASEAN Power Grid are various sub-regional grids. The power grids of southern Thailand and peninsular Malaysia are already connected, as are peninsular Malaysia and Singapore. Sales of Malaysian electricity to Singapore were discussed at a meeting between the prime ministers of Malaysia and Singapore in January 2012.[26] Plans for lines connecting Sumatra (Indonesia) to peninsular Malaysia are still in the very early stages.[27]

The power grids within the Greater Mekong sub-region, by contrast, are less well developed. This sub-region comprises roughly the area of mainland Southeast Asia between India on the west, China in the north, and the South China Sea in the east, and includes the countries of Laos, Myanmar, Thailand, Cambodia, and Vietnam. The ADB is financing transmission as well as electricity generation projects in this region.

The countries in this sub-region are quite diverse in the types and quantities of energy resources they possess. Myanmar is rich in natural gas and petroleum reserves; Cambodia has petroleum and hydropower potential; while Laos has primarily hydropower potential. The transmission infrastructure in this region is also very uneven. Thailand and Vietnam have well-developed power grid systems (with 500 kilovolt integrated backbone grids), but Cambodia, Laos, and Myanmar "have only low and medium voltage power systems of limited [reach], quality, and reliability."[28]

Another sub-regional grid being developed is the Trans Borneo Power Grid, which will connect West Kalimantan (Indonesia) through Sarawak (Malaysia) and Brunei to Sabah (Malaysia). Borneo is home to significant hydropower potential.[29] Later, it is expected that Palawan (Philippines) will be connected to the Trans Borneo Power Grid. Palawan is located near significant oil and natural gas reserves in the Philippines' exclusive economic zone in the South China Sea. Currently, there are only rudimentary plans to begin connecting most of the Philippines to the ASEAN Power Grid.[30]

Trans-ASEAN Gas Pipeline and Liquefied Natural Gas Network

The objective of an extensive ASEAN-wide gas pipeline network is to assure long-term regional energy security by linking existing pipeline networks. In 2001, the ASEAN Council on Petroleum, spearheaded by Petronas of Malaysia, began planning the Trans-ASEAN Gas Pipeline system. The pipeline would connect the natural gas pipelines of member nations and could provide the physical infrastructure for a single market for natural gas. At the ASEAN Ministers of Energy

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26. Lydia Lim, "Singapore open to buying electricity from Malaysia," *Straits Times*, January 6, 2012, http://www.straitstimes.com/BreakingNews/Singapore/Story/STIStory_752135.html;

"Malaysia offers to sell electricity to Singapore," *Bernama*, January 5, 2012, http://www.nst.com.my/malaysia-offers-to-sell-electricity-to-singapore-1.28260.

27. "Malaysia, Indonesia to begin power trade in 2014," *Bernama,* February 28, 2012, http://www.nst.com.my/top-news/malaysia-indonesia-to-begin-power-trade-in-2014-1.53020.

28. Yongping Zhai, "Energy Sector Integration for Low Carbon Development in Greater Mekong Sub-region:

Towards a Model of South-South Cooperation," World Energy Council, August 15, 2010, 2, http://www.worldenergy.org/documents/congresspapers/52.pdf.

29. Mustaqim Adamrah, "Kalimantan hydropower project likely ready by 2013: RI," *Jakarta Post*, March 10, 2011, http://www.thejakartapost.com/news/2011/03/10/kalimantan-hydropower-project-likely-ready-2013-ri.html.

30. Amy R. Remo, "PH power grid operator eyes linkup with Asean via Sabah," *Philippine Daily Inquirer*, March 6, 2011, http://www.inquirer.net/specialfeatures/power/view.php?db=1&article=20110306-323899.

meeting in September 2011, the ministers welcomed regional efforts to finalize guidelines to speed up implementation of an ASEAN power grid and noted progress in the implementation of the Trans-ASEAN gas pipeline project. The Memorandum of Understanding on developing the Trans-ASEAN Gas Pipeline was extended for another decade. Senior officials were asked to work with the ASEAN Energy Regulators Network to expedite the harmonization of regulatory practices and technical standards and report back on their progress at the next meeting.[31] By 2013, the Trans-ASEAN Pipeline is expected to include 1,880 miles of pipeline out of a total of 4,350 miles of planned pipelines.[32]

Beyond gas pipelines, if ASEAN is to move toward a single market for natural gas, significant regulatory reform and standards harmonization must be tackled. Currently, the Thai and Malaysian state oil and gas companies, the Petroleum Authority of Thailand and Petronas, are vertically integrated monopolies that exclude third party distributors and, some analysts say, distort market prices. Breaking up these vertical monopolies could help to create the market conditions necessary for competition in downstream distribution.

The East Natuna Field is intended to be the anchor of the Trans-ASEAN Gas Pipeline. The field, which has estimated reserves of 46 trillion cubic feet, is located in Indonesia's exclusive economic zone near peninsular Malaysia in the South China Sea. Indonesia's Pertamina, ExxonMobil, and Total of France are jointly developing the gas field, which will require an investment of between $20 and $40 billion. (Malaysia's Petronas withdrew from the project in February 2012.)[33] The challenge in developing the gas reserves is the high carbon dioxide content (71 percent) of the gas. This requires significant investment in carbon capture and storage technology. Proposed pipelines would connect the East Natuna field to peninsular Malaysia, Thailand, Java (Indonesia) and Vietnam. A planned pipeline to Sabah (Malaysia), Brunei Darussalam, and Palawan (Philippines) has been cancelled because it is not commercially viable.[34]

In addition to the technical difficulties, the Trans-ASEAN Gas Pipeline project faces significant challenges from plans to boost distribution of liquefied natural gas (LNG). Instead of connecting gas fields to major markets via pipelines, LNG relies on liquefaction and regasification terminals and requires a distribution system consisting of tanker trucks, trains, and waterborne LNG carriers. Depending on market conditions, LNG could be a more cost-effective way to deliver energy to customers in the ASEAN-5 countries. LNG's advantage lies in its ability to bridge great distances between producers and consumers; pipelines become uneconomical at greater distances. Another benefit of LNG is the ability to supply energy to remote areas with small or "mini" LNG facilities where the economics do not justify natural gas pipelines.[35]

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31. ASEAN Secretariat, "Joint Ministerial Statement of the 29th ASEAN Ministers on Energy Meeting (AMEM)," September 20, 2011, http://www.aseansec.org/26626.htm.

32. ASEAN Secretariat, *Master Plan on ASEAN Connectivity*, January 2011, 17, http://www.aseansec.org/documents/MPAC.pdf;

ASEAN Secretariat, *Plan of Action*, 14.

33. "Malaysia's Petronas resigns from big Indonesia's East Natuna," Reuters, February, 27, 2012, http://af.reuters.com/article/energyOilNews/idAFL4E8DR5AV20120227.

34. "ASEAN and ASCOPE Lay Foundation for Growth," *PetroMin Pipeliner*, January–March 2011, 3, http://www.pm-pipeliner.safan.com/mag/ppl0311/r12.pdf.

35. Tore Høifødt, "Large potential for LNG in regional shipping and power generation," *DNV*, March 16, 2011, http://www.dnv.com/press_area/press_releases/2011/largepotentialforlnginregionalshippingandpowergeneration.asp.

Several LNG terminals in the region are already in operation, with others in the planning or construction phases. Singapore is positioning itself as a regional LNG hub with a new terminal nearing completion on Jurong Island.[36] Recent opposition to coal-fired and nuclear power plants in Thailand has led the Petroleum Authority of Thailand to push up the timeline for completion of an LNG terminal in Rayong, in the eastern part of the country.[37] The Philippines is also looking to LNG to replace depleting production from its Malampaya gas field. [38]

Mekong River Commission

A fourth regional organization focusing on energy and environmental issues is the Mekong River Commission, a multilateral body that includes Cambodia, Laos, Thailand, and Vietnam—the countries of the Lower Mekong Basin. These four nations share the bounty of the Mekong River and in 1995 formed the MRC, the successor to the 1950s-era United Nations–backed Mekong Committee, to manage the river's resources responsibly. China and Myanmar are also engaged as dialogue partners in the commission, while the United States, Japan, and several other governments provide technical and financial assistance.[39]

The MRC has developed an Integrated Water Resource Management process with three goals in mind: the efficient, equitable, and sustainable use of water resources and services. One of the commission's program areas is the Initiative on Sustainable Hydropower, which aims to ensure that hydropower projects are considered in the context of larger resource management—that is, including agriculture and aquaculture—and that sustainability is protected.

In December 2011, the MRC met in Siem Reap, Cambodia, to discuss the fate of the Xayaburi Dam, the first of six mainstream dams scheduled to be built along the Mekong in Laos. Electricity produced by the Xayaburi Dam is slated to serve Thai consumers, but the dam is opposed by Cambodia and Vietnam on the grounds that it will significantly impact fish stocks downstream and prevent the flow of nutrient-rich silt, which will impact downstream rice production and eliminate many people's livelihood.[40] An MRC study of the project found that it would impact the habitat of between 23 and 100 species, possibly leading to the extinction of some of them.[41]

Without reaching a final decision on whether the project should move forward, the MRC agreed to conduct further studies on the impact of the dam. Laos said it would delay construction until the commission comes to an agreement.[42] However, work on the dam was reportedly re-

36. "Singapore LNG Terminal, Jurong Island, Singapore," *Net Resources International*, http://www.hydrocarbons-technology.com/projects/singaporelngterminal/.

37. Boonsong Kosit, "Thai PTT to expedite expansion of LNG terminal on gas demand surge," *Platts*, January 16, 2012, http://www.platts.com/RSSFeedDetailedNews/RSSFeed/NaturalGas/7031937.

38. "Philippines aims to begin importing LNG in 4 to 5 yrs," Reuters, September 20, 2011, http://www.abs-cbnnews.com/business/09/20/11/philippines-aims-begin-importing-lng-4-5-yrs.

39. Mekong River Commission, "Development Partners & Partner Organisations," http://www.mrcmekong.org/about-the-mrc/development-partners-and-partner-organisations/.

40. "Laos' Mekong Xayaburi dam plan delayed again," BBC, December 8, 2011, http://www.bbc.co.uk/news/world-asia-16085584.

41. Mekong River Commission Secretariat, *Proposed Xayaburi Dam Project—Mekong River: Project Consultation Project Review Report*, March 24, 2011, i–ii, http://www.mrcmekong.org/assets/Publications/Reports/PC-Proj-Review-Report-Xaiyaburi-24-3-11.pdf.

42. Supalak Ganjanakhundee, "Laos: no work on Xayaburi dam until green concerns solved," *The Nation*, May 4, 2012, http://www.nationmultimedia.com/politics/Laos-no-work-on-Xayaburi-dam-until-

started in March 2012 and strains are developing between Cambodia and Laos over the fate of the dam.[43] If construction does stop until an agreement is eventually reached using the mechanisms included in the commission, it could suggest the possible emergence of genuinely collaborative engagement in the region on the development of hydropower resources.[44]

The Geopolitics and Economics of Energy

China's Role and Its Engagement in the Region

Geopolitics in the region is also an important factor shaping the energy mix. China's engagement with the ASEAN-5 on energy issues represents both a potential challenge and an opportunity. In Indonesia, for example, China is both a major purchaser of coal and a supplier of technology for coal-fired power plants. In northern Vietnam, China is an important supplier of electricity. Along the Mekong River, China's construction of hydropower plants, both those already existing and those planned for the future, will have an impact on the river and on the ability of countries downstream to contemplate building hydropower stations of their own.

In the South China Sea, overlapping claims between China and several of the ASEAN-5 will make it difficult to begin exploiting oil and gas resources believed to be in the sea. The questions for several of the countries in this study are whether the different ASEAN claimants in the South China Sea will compete for resources or find a way to collaborate. Answers to these questions will help determine what energy mix each country promotes, the level of technology it chooses to deploy, and the level and types of investment it can secure.

U.S. Programs and Engagement

The U.S. Department of Energy (DOE) has engaged in cooperative activities in several of the ASEAN-5 countries. It has had long-standing cooperation with Indonesia, extensive past cooperation with the Philippines, and emerging cooperation with Vietnam. DOE lists four overarching areas in which it is actively engaged in Southeast Asia:

1. Enhancing energy security;
2. Stimulating low-carbon energy pathways and facilitating the deployment of clean energy technologies;
3. Supporting investment by U.S. companies; and
4. Supporting responsible decisions on nuclear power.

Within these four overarching areas, DOE has established seven goals it wishes to accomplish:

1. Improving energy policies and governance (including the elimination of fossil fuel subsidies);

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green-concerns--30181251.html; "Laos' Mekong Xayaburi dam plan delayed again," BBC, December 8, 2011, http://www.bbc.co.uk/news/world-asia-16085584.

43. "A dam on the Mekong: Opening the floodgates," *Economist*, May 5, 2012, http://www.economist.com/node/21554253.

44. Robert Costanza et al., *Planning Approaches for Water Resources Development in the Lower Mekong Basin*, July 2011, 4, http://web.pdx.edu/~kub/publicfiles/Mekong/LMB_Report_FullReport.pdf.

2. Improving the energy investment climate which would lead to increase production and improved opportunities for U.S. companies;
3. Encouraging the transition to low carbon mobility;
4. Increasing industrial and building energy efficiency;
5. Increasing renewable energy for the grid;
6. Increasing electrification using renewable energy; and
7. Ensuring compliance with international norms for nuclear safety.

DOE utilizes a variety of mechanisms to achieve these goals including high level meetings, energy policy dialogues, workshops and seminars, trade missions, study missions, expert exchanges, demonstration projects, joint research and scientific collaboration, and industry investment roundtables. DOE is also actively engaged in several of the region's multilateral forums. It actively meets with APEC leaders and has had increased engagement with ASEAN since President Barack Obama's first U.S.–ASEAN leaders meeting in November 2009, which established collaboration on energy security and clean energy. DOE also works with each individual country, largely though energy policy dialogues that have led to energy investment roundtables.

Another U.S.-backed effort is the Lower Mekong Initiative (LMI), supported by the State Department and U.S. Agency for International Development (USAID). The LMI brings together Cambodia, Laos, Thailand, Vietnam, Myanmar, and the United States to work on specific areas of shared interest, including sustainability, health, education, and infrastructure. The initiative began in July 2009 as part of a general U.S. foreign policy reorientation toward Asia and ASEAN. Myanmar was not initially invited to participate because of the longstanding U.S. sanctions against its military junta and the fact that only 2 percent of the Mekong's water comes from the Myanmar watershed.[45] But in light of recent political reforms in Myanmar, Secretary of State Hillary Clinton extended an invitation to the Myanmar government in December 2011 to participate in the LMI, and Myanmar was welcomed as a member of the group in July 2012.[46]

According to a study funded by USAID and implemented by the Environmental-Cooperation Asia project, two dozen dams will be built on Mekong tributaries by 2015 and another 40 to 50 by 2030, in addition to 11 planned hydropower projects on the mainstream of the river.[47] This makes cooperation on hydropower projects among the Mekong River countries necessary for responsible resource management.[48]

Millennium Challenge Corporation

A third effort at U.S. engagement was Washington's decision to establish the Millennium Challenge Corporation (MCC) in 2004 to encourage developing nations to improve governance and accountability in return for development financing and economic aid. Potential recipients are

45. U.S. Department of State, "Lower Mekong Initiative FAQ's," http://www.state.gov/p/eap/mekong/faq/index.htm.

46. "Clinton urges Myanmar to continue reforms," *Al Jazeera*, December 1, 2011, http://www.aljazeera.com/news/asia-pacific/2011/12/201112192944890286.html.

47. Robert Costanza et al., *Planning Approaches*, 10.

48. Rachel Vandenbrink, "'Turning Point' for Mekong Dams," *Eurasia Review*, March 12, 2012, http://www.eurasiareview.com/24032012-%E2%80%98turning-point%E2%80%99-for-mekong-dams/.

evaluated on the basis of their performance on a series of governance and accountability metrics. If a country meets these goals, the MCC will award it an individually tailored compact based on the country's unique domestic industries and development challenges.

Jakarta signed a $600 million compact with the MCC in November 2011 after Indonesia met its goals. The agreement included $332.5 million for a Green Prosperity Project designed both to increase Indonesians' standard of living by encouraging sustainable land-use decisions and resource management and to reduce reliance on fossil fuels by providing technical and financial assistance for renewable energy generation.[49] Since the agreement, the Indonesian government and the MCC have been negotiating specific projects that will be included in the Green Prosperity Project.

The United States also engages with the region financially through the Export-Import (Ex-Im) Bank and the Overseas Private Investment Corporation (OPIC). Congress chartered the Ex-Im Bank in 1945 with the purpose of financing foreign buyers of capital goods and services produced by U.S. companies. The renewal of that charter has become contentious lately;[50] some companies say that the bank's loans amount to an industrial policy through which the government is choosing sectors of the economy that will be "winners" and "losers" in violation of free-market principles.[51] In response, the bank argues that U.S. manufacturers are already competing at a disadvantage with heavily subsidized Chinese firms that also enjoy the benefit of an undervalued currency.[52] Congressional leaders reached a deal in May 2012 to extend the bank's charter for three years and gradually expand the line of credit that it is authorized to extend to customers from $100 billion to $140 billion.[53] Domestic producers of wind turbines, solar panels, and smart-grid technology could benefit from Ex-Im Bank financing for overseas projects.

OPIC is the U.S. government's development finance institution and provides financing and risk insurance for companies (usually small and medium enterprises) to engage in infrastructure and social development projects in less-developed countries. In the energy sector, OPIC finances relatively small hydroelectric, solar, and clean-energy projects.

International Financial Institutions and Development Aid

The World Bank, the IFC, and the ADB are also involved in improving the energy infrastructure of several of the ASEAN-5 nations. The World Bank is providing most of the financing for two hydroelectric projects: the Upper Cisokan project in Indonesia ($640 million) and the Trung Son dam in Vietnam ($330 million). Indonesia's geothermal energy capacity is also being tapped with

49. Millennium Challenge Corporation, "MCC and Indonesia: Investing in Innovation for Sustainable Economic Growth," March 22, 2012, http://www.mcc.gov/documents/press/factsheet-2011002094002-indonesiacompact.pdf.

50. Erik Wasson, "Schumer sees deal emerging on Ex-Im Bank," *On the Money: THE HILL's Finance & Economy Blog*, April 17, 2012, http://thehill.com/blogs/on-the-money/1005-trade/221979-schumer-sees-deal-emerging-on-ex-im-bank.

51. "Delta Embarrassed by Export-Import Bank Loan Guarantee While Lobbying against Agency," *Texas Insider*, April 13, 2012, http://www.texasinsider.org/?p=61001.

52. Brian Wingfield and Eric Martin, "Ex-Im Bank Critics Favor a Surrender on Trade, Chief Says," Bloomberg, April 12, 2012, http://www.bloomberg.com/news/2012-04-12/ex-im-bank-critics-favor-a-surrender-on-trade-chief-says.html.

53. Josh Mitchell, "House Leaders Reach Deal to Increase Export Lending," *Wall Street Journal*, May 4, 2012, http://online.wsj.com/article/SB10001424052702304020104577384320280024662.html.

the help of $175 million in financing for projects in South Sumatra and Manado. In Vietnam and the Philippines, the bank is increasing rural electrification with loans for upgrading infrastructure. The bank is also provided loans worth $80 million to help upgrade Indonesia's West Java natural gas distribution system.

The IFC, the World Bank Group's private sector financing arm, provides funding and financial services for private sector projects, including many energy, renewable-energy, and infrastructure projects. The corporation launched the Philippines Sustainable Energy Finance program in 2008 to provide loans for renewable-energy and energy-efficiency projects, and it has since renewed the program three times.[54] The IFC is also sharing the credit risk for $70 million of renewable-energy and energy-efficiency projects in Thailand.[55]

As part of a $200 million investment in Indonesia's infrastructure announced in May 2012, the IFC is providing a $75 million loan to a domestic bank to finance renewable-energy projects.[56] The IFC is a $25 million equity partner in a Malaysian and Singaporean private equity fund that finances renewable-energy projects in all of the ASEAN-5 countries.[57] The IFC is also financing several traditional-energy projects, including three investments in Salamander Energy, a firm focused on oil and gas exploration in Thailand and Indonesia.[58]

The ADB has worked to shift the energy in the region toward clean and renewable sources. The bank has organized the annual Asia Clean Energy Forum since 2006, bringing together experts, policymakers, and industry representatives. The ADB launched the Asia Solar Energy Initiative in 2010 to add 3,000 MW of solar generation to the energy mix of Thailand and other countries.[59] The bank is supplying up to $730 million to finance the upgrading of Vietnam's electricity transmission infrastructure.[60] The Philippines, Thailand, and Vietnam are also the beneficiaries of billions of dollars of financing through the ADB's Clean Technology Fund for low-carbon energy projects.[61]

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54. "BPI, IFC renew energy finance program," *Philippine Star*, April 10, 2012, http://www.philstar.com/Article.aspx?articleId=795400.

55. "IFC launches energy financing project in Thailand," *The Nation*, December 8, 2011, http://www.nationmultimedia.com/business/IFC-launches-energy-financing-project-in-Thailand-30171475.html.

56. "IFC to invest $200 million in RI projects," *Jakarta Post*, May 3, 2012, http://www.thejakartapost.com/news/2012/05/03/ifc-invest-200-million-ri-projects.html.

57. International Finance Corporation, "Maybank MEACP Clean Energy Fund: Summary of Proposed Investment," http://www.ifc.org/ifcext/spiwebsite1.nsf/ProjectDisplay/SPI_DP30176.

58. "IFC invests $25M in Salamander Energy projects," Reuters, January 14, 2009, http://www.abs-cbnnews.com/business/01/14/09/ifc-invests-25m-salamander-energy-projects.

59. Asian Development Bank, "ADB Vice-President Says Wider Solar Power Use Critical for Asia's Future Growth," May 20, 2011, http://www.adb.org/news/adb-vice-president-says-wider-solar-power-use-critical-asias-future-growth; Asian Development Bank, *Asia Solar Energy Initiative: A Primer*, April 2011, vi, http://www.adb.org/sites/default/files/pub/2011/solar-energy-initiative.pdf.

60. Asian Development Bank, "ADB $730 Million Loans to Help Viet Nam Remove Power Transmission Bottlenecks," December 16, 2011, http://www.adb.org/news/adb-730-million-loans-help-viet-nam-remove-power-transmission-bottlenecks.

61. Asian Development Bank, "ADB, Philippines Mark New Clean Energy Investment on Copenhagen Sidelines," December 18, 2009, http://www.adb.org/news/adb-philippines-mark-new-clean-energy-investment-copenhagen-sidelines.

Conclusion

The current energy environment and future energy trajectory of each of the ASEAN-5 is determined not solely by domestic, but also by external, factors. Trends at the global and regional level influence and determine energy use and policies in each of the countries. Factors such as trade, environment, and energy security dynamics all shape the ASEAN-5's energy path forward. Among the major external actors, regional institutions are growing increasingly important. ASEAN and APEC initiatives are both helping to boost energy market integration in the ASEAN-5. In addition, bodies like the MRC, LMI, and ADB are incentivizing green growth and offering a boost to voices calling for sustainable energy development, providing a much-needed balance to the region's long-standing focus on growth at any cost.

Regional and global trends play an unavoidable role in all domestic energy markets, and the ASEAN-5 are no different. Creating incentives for sustainable energy development is therefore beyond the ability of any of the ASEAN countries to accomplish on their own. That is why regional organizations like ASEAN and APEC, as well as international bodies like the ADB and World Bank, are playing such and increasingly critical role in boosting green growth around the region. The next section will offer recommendations for the ASEAN-5 to pursue sustainable energy sector development, as well as for international actors and the United States in particular to help incentivize that development.

3 POLICY RECOMMENDATIONS

The energy environment and policies of the ASEAN-5 have giant implications not only for the global environment, but also for the U.S. companies vying for a share of the billions of dollars in energy equipment these countries will import in the years ahead. The ASEAN-5 governments have all developed plans for how they intend to meet their future energy needs. But before U.S. firms will invest their own capital in energy projects they will need to be reassured by a strong commercial and legal infrastructure, secure rule of law, and the potential for stable returns on investment in the ASEAN-5. Based on our analysis, we have several recommendations for both regional policymakers and the United States.

Regional Policymakers

Energy policymakers in the ASEAN-5 are moving roughly in the right direction. The bigger question is if they are moving quickly enough. Energy efficiency standards and smart grids are relatively passive ways to squeeze more out of the energy mix, but they require long-term investments in building institutional capacity. The Trans-ASEAN Gas Pipeline network and the ASEAN Power Grid are beginning to fall into place, albeit slowly and in a piecemeal fashion. Most of the ASEAN-5 nations recognize that reducing or eliminating fuel and electricity subsidies is a policy imperative, but short-term domestic political priorities hinder execution. Fostering a stable investment environment would be hugely beneficial in the energy sector, but it is not a high priority in some of the ASEAN-5 countries. Below are our specific recommendations for ASEAN-5 and other regional policymakers.

- Move toward market pricing.

  Governments in the region should consider reducing, and eventually cutting altogether, their subsidies on energy. The governments of Indonesia, Malaysia, Thailand, and Vietnam all spend more than 2 percent of their GDP on subsidies for oil, gas, coal, and/or electricity. These subsidies distort market prices for energy, reduce the incentives for conservation, deprive energy utilities and government budgets of revenue that could be used to improve energy infrastructure, and use scarce budgetary dollars that could be more effectively directed to targeted social spending. In each country, political and economic realities make maintaining subsidies a convenient course of action in the short term, but the long-term costs of the subsidies make moving toward market prices critically important.

- Create a stable investment environment.

  The ASEAN-5 governments should work to ensure a strong investment climate. International oil and gas companies are hesitant to make significant capital investments in upstream projects

when the terms of production-sharing contracts are not ironclad. Governments may be tempted to press companies to renegotiate the terms of these contracts, including capping recovery costs, to obtain a larger share of the revenue, but doing so poisons the investment environment and depresses future prospects for exploration and production. Regulatory and investment instability may not have caused the decline in Indonesia's oil production in the last two decades, but they are widely believed to have been important contributing factors.

- Improve the energy efficiency of coal power generation.

  Coal is and will remain a major source of electricity generation in Indonesia, Thailand, and Vietnam for the foreseeable future. Boosting the efficiency of coal-fired power plants is an important way to produce energy savings and decrease greenhouse gas emissions. Governments in the region must find ways to boost the efficiency of coal power plants, such as by reducing the heat that is unproductively radiated during the electricity generation cycle. Upgrades to the thermal efficiency of coal-fired power plants can be promoted in a number of ways, including via the Clean Development Mechanism under the Kyoto Protocol; with a combination of public, private, and international financing; and by making heat rates a factor in the pricing section of contracts for producers. Coal-based utilities should strive to apply cleaner coal technologies; doing so may entail higher initial capital costs, but it will lower overall life-cycle costs and bring greater environmental benefits.

- Develop energy efficiency standards for appliances, automobiles, and buildings.

  The ASEAN-5 could boost their energy efficiency and savings by introducing new energy standards and strengthening existing standards for buildings, appliances, and automobiles. Consumers will purchase more household appliances and automobiles as living standards and disposable incomes continue to grow in the region. Well-formulated energy-efficiency standards on appliances and fuel-economy standards on cars are an important way to build energy efficiency into the daily lives of consumers. Efficiency standards in building codes and construction materials can also save significant energy over the lifetime of a building.

  Governments should consider introducing mandatory energy-efficiency standards in cooperation and dialogue with regional and international appliance, automobile, and building materials manufacturers. Currently, energy-efficiency standards in the region are largely voluntary and, where mandatory, are poorly enforced. Transparent laboratory testing and standards certification should be integrated into the manufacturing, construction, and permitting processes at the national level. Appliance labeling will help consumers make more informed decisions about which appliances and automobiles will help them save money on their electricity and fuel bills.

  Developing the institutional capacity for crafting international standards, certification, and labeling schemes can be challenging. The payoff, however, could be found not only by facilitating domestic residential and commercial energy savings but also by enabling appliances and building materials from Southeast Asia to be exported to foreign markets that follow the stricter international standards.

- Establish smart grids.

  The ASEAN-5 countries will benefit from increased energy efficiency if they step up their efforts to establish smart grids. Each of the ASEAN-5 countries, with the exception of Malaysia, is weighing the benefits of or is currently pursuing smart-grid technology. The cost-benefit analysis of creating a smart grid is complex, and countries must weigh difficult-to-measure costs, such as the productivity lost through power outages and the dangers of energy dependence, against benefits that include decreased greenhouse gas emissions and improved capacity.

  A regional smart grid would add another level of complexity to the creation of the ASEAN Power Grid. Although such advanced systems of ASEAN connectivity may be some time off, however, it is important to keep them in mind as ASEAN begins to reach toward its connectivity goals and increased economic integration in 2015 and beyond.

- Step up efforts to build the Trans-ASEAN Gas Pipeline and ASEAN Power Grid.

  The ASEAN-5 countries should continue exploring the construction of the Trans-ASEAN Gas Pipeline and ASEAN Power Grid. ASEAN as an organization operates by consensus, and its structure does not lend itself easily to the kind of sizeable physical connectivity projects that are needed in the energy sector. Nonetheless, ASEAN officials recognize that connectivity will serve the economic interests of the region as it pursues higher standards of living for Southeast Asians.

  To be sure, economic viability is necessarily the measure by which potential pipeline and grid projects are considered and built. The economics of natural gas has changed significantly in recent years, with the boom in U.S. production of shale gas and world natural gas prices dropping to their lowest levels in years. This undoubtedly will affect the cost-benefit calculations of natural gas projects in Southeast Asia and around the world.

- Develop and strengthen a dispute resolution mechanism to resolve differences over use of the Mekong River's resources for energy production.

  Laos' apparent resumption of construction of the Xayaburi Dam to the frustration of Cambodia and Vietnam, not to mention its plans to build 10 other mainstream dams, suggests that these riparian countries urgently need to develop an effective dispute resolution mechanism to address differences that emerge from their conflicting energy needs and priorities. Laos should commit to stop work on all dams on the main branch of the Mekong until an impartial environmental impact study has been completed and an effective dispute resolution mechanism established, likely under the Mekong River Commission.

- Clarify claims and work toward dispute resolution in the South China Sea.

  Since 2002, a declaration of conduct in the South China Sea between China and ASEAN has given the claimants a rough and non-binding set of rules to abide by to avoid exacerbating disagreements over territorial disputes in the South China Sea. Attempts to negotiate a binding code of conduct have come up against conflicting methods of dispute resolution between China and ASEAN. ASEAN calls for multilateral negotiations and presented its own version of a code of conduct to China at the ASEAN Ministerial Meetings in July 2012. China meanwhile

calls for bilateral engagement and refuses to negotiate with the Southeast Asian nations as a group.

All the claimants have ratified the UN Convention on the Law of the Sea, but China refuses to bring its maritime claims in line with the treaty or recognize the exclusive economic zones its guarantees the Southeast Asian claimants. Instead, China makes vast claims in the South China Sea based on historical evidence. Vietnam, the Philippines, Malaysia, and Brunei should bring all of their claims in-line with the Law of the Sea, including by codifying in law which islands and features in the sea they claim and which, if any, they consider habitable, then submitting their maritime claims to the UN Commission on the Limits of the Continental Shelf. This will provide clarity for oil and gas companies interested in operating in the South China Sea and will place the onus on China to clarify its claims in line with international law.

A more stable diplomatic and military environment in the South China Sea will be necessary before hydrocarbons in these disputed waters can be fully exploited. In the end, however, joint exploration of resources in the disputed waters may be the most viable path toward exploiting these resources, an option that has offered mixed results when tried among the Southeast Asian parties and abject failure when sought with China.[1]

- Share expertise to promote renewable energy development.

  The ASEAN-5 have established goals and instruments to promote the development of renewable energy, but the robustness and effectiveness of these programs varies widely. All the countries recognize the vital role renewables must play in their future energy mix as consumption continues to outstrip the production of traditional hydrocarbons and as climate change and environmental concerns become increasingly urgent.

  Thailand and Malaysia have been particularly active in establishing tools to promote the development and competitiveness of renewable energies, but Indonesia, the Philippines, and Vietnam have also begun to implement such strategies. Each country's strategy will need to be tailored to its unique physical, socioeconomic, and energy landscape, but all will need some mixture of fiscal and non-financial incentives, including preferential grid access, feed-in tariffs, tax breaks and holidays, and guaranteed access to credit, among others. Regional policymakers should look to their neighbors' experience to see what would best serve their needs.

- Continue to decrease barriers to trade in environmental goods and services.

  APEC and the TPP are currently the most dynamic trade architectures in the region. The ASEAN-5 and the United States should cooperate in these forums to reduce tariffs on energy and on environmental goods and services.

U.S. Policymakers

The United States has several options for aligning its interests with the ASEAN-5 and supporting the achievement of their energy goals. Empowering the State Department's Bureau of Energy

1. Manuel Mogato, "Philippines rules out joint exploration in disputed Reed Bank," Reuters, July 1, 2011, http://www.reuters.com/article/2011/07/01/philippines-southchinasea-idUSL3E7I10T320110701.

Resources will make energy a driving factor, instead of an afterthought, in crafting U.S. foreign policy toward the region. The Ex-Im Bank and OPIC can both serve as conduits for U.S. trade with Southeast Asia and contribute to job creation in the United States by promoting the sale of energy and environmental goods and services. At the same time, U.S. products can help the ASEAN-5 move toward a greener energy profile, curbing greenhouse gas emissions while still meeting their need for increased supplies of energy. What follows are recommendations for U.S policymakers.

- Better focus and fund Department of Energy cooperative activities.

  Much has been made of the U.S. foreign policy rebalance toward Asia and what the role of the Department of Energy (DOE) should be within this new policy focus. While DOE has established specific goals for its work in Southeast Asia, it has limited personnel capacity to achieve all of its objectives. DOE should do three things.

  First, it should map each initiative across an axis of effort and probability of success and determine which goals have the highest likelihood of success. This would help DOE determine where best to allocate its scarce resources. Second, DOE should evaluate what mechanisms have been the most successful and productive and prioritize its engagements to advance U.S. energy priorities in the region. Finally, sufficient resources should be provided to help DOE successfully complete these priorities. These programs should be well coordinated with other U.S. government efforts in the region, including those of the U.S. Agency for International Development and the State Department's new Bureau of Energy Resources.

- Continue to renew the Ex-Im Bank's charter and expand lending.

  The U.S. Congress should boost funding for the Ex-Im Bank so that it can help U.S. companies compete in Southeast Asia. The bank was given a renewable charter in 1945 with the purpose of financing foreign buyers of capital goods and services produced by U.S. companies.

  President Barack Obama pledged to double exports during his first term in office. Expanding the Ex-Im Bank's lending could help achieve this goal with the export of environmental goods and services. Domestic producers of wind turbines, solar panels, and smart grid technology could benefit from Ex-Im financing for overseas projects. This would help create more green jobs, another of the president's objectives.

  Renewing the Ex-Im Bank's charter and expanding its lending is only part of the solution. Since 2008, Congress has mandated that the bank lend 10 percent of its financing to purchasers of renewable energy and energy efficient technology, but it has fallen short of meeting that target.[2] The new pool of capital made available by the May 2012 congressional deal should be used to meet the mandated level of financing for these products.

- Boost the activities of OPIC.

  Currently, the Chinese, Korean, and Japanese governments are assembling competitive energy infrastructure proposals to submit to Southeast Asian governments that are eager to increase power generation, distribution, and transmission capacity. These proposals are comprehensive

2. Travis Lowder, "The United States Export-Import Bank and Renewable Energy Finance," National Renewable Energy Laboratory, December 5, 2011, https://financere.nrel.gov/finance/content/united-states-export-import-bank-and-renewable-energy-finance.

packages that include the lending, insurance, and construction for turnkey power plants and major energy infrastructure projects.

The U.S. government has not been as proactive as its competitors in coordinating efforts between the private sector, Ex-Im Bank, and OPIC. Washington should address this by increasing export credit arrangements and development lending to better promote the involvement of the U.S. private sector in significant infrastructure projects in Southeast Asia. This could help economies in the region move toward greater energy independence and sustainability while creating more U.S. jobs and furthering U.S. foreign policy goals.

- Increase funding for the Lower Mekong Initiative.

  The LMI is an important forum for increasing regional cooperation between the countries in the Lower Mekong Basin. It is also an effective tool for U.S. engagement with the region. As the ongoing issue of the Xayaburi Dam in Laos illustrates, the need for multilateral initiatives to discuss transnational infrastructure and environmental issues will likely become more pressing in the years ahead. Although the majority of U.S. funding for the LMI is allocated to health programs, increased resources could help facilitate more research and planning for hydropower projects in the region.[3] Secretary of State Hillary Clinton announced during the LMI meeting in Phnom Penh in July 2012 that the United States would provide an additional $50 million to fund projects in health, infrastructure, education, and the environment. This is a good start, but much more should be done to meet the challenges of sustainable development and energy generation along the Mekong River.

- Explore possibilities for more energy projects through MCC compacts.

  The MCC's Green Prosperity Project was crafted to support Indonesia's efforts to achieve environmentally sustainable growth. While MCC compacts are uniquely tailored to each country, the Green Prosperity Project could serve as a model for similar compacts with the Philippines and other members of the ASEAN-5. Energy sustainability should be integrated into future compacts awarded through the MCC and funding for these kinds of projects should be increased.

3. Merle David Kellerhals Jr., "Clinton Promotes Priority of Lower Mekong Initiative," *IIP Digital*, July 22, 2011, http://iipdigital.usembassy.gov/st/english/article/2011/07/20110722155134elrem0.9994928.html#axzz1vXWCANbU.

ABOUT THE PROJECT DIRECTOR AND AUTHORS

About the Project Director

Ernest Z. Bower is senior adviser and chair for Southeast Asia Studies at CSIS in Washington, D.C. He is also president and CEO of Bower Group Asia, a well-known business advisory firm. Before forming his company, he served for a decade as president of the U.S.-ASEAN Business Council, a top private business group composed of America's leading companies in Southeast Asia. For more than 20 years, he helped to establish and build the council from the ground level, working with government and private-sector leaders from the United States and Southeast Asia.

About the Authors

Murray Hiebert is senior fellow and deputy director of the Chair for Southeast Asia Studies at CSIS. Before joining CSIS, he was senior director for Southeast Asia at the U.S. Chamber of Commerce, where he worked to promote trade and investment opportunities between the United States and Asia. He joined the U.S. Chamber in 2006 from the *Wall Street Journal*'s China bureau, where he covered trade, intellectual property rights, and China's accession to the World Trade Organization. Before his posting in Beijing, he worked for the *Wall Street Journal Asia* and the *Far Eastern Economic Review* in Washington. His previous postings included Malaysia, Singapore, Vietnam, and Thailand.

David L. Pumphrey is a senior fellow and co-director of the CSIS Energy and National Security Program. He has extensive public-sector experience in international energy security issues. He was most recently deputy assistant secretary for international energy cooperation at the Department of Energy. Pumphrey received a B.A. in economics from Duke University and an M.A. in economics from George Mason University. He has spoken extensively on international energy issues and testified before Congress on energy security issues related to China and India.

Gregory B. Poling is a research associate with the Chair for Southeast Asia Studies at CSIS, where he manages projects that focus on U.S. foreign policy in ASEAN countries. His current research interests include disputes in the South China Sea, democratization in Southeast Asia, and Asian multilateralism. Before joining CSIS, he lived and worked in China as an English language teacher. He received an M.A. in international affairs from American University, a B.A. in history and philosophy from Saint Mary's College of Maryland, and studied at Fudan University in Shanghai.

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