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Strengthening Emerging Asia's Power Sector

By

The National Bureau of Asian Research

For

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Strengthening Emerging Asia's Power Sector

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Executive Summary

This report explores key challenges and strategic opportunities for strengthening power sector outlooks in South and Southeast Asia. In doing so, it aims to identify potential needs, requirements, and roles for greater US, Japanese, and East Asia Summit engagement.

Main Argument

Growth in electricity demand in South and Southeast Asia is amongst the fastest in the world. Yet questions remain about how countries across this region might be able to individually or collectively meet their demand requirements, while also navigating complex economic, environmental, and energy security considerations. Success will largely depend on the ability of countries to address unmet infrastructure, human capacity, and investment needs across the region and leverage existing or new opportunities for collaboration at the national, regional, and international levels.

Policy Implications

- To strengthen human capacity and resources, three challenges will need to be addressed at the individual level: reluctance to change (whether due to the influence of trade unions or other incentives to maintain the status quo), inability to grasp new knowledge, and poor retention of trained employees.
- To mitigate localised risks and spur inbound investment in energy infrastructure and production, countries can take numerous steps to improve their market fundamentals. These include adopting a more open trade and investment policy in energy distribution, accelerating low-carbon investments via targeted activities in Covid-19 stimulus packages, and rethinking tax structures around investment in cross-border energy infrastructure.
- The 'free and open Indo–Pacific' concept, initiated by Japan, has positively contributed to efforts to advance digital connectivity, infrastructure, and energy security in emerging Asia through several means (including via cooperation with the United States and Australia) and should continue to inform efforts to enhance regional prosperity.
- In terms of how the East Asia Summit and initiatives such as the Indo–Pacific strategy can better respond to regional interests, a number of regional countries (including Indonesia and Thailand) have detailed their own priorities for strengthening bilateral and multilateral coordination. These include expanding soft-loan multilateral funding, promoting debt-swapping initiatives, and enhancing a blended financing scheme (e.g., philanthropic and private funds).

Chapter 1

Introduction

South and Southeast Asia are experiencing some of the fastest-growing electricity demand in the world. Between 2016 and 2050, the Institute of Energy Economics, Japan (IEEJ) estimates that electricity consumption in Southeast Asia will grow by 2,093 terawatt-hours (TWh), which is an increase of roughly 245%.[1] Meanwhile, in South Asia, India alone will increase its consumption by 3,992 TWh on its way to becoming an electricity market rivaling the United States in 2050.[2]

Finding ways to meet this demand is essential to sustaining economic development and improving standards of living in the region. Yet the ways in which countries might seek to address their demand requirements can also raise new market, geopolitical, environmental, and energy security concerns. This report is the product of a larger project conducted by the National Bureau of Asian Research (NBR) for the Energy Research Institute Network (ERIN) on 'Strengthening Emerging Asia's Power Sector: Needs, Requirements, and Potential Roles for East Asia Summit Engagement.'[3]

The report builds on expert interviews and a workshop hosted in January 2021 (see **Appendix II**), as well as research conducted by NBR through other ongoing energy initiatives, such as the Energy Security Program and a project on the US government's Asia EDGE initiative. This research and programming complemented the ongoing efforts of ERIN's 'commitment to work on the next generation of energy policies that support the long-term energy sector aspirations of the EAS [East Asia Summit] countries' (see **Appendix III** for the full 1st ERIN Statement on the East Asia Energy Forum).

Activities in this project were designed to explore key challenges and strategic opportunities for strengthening the outlook for power sectors in South and Southeast Asia with the aim of identifying potential roles for enhanced US, Japanese, and EAS engagement. Given the notable shift in US policy following the election of Joe Biden as president, this report also includes specific context for how US engagement may change under the Biden administration. What are the major risks and obstacles that South and Southeast Asian efforts face? How can stakeholders from a wide range of country and professional backgrounds work together to catalyse inbound investment, promote

[1] IIEJ, 'IEEJ Outlook 2019,' October 2018, https://eneken.ieej.or.jp/data/8122.pdf.
[2] Ibid.
[3] ERIN was established to support the Economic Research Institute for ASEAN and EAST Asia (ERIA) by providing data, information, and research on East Asia Summit countries' energy policies; disseminating research outcomes to policy and research leaders; and supporting ERIA's capacity-building programming. ERIN currently comprises organisations representing Australia, Brunei Darussalam, Cambodia, China, India, Indonesia, Japan, Lao PDR, Malaysia, Mongolia, Myanmar, New Zealand, Philippines, Republic of Korea, Singapore, Thailand, United States, and Viet Nam. Additional information on ERIN's goals and activities is available at https://www.eria.org/about-us/eria-energy-research-institutes-network.

market reforms, and heighten collective energy security? Who are the natural and necessary partners in this process?

Section one overviews major trends in South and Southeast Asia's growing demand for electricity, noting implications for efforts to strengthen the power sector in this region. Sections two through five then examines four challenges in greater depth. Building on this analysis, section six discusses several national and multilateral strategies that align with these concerns and that might be amplified or further refined to better address the expressed priorities of specific countries. Policy changes are occurring in the United States that are relevant to these issues and have implications for power sector development in Asia. These are examined further in **Appendix I**. Both the workshop and discussions during the previous six months emphasised that the new US administration will likely have a notable impact on how partnerships can achieve national strategies. The report concludes by considering policy options for new or enhanced EAS engagement.

Chapter 2

Background: Growing Demand for Electricity in South and Southeast Asia

South and Southeast Asia's projected growth in electricity demand tracks with this region's overall economic transformation, with greater industrial activity, novel applications in agriculture and transportation, and rising per capita income spurring new consumption.[4] However, as **Table 1** suggests, additional drivers behind the region's demand growth vary widely on a country-by-country basis. For some countries, such as India, Cambodia, Lao PDR, and Myanmar, a key factor is the ongoing task of extending basic access to electricity to a sizeable share of their respective populations. The Energy and Resources Institute in India has done extensive research and modeling in this space and has noted that for India, in particular, electrification and transmission across states present an additional challenge when each of the states are at various stages of development.[5] Other countries, such as Indonesia and Viet Nam, are closer to or have already achieved universal access to electricity, but are nonetheless undergoing robust economic growth or other demographic changes that are adding to their total demand requirements.

Meanwhile, the fact that the level of national development, population size, and patterns in consumption vary widely between countries means that not all these changes equally shape regional outlooks. For example, as of 2020, over 80% of total electricity demand in Southeast Asia came from just four countries: Indonesia, Viet Nam, Thailand, and Malaysia.[6] Looking out to 2050, this imbalance is expected to continue, though with Malaysia's and Thailand's relative weight diminishing and the Philippines' growing.[7] Similar trends can be observed in South Asia, where demand from India dramatically outstrips that of its neighbors (though with greater demand requirements from a growing Pakistan and a geographically small yet densely populated Bangladesh expected by midcentury).[8]

[4] Shigeru Kimura and Han Phoumin, eds., 'Energy Outlook and Energy Saving Potential in East Asia 2019,' ERIA, https://www.eria.org/uploads/media/0.Energy_Outlook_and_Energy_Saving_Potential_2019.pdf.

[5] A.K. Saxena et al., 'Transitions in Indian Electricity Sector 2017–2030,' The Energy and Resources Institute, February 2017, 3, https://www.teriin.org/files/transition-report/mobile/index.html#p=3.

[6] Courtney Weatherby, 'Renewable Energy in Southeast Asia,' in 'Powering Southeast Asia: Meeting the Region's Electricity Needs,' National Bureau of Asian Research (NBR), NBR Special Report, December 2020, https://www.nbr.org/wp-content/uploads/pdfs/publications/sr89_poweringsoutheastasia_dec2020.pdf.

[7] Kimura and Han, 'Energy Outlook and Energy Saving Potential in East Asia 2019.'

[8] Robert F. Ichord, 'Transforming the Power Sector in Developing Countries: Geopolitics, Poverty, and Climate Change in Bangladesh,' Atlantic Council, January 9, 2020, https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/transforming-the-power-sector-in-developing-countries-geopolitics-poverty-and-climate-change-in-bangladesh/.

Table 1: Access to Electricity

Country	1990			2000			2012			2018
	Rural	*Urban*	*National*	*Rural*	*Urban*	*National*	*Rural*	*Urban*	*National*	*National*
Cambodia	5.0	36.6	19.2	9.0	49.9	16.6	18.8	91.3	31.1	91.5
Myanmar	.	.	.	.	.	.	.	.	32*	66.3
Lao PDR	39.7	100.0	51.5	40.0	68.7	46.3	54.8	97.9	70	97.9
Brunei Darussalam	56.4	70.5	65.7	61.2	72.7	69.4	67.1	79.0	76.2	100
India	38.7	86.5	50.9	48.4	98.6	62.3	69.7	98.2	78.7	95.2
Indonesia	.	.	66.9	.	.	.	.	.	74**	98.5
Viet Nam	84.5	100	87.9	86.6	96.9	89.1	97.7	100.0	99	100
Philippines	46.4	85.5	65.4	51.9	92.3	71.3	81.5	93.7	87.5	94.8
Malaysia	89.2	97.3	93.2	93.0	98.5	96.4	100	100	100	100
Singapore	99	100	100	99	100	100	99	100	100	100
Thailand	82	75.2	80	87.0	72.6	82.5	99.8	100	100	100
Australia	100	100	100	100	100	100	100.0	100	100	100
China	92.0	100.0	94.2	95.3	100	98	100.0	100	100	100
Rep. of Korea	92.0	95.0	94.2	95.3	98.7	98	100	100	100	100
Japan	100	100	100	100	100	100	100	100	100	100
New Zealand	100	100	100	100	100	100	100	100	100	100
United States	100	100	100	100	100	100	100	100	100	100

Note: * The number was taken from the presentation of Khin Seint Wint, Renewable Energy Association of Myanmar, 2014. ** The number was taken from 'ASEAN Guideline on Off-grid Rural Electrification Approaches,' ASEAN Center for Energy, 2013.
Source: World Bank, 'World Development Indicators,' 2021; and Kimura and Han, 'Energy Outlook and Energy Saving Potential in East Asia 2019.'

1. Implications

Keeping in mind this level of subregional variation, two general observations about the outlook for power sectors in South and Southeast Asia should be noted at the outset. The first is that for many of the region's economies, a first order challenge remains securing reliable and affordable access to necessary energy supplies. For several countries – particularly those in Southeast Asia – this also means grappling with the added implications of shifting trade dynamics and becoming a net importer for the first time in history.[9]

Indonesia was once the largest supplier of liquefied natural gas (LNG) in the world before it began importing the fuel in 2012. Malaysia remains one of the largest producers of LNG, but it too has been increasing imports to keep up with rising demand, a trend that is also occurring in Thailand. In a recent report by the Oxford Institute of Energy Studies, it is estimated that Indonesia, and potentially Malaysia as well, may stop LNG exports altogether after 2035 if no new offshore or nonconventional production projects are pursued.[10] Elsewhere in the Indo–Pacific, Japan, and the Republic of Korea remain almost completely dependent on fossil fuel imports, while Australia and the United States have been providing needed supply diversification for the region (see Appendix I for additional context on the outlook for US natural gas policy).

The rise of national strategies to achieve carbon neutrality by midcentury pose new questions for how countries will source their energy and power needs. Such dynamics can create powerful anxieties that, if not well-managed, could further contribute to rising resource nationalism and geopolitical tension.[11] Moreover, with major cities across the region seeing rapidly worsening air pollution, many South and Southeast Asia governments are increasingly interested not only in securing more energy supplies but also in revisiting their strategies for managing energy demand and CO_2 emissions.

The second observation is that booming electricity demand has already put immense pressure on existing power grids and transmission infrastructure. This is something that has, at times, triggered blackouts in India, Thailand, and the Philippines.[12] Demand for improved access to electricity is based in part on the logic that such access will result in better socioeconomic outcomes, improving the quality of life and the income of a country's people.

As studied by the World Bank, blackouts undermine social, health, and economic advancement by reducing the ability for children to learn at home, forcing families to use kerosene or other fuels that increase indoor air pollution, and requiring businesses to rely

[9] Han Phoumin, 'The Need for Quality Infrastructure to Meet Rising Energy Demand in the ASEAN Region,' in 'Powering Southeast Asia,' 33.

[10] Mike Fulwood, James Henderson, and Ieda Gomes et al., 'Emerging Asia LNG Demand,' Oxford Institute for Energy Studies, September 2020, 37, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/09/Emerging-Asia-LNG-demand-NG-162.pdf.

[11] Clara Gillispie, 'US–Australia Energy Cooperation in the Indo–Pacific,' NBR, January 10, 2020, https://www.nbr.org/publication/u-s-australia-energy-cooperation-in-the-indo-pacific.

[12] Fan Zhang, 'In the Dark: How Much do Power Sector Distortions Cost South Asia,' World Bank, December 12, 2018, https://openknowledge.worldbank.org/bitstream/handle/10986/30923/9781464811548.pdf.

on generators during power outages or electricity rate hikes.[13] Addressing blackouts and unreliable electricity access has become a key rallying cry for many countries, with massive gains made since the turn of the century across developing Asia. According to the International Energy Agency (IEA), Southeast Asian nations have brought electricity to millions of their citizens in the past twenty years.[14] In India the story is even more dramatic. Two-thirds of developing Asia's new electricity connections have been built in India since 2000.[15]

While these expansions of access are an extraordinary success, the next step of securing a more reliable and consistent electricity supply is a necessary one to achieving the ultimate goal of developing a country's economy and improving quality of life. Researchers have suggested that the quality of electricity can have over twice the impact on household wellbeing and economic output as simply connecting the consumer to the grid.[16] One study of Bangladesh's electricity sector found that, even without taking into account the benefits of better conditions for education and the empowerment of women, the country's rural households would see $480 million in increased annual income if power supply became constant.[17] To provide the full benefits of expanded access, governments must ensure that grids are able to deliver power consistently to consumers.

Grid-level investments, market reforms to attract foreign investment, and other country-wide efforts are important to improving access, but the 'last mile' of connectivity can be a stumbling block in achieving desired outcomes. Analysis of electricity quality in India has shown significant disparities even between households in the same village, alongside regional variations.[18] Additionally, households that struggled to register or receive other forms of government aid appeared similarly unable to benefit from electrification efforts, leaving some of the most vulnerable citizens out of programs aimed at improving their quality of life. This suggests that national-level efforts should use intrastate partnerships, down to the grassroots level, to ensure widespread success of efforts to improve electricity access and quality.

And while such strains are not exclusive to developing Asia, it is worth noting that the Asian Development Bank (ADB) and other stakeholders have long suggested that the region is likely to disproportionately experience the worst effects of global climate change. In particular, events such as increasingly frequent droughts (which reduce

[13] Zhang, 'In the Dark,' 2.

[14] International Energy Agency (IEA), 'Electricity Access Rates across Southeast Asia, 2000–2040,' December 2019, https://www.iea.org/data-and-statistics/charts/electricity-access-rates-across-southeast-asia-2000-2040.

[15] IEA, 'SDG7: Data and Projections,' October 2020, https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity.

[16] Ujjayant Chakravorty, Martino Pelli, and Beyza Ural Marchand, 'Does the Quality of Electricity Matter? Evidence from Rural India,' *Journal of Economic Behavior and Organization* 107 (A) (2014): 228–47, https://www.sciencedirect.com/science/article/pii/S0167268114001164?via%3Dihub.

[17] Hussain Samad and Fan Zhang, 'Heterogeneous Effects of Rural Electrification: Evidence from Bangladesh.' World Bank, 2017, http://documents.worldbank.org/curated/en/904491497275742546/pdf/WPS8102.pdf.

[18] Michaek Keppler, Thomas Lutken, and Sumin Wang, 'Understanding Patterns and Impacts of Electricity Quality and Access in Northern India,' Duke University, 2019.

hydroelectric potential) or the destruction caused by earthquakes or cyclones can exacerbate existing strains on power sector infrastructure.[19] Consequently, for many countries in the region, strengthening access to electricity will require not only a dramatic expansion of new infrastructure but also improvements to the overall sustainability, health, and resilience of existing systems.

A third consideration lies in individual and regional plans for clean energy transitions, as countries seek to meet climate mitigation and adaptation plans outlined at the Conference of the Parties in Paris in 2015. In order to offset the most severe effects of climate change, these plans for achieving carbon neutrality, meeting nationally determined contributions (NDCs), or establishing cleaner energy mixes have become critical aspects of policymaking and national strategies for trade and economic development. NDCs and carbon-neutral policies vary across the region to align with domestic capabilities and resources, as illustrated by the following examples.

1.1. Association of Southeast Asian Nations (ASEAN)

Rather than a specific plan for carbon neutrality, member states have agreed to reduce the energy intensity of their economies by 21.9% as part of the ASEAN Joint Statement on Climate Change.[20] Additionally, the statement emphasises the importance of climate mitigation efforts and calls on developed nations to fulfill their promises under the Paris Agreement to help avert the most disastrous effects of climate change in developing countries. Several countries, including Cambodia, Thailand, and Viet Nam, have submitted revised NDCs that aim to both navigate the additional burdens caused by Covid-19 and increase the targets set in their original documents.[21]

1.2. China

President Xi Jinping announced in September that China will aim to peak its CO_2 emissions by 2030 and achieve carbon neutrality by 2060. At its 14th Five-Year Plan meeting early in 2021, the Chinese Communist Party proposed cutting both energy and CO_2 per unit GDP by 13.5% and 18%, respectively.[22] China is investing heavily in nuclear power and third-generation facilities to achieve these goals. Moreover, despite setting no concrete targets at the meeting, the country continues to see solar and wind capacity grow.

[19] Asian Development Bank (ADB), *Climate Risk and Adaptation in the Electric Power Sector* (Mandaluyong City: ADB, 2012), https://www.adb.org/sites/default/files/publication/29889/climate-risks-adaptation-power-sector.pdf.

[20] Association of Southeast Asian Nations (ASEAN), 'ASEAN Joint Statement on Climate Change to the 25th Session of the Conference of the Parties to the United Nations Framework, Convention on Climate Change,' November 2, 2019, https://asean.org/storage/2019/11/2-ASEAN-Joint-Statement-on-Climate-Change-to-the-UNFCCC-COP-25.pdf.

[21] UN Framework Convention on Climate Change, 'NDC Registry: The Latest Submissions,' https://www4.unfccc.int/sites/ndcstaging/Pages/LatestSubmissions.aspx.

[22] Shi Yi, 'The 14th Five Year Plan Sends Mixed Message about China's Near-Term Climate Trajectory,' China Dialogue, March 8, 2021, https://chinadialogue.net/en/energy/the-14th-five-year-plan-sends-mixed-message-about-chinas-near-term-climate-trajectory.

1.3. India

India has not instituted a carbon neutrality goal yet, though pressure has been mounting in the past year for Prime Minister Narendra Modi to do so. India's NDC under the Paris Agreement focuses on emissions intensity per GDP, aiming to cut this ratio by 33%–35% from 2005 levels by 2030, and to increase non-fossil fuel capacity to about 40% by that year.[23] Though slowed by the coronavirus pandemic, India's target of 175 gigawatts (GW) of renewable capacity by 2022 has spurred progress toward this goal.

1.4. Japan.

In October 2020, Japan's recently elected prime minister Yoshihide Suga announced that the country would achieve carbon neutrality by 2050. He followed the announcement by releasing the 'Green Growth Strategy Through Achieving Carbon Neutrality' in December.[24] This strategy includes a particular emphasis on the electricity sector, which accounts for 37% of the country's greenhouse gas emissions. Power sector decarbonisation aims for a balance of increasing the share of renewables (approximately 50%–60% as a target by 2050), upgrading and ensuring the safety of existing nuclear capacity, and offsetting some thermal power through carbon capture, utilisation, and storage. For other sectors of the economy where electrification is difficult, the strategy pushes for 'recycled carbon' technologies.[25]

1.5. Republic of Korea.

The Republic of Korea has an integrated strategy for achieving carbon neutrality by 2050 by 'creating synergies between the Green New Deal and the Digital New Deal, the pillars of the Korean New Deal.'[26] In addition to expanding the use of renewable energy and improving efficiency, the plan calls for expanding the role of hydrogen across the economy and improving carbon removal technologies. The Republic of Korea also is pursuing broader sustainability in its industrial sector through use of a circular economy.

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[23] Chloe Farand, 'Under Diplomatic Pressure, India Considers Net Zero – but Major Hurdles Remain,' Climate Home News, February 18, 2021, https://www.climatechangenews.com/2021/02/18/diplomatic-pressure-india-considers-net-zero-major-hurdles-remain.

[24] Ministry of Economy, Trade and Industry (Japan), ''Green Growth Strategy Through Achieving Carbon Neutrality' Formulated,' December 25, 2020, https://www.meti.go.jp/english/press/2020/1225_001.html.

[25] 'Overview of Japan's Green Growth Strategy Through Achieving Carbon Neutrality in 2050,' presentation by the Ministry of Economy, Trade and Industry (Japan), January 2021, https://www.meti.go.jp/english/press/2020/pdf/1225_001a.pdf.

[26] Government of the Republic of Korea, '2050 Carbon Neutral Strategy of the Republic of Korea: Towards a Sustainable and Green Society,' December 2020, https://unfccc.int/sites/default/files/resource/LTS1_RKorea.pdf.

1.6. New Zealand

With the adoption of the Climate Change Response (Zero Carbon) Amendment Act in November of 2019, New Zealand committed its carbon neutrality goals into law.[27] The country aims to reduce net emissions of all greenhouse gases to zero by 2050, with the notable exception of biogenic methane. This methane, produced from agriculture and waste, has a separate target of 24%–47% below 2017 levels by 2050. Since 2008, New Zealand has utilised an emissions trading scheme to help achieve its carbon neutrality goals by giving a financial incentive to decarbonising businesses and investing in carbon sequestration.[28]

1.7. Other developing Asian nations

Smaller countries, including those still undergoing development, have also pledged to achieve carbon neutrality. Maldives, a frequent champion of climate action due to the threat that rising sea levels pose for the small island nation, has a carbon neutrality goal of 2030, pending 'extensive support and assistance from the international community.'[29] Nepal also updated its NDC under the Paris Agreement to include carbon neutrality by 2050, including efforts to electrify its transportation sector and increase renewable sources beyond hydropower.

1.8. The United States

Although President Biden has not yet released a comprehensive plan for carbon neutrality, through executive orders he has worked to fulfill a campaign promise of achieving 'a carbon pollution-free electricity sector no later than 2035,' as well as net zero emissions by 2050 across the economy.[30] The Biden Climate Plan includes proposals for doubling offshore wind capacity by 2030, investing billions of dollars in research and development for batteries and carbon-neutral liquid fuels, and investing in transmission infrastructure that will allow variable renewables to benefit from widespread interconnectivity.

Thus, power-generation requirements in the Indo–Pacific raise important economic, environmental, and even geopolitical questions that will need to be addressed by national- and regional-level decision-makers in any comprehensive, long-term development strategy. The next section explores these questions in the context of four key strategic challenges for the region.

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[27] Ministry for the Environment (New Zealand), 'Climate Change Response (Zero Carbon) Amendment Act,' 2019, https://www.mfe.govt.nz/climate-change/zero-carbon-amendment-act#:~:text=set%20a%20new%20domestic%20greenhouse,below%202017%20levels%20by%202030.

[28] Ministry for the Environment (New Zealand), 'About the New Zealand Emissions Trading Scheme,' 2020, https://www.mfe.govt.nz/climate-change/new-zealand-emissions-trading-scheme/about-nz-ets.

[29] Ministry of Environment (Maldives), 'Update of Nationally Determined Contribution of Maldives,' 2020, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Maldives%20First/Maldives%20Nationally%20Determined%20Contribution%202020.pdf.

[30] White House, 'Executive Order on Tackling the Climate Crisis at Home and Abroad,' January 27, 2021, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad.

Chapter 3

Challenge One: Getting to the Right Power Mix

1. Supply Outlooks for Regional Power Mixes

As of 2020, coal, natural gas, and hydropower dominate power-generation mixes in much of South and Southeast Asia, with many countries disproportionately reliant on coal.[31] **Table 2** provides a breakdown of the power mix for each EAS country. Although many countries in the region are working toward decarbonisation, they face the pressing challenge of scaling up energy supply while trying to minimise carbon emissions. During the NBR–ERIN workshop, the importance of fossil fuels in the region's energy future was discussed. Some participants claimed that fossil fuel investments will continue to provide the majority of new energy capacity added in the region due to many countries trying to make electricity more affordable and reliable.

[31] India, for example, gets roughly 70% of its electricity from coal-fired plants. IEA, 'Coal Demand by Region and Scenario, 2018–2040,' https://www.iea.org/data-and-statistics/charts/coal-demand-by-region-and-scenario-2018-2040.

Table 2: Existing Installed Energy Capacity (Percentage of Energy Mix)

Country	Coal	Gas	Oil	Hydro-power	Small-scale hydropower	Biomass	Geothermal	Renewables	Nuclear	Other
Brunei (2017)	–	99.0	0.5	–	–	–	–	0.5	–	–
Cambodia (2020)	30.2	–	2.5	62.3	–	–	–	3.5	–	1.5
Indonesia (2018)	57.0	29.0	1.6	-	–	–	–	12.4	–	–
Lao PDR (2020)	19.0	–	–	79.0	1.0	1.0	–	–	–	–
Malaysia (2017)	44.0	38.0	1.0	16.0	–	0.5	–	0.5	–	–
Myanmar (2016)	3.0	35.6	1.0	60.3	–	-	–	0.1	–	–
Philippines (2017)	50.0	22.0	4.0	10.0	–	1.0	11.0	1.0	–	1.0
Singapore (2017)	1.3	94.9	0.7	-	–	0.5	–	0.3	–	2.3
Thailand (2018)	18.0	57.0	1.0	5.0	–	–	–	19.0	–	–
Viet Nam (2018)	38.0	15.0	–	35.0	6.0	–	–	6.0	–	–
India (2019)	71.0	4.5	0.5	10.9	–	2.9	–	7.3	2.9	–
China (2019)	64.6	3.3	0.1	17.3	–	1.6	–	8.4	4.6	–
Japan (2019)	31.6	33.9	4.8	8.8	–	4.1	0.3	8.2	6.4	1.9
Rep. of Korea (2019)	40.3	26.0	2.5	1.2	–	1.8	–	2.7	25.1	0.4
Australia (2019)	58.4	20.0	1.9	6.1	–	1.3	–	12.3	–	–
New Zealand (2019)	5.2	13.0	–	57.2	–	1.4	17.8	5.3	–	0.1
United States (2019)	24.2	37.4	0.8	6.8	–	1.7	0.4	9.2	19.3	0.1

Note: All values are rounded up. Information for Cambodia, Lao PDR, and Viet Nam is installed capacity. This table is based on Weatherby, 'Renewable Energy in Southeast Asia,' 16.
Source: IEA country profiles; 'ERIA 2020 Outlooks for Individual Countries'; and 'Mekong Infrastructure Tracker.'

1.1. Coal

Both South and Southeast Asia still depend heavily on coal as a consistent energy source that can meet the rising demand for electricity and bolster economic growth.[32] Coal-fired power plants remain in demand due to the abundance of coal in the region and the perceived lower economic costs compared to natural gas and renewables. Coal is also regarded as easier to feed into power grids compared to methods that could integrate renewables like solar or wind.[33] Additionally, South and Southeast Asia as a whole have been somewhat slower to adopt policies that would raise emission standards and phase out coal projects, although recent NDC efforts are seeking to change this status quo. This is largely due to the fact that emerging Asia is still seeking to expand electricity access, and implementing policies that could raise capital costs during a period of expansion is unattractive to financers.

Although clean-coal technologies are being utilised in parts of the world, some South and Southeast Asian nations lack the means to afford these technologies. The transfer of knowledge regarding these technologies to the developing world also has been slow.[34] The staying power of coal can be attributed not just to a lower perceived price but to the fact that it is convenient to implement and familiar to constituencies that know how to deploy and scale up coal projects.[35]

1.2. Natural Gas

Meanwhile, virtually all EAS members in South and Southeast Asia have articulated plans to increase their natural gas consumption, either as a means of reducing reliance on less desirable forms of generation or as a baseload partner that helps alleviate variability concerns with wind and solar power. Although still a fossil fuel, natural gas is a cleaner alternative to coal and offers an improvement to the air quality in urban environments. This a major incentive for many nations in the region. Nearly seven million deaths occur globally due to air pollution, two million of which happen in Southeast Asia.[36] In an effort to curb air pollution, reduce oil dependence, and diversify its energy mix, India plans to raise the share of natural gas from 6.5% to 15% by 2030 by dramatically increasing LNG imports.[37]

However, much of regional growth will depend on the price stability of LNG and whether countries in the region can develop the infrastructure necessary to support a gas-based economy.[38] As Nikos Tsafos writes in an NBR report on Southeast Asia's energy demand,

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[32] Han, 'The Need for Quality Infrastructure,' 36.
[33] Mikkal E. Herberg, 'High-Quality Infrastructure and the Free and Open Indo-Pacific Vision,' in 'Powering Southeast Asia,' 29.
[34] Han, 'The Need for Quality Infrastructure,' 36.
[35] Nikos Tsafos, 'The Outlook for Power Generation in Southeast Asia and the Geopolitics of the Indo-Pacific,' in 'Powering Southeast Asia,' 7.
[36] Han, 'The Need for Quality Infrastructure,' 36.
[37] Cedigaz, 'Oil and Gas Majors in India: Co-creating the Gas and LNG Market,' July 15, 2020, https://www.cedigaz.org/oil-and-gas-majors-in-india-co-creating-the-gas-and-lng-market-report.
[38] Han, 'The Need for Quality Infrastructure,' 38.

all the gas consumed in Viet Nam and the Philippines is produced locally because 'both countries have failed, despite ongoing efforts, to build the infrastructure to import LNG.'[39]

As participants at the NBR–ERIN workshop discussed, stable and reasonable prices are a prerequisite for LNG to remain competitive with coal. There is a call for international cooperation between governments and private firms to stabilise prices so that LNG can be better utilised as a transition fuel to renewable energy. This is a popular notion amongst South and Southeast Asian countries, given that demand for LNG is expected to increase over the coming decades. However, as more countries transition to a low-carbon or carbon-zero future, questions have emerged about the staying power of natural gas.

1.3. Renewable Energy

Currently, Asia represents nearly half of global energy consumption. Even in the face of rising energy demand, there are renewed concerns about carbon emissions, climate change, and sustainability, with several countries and regional forums outlining ambitious plans to radically reshape regional power mixes. The members of ASEAN, for example, have agreed to a collective target for 23% of the region's primary energy supply to come from renewable energy sources by 2025.[40] This goal poses a monumental challenge as member countries are coming from different starting points in their decarbonisation journey.

For example, Singapore and Brunei are still heavily reliant on fossil fuels, with approximately 95% of Singapore's electricity coming from natural gas[41] and virtually all of Brunei's energy mix consisting of natural gas and oil.[42] Other countries are at a better starting point to meet this 2025 goal, such as Myanmar, Lao PDR, and Cambodia, which draw most of their power from hydroelectricity.

Hydropower is the largest renewable energy source globally and makes up the vast majority of the 15% of power that comes from renewables in the ASEAN region.[43] This gives regional policymakers confidence in their ability to manage the seasonality challenges that come with hydropower. Looking toward the future, hydropower is common in national plans due to its abundance, affordability, familiarity, and remaining untapped capacity. However, hydropower is also controversial and faces social and political constraints because of the impact on fish migration, large land use, deforestation, and displacement of residents. Because of these negative impacts, hydropower can be slow to develop.

[39] Tsafos, 'The Outlook for Power Generation in Southeast Asia and the Geopolitics of the Indo-Pacific,' 8.
[40] Weatherby, 'Renewable Energy in Southeast Asia,' 14.
[41] Shigeru Kimura and Han Phoumin, eds., 'Energy Outlook and Energy Saving Potential in East Asia 2020,' ERIA, March 2021, 250, https://www.eria.org/uploads/media/Books/2021-Energy-Outlook-and-Saving-Potential-East-Asia-2020/Energy-Outlook-and-Saving-Potential-East-Asia-2020-1603.pdf.
[42] IEA, 'Brunei Darussalam,' 2018, https://www.iea.org/countries/brunei-darussalamm.
[43] IEA, 'Southeast Asia Energy Outlook 2019,' October 2019, https://www.iea.org/reports/southeast-asia-energy-outlook-2019.

The regional capacity for solar and wind power is rapidly being realised by South and Southeast Asian countries. Both energy sources have the potential to be widely available across the region and are attracting the most attention as an option for green energy mixes. This renewed interest can be attributed to the continued declining cost of wind and solar worldwide as a result of advancements in technology and wider deployment of these renewables.[44] As one workshop panelist stated, the higher price was a major barrier for solar and wind, which is no longer the case. From 2010 to 2019, solar dropped by 82% in cost, onshore wind by 40%, and offshore wind by 29%.[45]

However, policymakers still have reservations about these renewables. Unlike most other technologies, solar and wind cannot be produced on demand. Despite having a high level of solar irradiation across the region, and therefore a high potential to increase solar capacity, Southeast Asia has been slow to adopt supportive renewable policies that could capitalise on this potential for solar power.[46] With concerns over price fading, the remaining challenges for wind and solar involve integrating them into preexisting grids, managing weather variability and power intermittency, and waiting for improvements in battery storage technologies.

As was discussed by NBR experts and workshop participants, investment in renewable energy has proved to be lucrative, with interest significantly surpassing renewable capacity goals when the right policies are implemented. When the price of solar dropped in 2016, countries in Southeast Asia began to roll out pilot projects and significantly invest in solar power. As workshop participants noted, Viet Nam is a major success story, moving from no solar capacity in 2017 to more than 8,000 megawatts (MW) in 2020, with 15,000 MW or more planned. The rate of Viet Nam's development in solar capacity is significant, as the country has overtaken Thailand, which was an early adopter of solar energy.

Other countries in the region are seeing these successes and moving forward with supportive policies for solar power. Both Malaysia and Cambodia developed solar power projects in 2016 and 2017, respectively. Malaysia is currently developing approximately 1,500 MW of solar power, while Cambodia is pushing for solar to make up 20% of total installed capacity by 2023.[47]

Another potential power source specifically for Southeast Asia is geothermal. The region has significant potential for geothermal energy given its location along the volcanically active Ring of Fire. As noted by Courtney Weatherby in her essay for NBR's 2020 Energy Security Report, 'Indonesia and the Philippines currently have the second and third most installed capacity for geothermal energy globally, with 2,133 MW and 1,988 MW, respectively.'[48] Indonesia alone has a staggering potential for 29,000 MW of geothermal

[44] Tsafos, 'The Outlook for Power Generation in Southeast Asia and the Geopolitics of the Indo-Pacific,' 10.
[45] International Renewable Energy Agency, 'Renewable Power Generation Costs in 2019,' June 2020, https://www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019.
[46] Weatherby, 'Renewable Energy in Southeast Asia,' 17.
[47] Ibid., 18.
[48] Ibid., 16.

power, which remains largely undeveloped.[49] The capacity building that geothermal presents to countries like Indonesia and the Philippines should not be left out of national plans. (See Appendix I for analysis of current trends for renewable energy in the United States.)

1.4. Hydrogen

While falling costs have allowed more renewable energy production, the electrolysis technology used to produce hydrogen has also seen a drastic price reduction. From 2010 to 2020, the price of producing one kilogram of renewable hydrogen (that is, electrolysis of water using renewable energy sources) dropped 60% to between $4 and $6 per kilogram.[50] In addition to serving as a long-term storage option for renewables, thereby increasing their viability as power sources, carbon-neutral hydrogen has the potential to aid in de-carbonising the broader economy. Using renewable hydrogen for ammonia and fertiliser production, as well as synthesising liquid fuels, could allow renewable electricity sources to supply energy to new sectors by removing the need for fossil fuels as an input, thereby expanding the reach of renewable power while also facilitating its adoption through energy storage.[51]

According to past study from the Economic Research Institute for ASEAN and East Asia (ERIA), current cost reduction trends are encouraging, but hydrogen will still require significant investments in technology and infrastructure to achieve the needed economies of scale for cost parity with fuels such as gasoline.[52] Additionally, pricing greenhouse gas emissions will increase the competitiveness of hydrogen as a fuel option. The analysis also shows that the EAS region, which imports much of its fossil fuels but has abundant renewable energy, could benefit greatly from hydrogen as a fuel. The study concludes that establishing a hydrogen supply chain is key to integrating hydrogen as a clean fuel of the future.

1.5. Nuclear

Nuclear energy can provide zero-carbon baseload electricity, making it a strong alternative, at least in theory, to replace coal and other fossil fuels in regional power mixes. However, ERIA has estimated that the role for nuclear energy in Asia's power sector will decrease from 8.5% in 2017 to 6.7% by 2050.[53] China leads in construction of new nuclear energy capacity, with a target of increasing the share in the country's energy

[49] Hadi Setiawan, 'Geothermal Energy Development in Indonesia: Progress, Challenges and Prospect,' *International Journal on Advanced Science Engineering Information Technology* 4, no. 4 (2014), https://core.ac.uk/download/pdf/296920228.pdf.

[50] Hydrogen Council, 'Path to Hydrogen Competitiveness,' January 2020, https://hydrogencouncil.com/wp-content/uploads/2020/01/Path-to-Hydrogen-Competitiveness_Full-Study-1.pdf.

[51] Han Phoumin, Fukunari Kumura, and Jun Arima, 'Potential Renewable Hydrogen from Curtailed Electricity to Decarbonize ASEAN's Emissions: Policy Implications,' *Sustainability* 12 (2020), https://www.eria.org/uploads/media/Journal-Articles/2020-December-ERIA-Potential-Renewable-Hydrogen-from-Curtailed-Electricity-to-Decarbonize-ASEAN-Emissions-Policy-Implications.pdf.

[52] Shigeru Kimura, Yanfei Li, and ERIA Study Group members, 'Demand and Supply Potential of Hydrogen Energy in East Asia,' ERIA, May 2019, https://www.eria.org/uploads/media/RPR_FY2018_01.pdf.

[53] Kimura and Han, 'Energy Outlook and Energy Saving Potential in East Asia 2020,' 17.

supply by 7.2% annually through 2040.[54] India also has active plans to significantly expand its nuclear energy capacity. As stated in analysis by The Energy and Resources Institute (TERI), the National Electricity Plan targets an additional 9.5 GW by 2022.[55]

Other mature nuclear markets – Japan, the Republic of Korea, and the United States – have struggled to sustain the role of nuclear energy in their power mixes for social, political, and market reasons. Although Japan began restarting its reactors in 2015, following the March 2011 disaster in Fukushima, significant opposition from both the public and policymakers remains over safety concerns. The Republic of Korea faces similar social and political pushback, with President Moon Jae-in pledging to phase out the country's reactors.[56]

Both Japan and the Republic of Korea face additional pressure in the debate on nuclear energy, given their near complete dependence on trade for oil and gas supplies. Nuclear has been and could be a significant baseload power source for both countries. Nuclear energy has made up approximately 20% of power generation in the United States, but the sector is also in decline. This is largely the result of concerns over supply chain management, regulatory oversight, and high upfront costs. These and other factors led to the bankruptcy of the leading US nuclear energy company, Westinghouse, and decreased interest from the private sector in further investment.[57]

Many similar concerns exist in Southeast Asia. Although some countries, such as Indonesia and the Philippines, would consider nuclear power, most do not include it as a potential fuel source in any development scenario, as noted by ERIA. Lao PDR and Myanmar do not have a plan for nuclear power, even under their alternative policy scenarios, and Malaysia scrapped its plans for nuclear power due to concerns over handling nuclear waste.[58] Singapore has also cited the lack of land to both build a reactor and store waste as a critical impediment to nuclear energy development.

2. Management of Energy Use in the Transportation Sector

Although industry has been the largest consumer of energy and is projected to remain so under ERIA's business-as-usual scenario, transportation is the second-largest source of energy consumption in the region.[59] However, if the energy efficiency and savings policies outlined under the alternative policy scenarios are utilised, the transportation sector is also projected to see the greatest reduction in consumption by 2050, with energy use decreasing by more than 21% from business-as-usual projections. As developing Asia's large populations have grown wealthier, ownership of personal vehicles has become more

[54] Ibid, 104.
[55] Saxena et al., 'Transitions in Indian Electricity Sector 2017–2030,' 15.
[56] Kimura and Han, 'Energy Outlook and Energy Saving Potential in East Asia 2020,' 148.
[57] James E. Platte, 'Pathways to Trans-Pacific Cooperation in the Nuclear Sector,' NBR, Pacific Energy Summit Working Paper, 2018, 12, https://www.nbr.org/wp-content/uploads/pdfs/publications/pes_working_paper_platte_120518.pdf.
[58] Kimura and Han, 'Energy Outlook and Energy Saving Potential in East Asia 2020,' 176.
[59] Ibid, 20.

common. Although vehicle ownership per capita is still well below the level in developed countries, demand for transportation will expand across the region.

Developing Asia continues to use petroleum for nearly all of its transportation needs. However, advances in battery technology have made electrified transportation more affordable, with many automakers, including General Motors, Hyundai, and Toyota, planning on increasing the production of electric vehicles over the next decade.[60] Vehicle electrification also doubles as a means of improving air quality, which causes millions of deaths across Asia annually. Yet whether the region can take advantage of this opportunity will depend on efforts made to manage and adjust power supply outlooks.[61]

The rise of electric vehicles will likely affect the overall electricity grid in two ways; through improved energy storage and through growth in demand. Variable renewable energy resources like wind and solar become increasingly more effective at meeting energy demand as the ability to store their energy becomes cheaper. If global economies of scale begin mass production of electric vehicle batteries, it will likely have co-benefits for renewable energy sources. On the other hand, transportation itself requires immense energy expenditure, rivaling or surpassing electricity as the chief use of energy in many economies. The potential transfer of this demand for energy from petroleum products to the power sector is an important medium-term to long-term consideration for the sector.

3. Market Reform

What makes for the right electricity mix will likely continue to vary by country, in line with national priorities, local conditions, and available resources. Still, expert participants in a recent NBR–ERIN workshop noted that while major market shifts have had a profound impact on the potential availability and affordability of a range of energy supply options, regional capacity to capitalise on these opportunities is often deeply constrained.

Key challenges in South and Southeast Asia generally and for emerging economies specifically include rigid, opaque, and uncompetitive energy markets, particularly for natural gas and renewables; unresponsive energy pricing arrangements; and weak energy sector policymaking and governance.[62] On the issue of governance, Mikkal Herberg noted in discussions that bureaucratic, state-dominated energy sectors can lack transparency in decision-making. This can undercut signals to the private sector and other investors on the benefits of eschewing investments in dirtier (yet easier and faster to scale) energy

[60] General Motors, 'General Motors, the Largest US Automaker to Be Carbon Neutral by 2040,' January 28, 2021, https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2021/jan/0128-carbon.html; Hyundai, 'Hyundai to Expand Electrified Eco-focused Line-up to Ten Models in 2022,' November 11, 2020, https://www.hyundainews.com/en-us/releases/3194; and Toyota, 'Toyota to Debut Three New Electrified Vehicles for US Market,' February 10, 2021, https://pressroom.toyota.com/toyota-to-debut-three-new-electrified-vehicles-for-u-s-market.

[61] World Health Organization, 'One Third of Global Air Pollution Deaths in Asia Pacific,' May 2, 2018, https://www.who.int/westernpacific/news/detail/02-05-2018-one-third-of-global-air-pollution-deaths-in-asia-pacific.

[62] NBR–ERIN workshop discussions.

sources in favor of cleaner alternatives that may only be viable under certain legal, regulatory, or market conditions.

Nonetheless, if not well orchestrated, new national policies or reform efforts may invite their own challenges. As Herberg observed, 'although some Asian markets have moved toward greater deregulation and liberalization, various rates of reform pose new risks for outside investors.'[63] Dramatic, unexpected changes in price subsidies or other sectoral regulations, for example, may risk overheating markets or cause other unintended effects. Herberg highlighted the example of China. To reduce air pollution, in 2016 Beijing mandated a shift toward natural gas use in heating and cooking, which was an important reform for transitioning the country away from coal use. However, the resulting increase in demand was not met with an increase in natural gas supplies. When faced with a cold winter in 2017 and spiking demand for heating fuel, there was a shortage of natural gas, which marked a major social and energy policy failure.

Workshop participants also noted the imperative for countries to prepare their power sectors for so-called 'prosumers' – electricity consumers who could also produce their own electricity. Whether from solar panels on homes or out of the batteries in vehicles, electrical grids will need new market rules and management mechanisms to handle a two-way flow of power. As developing Asia improves and expands its electrical power grid, workshop participants reiterated that countries should consider the importance of this evolving relationship between the utility and electricity consumers in order to realise all the benefits of a smart and fully integrated grid.

4. Regional Connectivity

More complicated still is the concern that some means of improving the region's energy security may only be viable if several countries move in tandem. Obstacles include ongoing regulatory and technical harmonisation issues, which continue to create a bottleneck impeding greater cross-border trade in electricity. This is not to say that the region is not actively working to overcome these challenges: efforts such as the Lao PDR–Thailand–Malaysia power interconnection project and several initiatives within the UN Economic and Social Commission for Asia and the Pacific represent success stories that should be reviewed, and even potentially expanded, as models for deepening regional integration and strengthening shared governance norms. However, success also is defined by how countries or the region as a whole achieve stated targets. In this case, infrastructure is key to both short-term and long-term success.

4.1. Lao PDR–Thailand–Malaysia power interconnection project

One notable example of regional connectivity efforts is the multilateral power-trading agreement between Lao PDR, Thailand, and Malaysia. The agreement centers on the sale of electricity that is produced in Lao PDR to Malaysia via Thailand, which acts as the

[63] Mikkal Herberg and Ashley Johnson, 'Introduction,' in 'Powering Southeast Asia.'

intermediary.[64] Thailand is the 'wheeling' country and charges a fee to provide the services of its own electricity grid, which facilitates power trade between Lao PDR and Malaysia. This 'wheeling model' for electricity is cited by the IEA as a possible template for more multilateral electricity trade across ASEAN. The Lao PDR–Thailand–Malaysia project raised the amount of power traded to 300 MW in 2019. One limitation, however, is that the power travels in only one direction. To add other participants like Singapore, which was originally included in the project, such a wheeling model would require multidirectional power trade between member states.[65]

While the IEA report mentions that political, economic, and institutional changes will be needed for ASEAN to benefit fully from such an integrated market, it concludes that there are no fundamental obstacles to such improvements. Indeed, the negotiating process for the Lao PDR–Thailand–Malaysia power interconnection project produced important lessons for future efforts, such as sharing responsibilities between all stakeholder countries and mutually agreed, firm timetables.

4.2. The potential for power trade in South Asia

South Asia has limited regional connectivity, with most instances being bilateral, one-way agreements between India and its neighbors. Although India and Nepal signed a power-trading agreement in 2014, trade between the two countries has remained modest, despite the potential for hydropower from Bhutan and Nepal to help supply some of India's most electricity-starved regions.[66] Analysis of the potential for more energy trading concludes that progress has been stalled in part by political difficulties and high upfront costs, but that environmental conflicts are an underappreciated barrier to cross-border electricity trade.[67] This research suggests that with sufficient local-level buy in and collective security frameworks, power trade can help South Asian countries meet growing demand for electricity.

4.3. Other factors

As countries strive to maximise the role for cleaner and zero-emission energy sources in their power mix, increased reliance on variable wind and solar inputs also raises distinct challenges that should be factored into policy planning. Managing sudden energy surges or drops in electricity production due to weather events can be a challenge for grid and power plant operators already struggling to ensure consistent power supply (and may even result in higher costs or unintended reliance on highly inefficient backup power).[68] Though some of these management challenges may need to be addressed with new and

[64] IEA, 'Establishing Multilateral Power Trade in ASEAN,' September 2019, https://www.iea.org/reports/establishing-multilateral-power-trade-in-asean.

[65] 'Lao PDR, Malaysia and Thailand Agree to Expand a Trilateral Power Deal,' Radio Free Asia, September 6, 2019, https://www.rfa.org/english/news/laos/asean-energy-09062019165748.html.

[66] Priyantha Wijayatunga, D. Chattopadhyay, and P.N. Fernando, 'Cross-Border Power Trading in South Asia: A Techno Economic Rationale,' ADB, https://www.adb.org/sites/default/files/publication/173198/south-asia-wp-038.pdf.

[67] Mirza S. Huda, *Energy Cooperation in South Asia: Utilising Natural Resources for Peace and Sustainable Development* (New York: Routledge, 2020).

[68] Weatherby, 'Renewable Energy in Southeast Asia,' 19.

more advanced infrastructure (as will be explored later), Weatherby stresses that levels of wind and solar energy penetration that exceed much of what is currently in the region are possible without significant upgrades to the grid or breakthroughs in battery storage.[69]

However, this may require greater support for various tools that can strengthen energy policy decision-making, such as improved weather forecasting so that planners can better predict conditions that may affect either overall electricity demand or wind and solar supply. Alongside this, additional tasks – such as the full implementation of planned and proposed energy efficiency and conservation measures – could help reduce and manage overall demand growth.

[69] Ibid.

Chapter 4

Challenge Two: Supporting High-Quality Infrastructure

Success in achieving the right electricity mix will be closely linked to how well countries across South and Southeast Asia are able to scale up a wide range of associated power sector infrastructure. High-quality infrastructure (HQI) is economically viable, reliable, and environmentally sustainable infrastructure that utilises the best technology available and follows international safety and efficiency standards. Such infrastructure should advance long-term development goals, have minimal environmental impact, and help build capacity.

This includes new, more reliable transmission and distribution (to enable greater integration of variable energy resources); more advanced thermal-fired power plants (to support cleaner, more efficient consumption of coal and natural gas); and other enabling physical infrastructure (such as receiving terminals, pipelines, transportation, and storage for moving LNG and other supplies to where they are needed).[70] As suggested earlier, in tandem with upgrading existing systems, overall capacity across much of the region will also need to rapidly expand. The IEA estimates that India, for example, will likely see electricity demand increase 5% a year to 2040, doubling overall demand.[71]

In terms of looking at market-based solutions to tackle energy security and climate challenges in South and Southeast Asia, HQI initiatives have proved to be a critical component. The United States and Japan have utilised HQI to further their efforts in establishing a free and open Indo–Pacific, and their joint approach emphasises competitive, transparent, compliant, and environmentally conscious projects from a mix of private and public financial backers.

Since 2015, Japan has led the HQI movement through the Partnership for Quality Infrastructure (PQI), which initially aimed to mobilise $100 billion for projects in Asia from 2015 to 2020. The PQI encouraged private-sector investment through increased public financing, and in 2016 it expanded the level of investment to $200 billion for a period from 2016 to 2021.[72] Outside of partnerships with the United States, Japan has fostered projects with countries in the region. In 2017 a joint statement from India and Japan announced their efforts to increase Japanese investment in India's rail infrastructure, energy, sanitation, and smart city projects.[73]

[70] Han, 'The Need for Quality Infrastructure,' 38.

[71] IEA, 'India Energy Outlook 2021,' March 2021, https://www.iea.org/reports/india-energy-outlook-2021/fuels-and-electricity-in-india#abstract.

[72] Hiroto Izumi, 'Quality Infrastructure Investment: Global Standards and New Finance' (speech at the International Economic Forum on Asia, Tokyo, April 14, 2017), https://www.mofa.go.jp/mofaj/files/000252520.pdf.

[73] Ministry of Foreign Affairs (Japan), 'Japan-India Joint Statement: Toward a Free, Open and Prosperous Indo-Pacific,' September 14, 2017, https://www.mofa.go.jp/files/000289999.pdf.

The Japan–US Strategic Energy Partnership (JUSEP) was amongst the first investment collaboration efforts and serves as a model for other regional partnerships such as the Japan–US Mekong Power Partnership (JUMPP) and the Trilateral Viet Nam–US–Japan Commercial Liquified Natural Gas Forum. JUMPP was announced in August 2019 to promote the enhancement of electricity connections between the Mekong countries. The partnership serves to create a more free, open, and stable electricity market in the region and is part of a larger effort to expand engagement between Mekong countries, Japan, and the United States. The trilateral partnership between Viet Nam, Japan, and the United States was created in December 2020 and aims to develop LNG infrastructure in Viet Nam through the help of Viet Namese, Japanese, and US private-sector partners.[74] The initiative will improve energy security for Viet Nam, reduce carbon emissions, and support a transition to a lower-carbon economy.[75]

Yet even though 'there is a clear need for resilient energy infrastructure in the region, policy measures and actions undertaken to build HQI have varied from country to country,' as energy specialist Han Phoumin noted in NBR's 2020 Energy Security Report.[76] As one explanation for this, workshop participants argued that 'quality' infrastructure projects are often better positioned to compete against less sustainable alternatives in more liberalised markets, due to their lower barriers to market entry. Consequently, several participants noted that a range of market-liberalisation steps – such as reducing the monopolies of state-owned enterprises in the power sector, reforming market-distorting subsidies, and ensuring third-party access to distribution networks and other infrastructure – could lower barriers to market entry for quality infrastructure projects.[77]

Along these same lines, participants argued that moving to a greener grid also likely requires the introduction of new business models for infrastructure development. Questions of how to appropriately navigate competing goals for land resource management can be especially complex. As discussed at the 2019 Pacific Energy Summit, one of the largest risks to breaking ground on new energy projects in Asia is related to land acquisition and property rights. By establishing land trusts, owners can retain their land but lease it to infrastructure companies that are interested in building exploration or transmission projects.

[74] US Embassy in Burma, 'Mekong-US Partnership Joint Ministerial Statement,' September 15, 2020, https://mm.usembassy.gov/mekong-u-s-partnership-joint-ministerial-statement.

[75] US Department of State, 'The United States and Japan Join with Viet Nam to Advance Shared Energy Goals,' December 3, 2020, https://2017-2021.state.gov/the-united-states-and-japan-join-with-vietnam-to-advance-shared-energy-goals//index.html.

[76] Han, 'The Need for Quality Infrastructure,' 40.

[77] For further discussion, see Jeanne Choi, 'Developing Free and Open Markets: Gas Market Reform in Japan and South Korea,' in 'Developing Free and Open Markets: Gas Market Reform in Japan and South Korea,' NBR, NBR Special Report, October 2019, https://www.nbr.org/publication/developing-free-and-open-markets-gas-market-reform-in-japan-and-south-korea.

It is worth noting that China has also played a large and steady role in infrastructure development in South and Southeast Asia through the Belt and Road Initiative. Although this initiative has aimed at investment in energy and power infrastructure, it so far has largely focused on coal power, in contrast with the aforementioned HQI initiatives.

As an example, the government of Pakistan has reported that over half of China's projected $39 billion investment in the China–Pakistan Economic Corridor has been focused on electricity generation, with three-quarters of that capacity coming from coal-fired power plants.[78] In Indonesia, 43% of the financing for coal-fired power plants commissioned from 2016 to 2019 came from China.[79]

The scope of the Belt and Road Initiative is vast, covering areas across Eurasia, South Asia, and Southeast Asia. Since 2013, China has invested more than $27 billion in energy projects in Southeast Asia.[80] Its economic and political power have given the country a large amount of regional influence, often with goals that do not align with US interests. As Herberg writes in the 2020 Energy Security Report, the increased clout of China has also presented a challenge for Japan's long-standing position as the major economic power in Asia and the key partner of the United States in the region.[81]

Although there is good evidence that China has favored supporting coal projects over other technologies, it also typically responds to local government requests and the immediate economic needs. For example, China invested largely in coal projects in Pakistan because that is what the Pakistani government had prioritised.[82] Despite the large sums of money invested from China, estimates have found that Chinese companies built less than 20% of the coal-fired plants in Asia from 2013 to 2022.[83] This is a testament to the affordability and convenience of coal for regional countries.

The rise in China's influence and economic power prompted concerns in the United States about China's differing views on South and Southeast Asia's economic development. The United States' and Japan's aligned initiatives for a free and open Indo–Pacific are meant to provide alternatives to the Belt and Road Initiative and to improve energy security by diminishing reliance on any one country for financial support. As noted by Herberg, 'the FOIP [free and open Indo–Pacific] concept has developed as a counter to China's expanding influence by bringing together the United States, Japan, Australia, and other regional partners to offer an alternative vision.'[84] As the United States returns to an emphasis on promoting multilateralism and combating climate change, there is an opportunity for growth in HQI in South and Southeast Asia as regional countries continue their plans toward low-carbon or carbon-neutral societies.

[78] Herberg, 'High-Quality Infrastructure and the Free and Open Indo-Pacific Vision,' 26.
[79] Tsafos, 'The Outlook for Power Generation in Southeast Asia and the Geopolitics of the Indo-Pacific,' 7.
[80] Herberg, 'High-Quality Infrastructure and the Free and Open Indo-Pacific Vision,' 26.
[81] Ibid.
[82] Tsafos, 'The Outlook for Power Generation in Southeast Asia and the Geopolitics of the Indo-Pacific,' 7–8.
[83] IEA, 'Chinese Companies Energy Activities in Emerging Asia,' April 2019, https://www.iea.org/reports/chinese-companies-energy-activities-in-emerging-asia.
[84] Herberg, 'High-Quality Infrastructure and the Free and Open Indo-Pacific Vision,' 26.

Chapter 5

Challenge Three: Attracting Critical Investment

In line with realising the above goals, the ADB estimates that Asia and the Pacific will require $1.7 trillion per year in energy infrastructure investments through 2030, with more than half of the total need in the power sector. Moreover, ERIA projects that investment in ASEAN's refineries and LNG terminals alone will require as much as $226 billion and $28 billion, respectively, between now and 2040.[85] For example, workshop participants noted that for Indonesia alone to meet its 2025 target for 23% renewables in its energy mix, the country needs an estimated $40 billion in clean energy investment.

Bridging the gap between confirmed and necessary investment in regional energy supply and infrastructure has been a long-standing challenge in much of South and Southeast Asia – one that has been further complicated by disruptions brought on by the Covid-19 pandemic. As of early 2021, the pandemic's negative impact on economic activity (and resulting decline in private-sector capital spending) and new demands on public funds for health and social welfare have placed immense strain on the funding available to stimulate investment in energy projects. In its October 2020 assessment, the IEA noted that fuel supply investment has been hit the hardest, with a 35% overall decrease in upstream oil and gas spending and a 25% decline in investment from large oil and gas companies.[86] Additional losses have included a 7% decline in power-generation investment and a 9% decline in energy efficiency improvements, amongst other areas. Such trends have negatively affected the Asian green bond market, in particular, with potential longer-term consequences for when or if planned clean energy projects might be brought online.

Yet as noted by Herberg, there are still many options available to help bridge the investment gap. Pension funds, insurance companies, large investment funds, sovereign wealth funds, and global energy companies continue to look for 'bankable' energy infrastructure investment opportunities. To that end, governments can take several steps to mitigate localised investment risk and improve their country's market fundamentals. These include adopting a more open trade and investment policy in energy distribution, providing a more favorable environment for institutional investors and bond market players, accelerating low-carbon investments through targeted stimulus-package measures, and revisiting the tax structure on cross-border energy infrastructure investment. (See Appendix I for analysis of similar policies in the United States.)

[85] Kimura and Han, 'Energy Outlook and Energy Saving Potential in East Asia 2019,' 44.

[86] IEA, 'Investment Estimates for 2020 Continue to Point to a Record Slump in Spending,' October 23, 2020, https://www.iea.org/articles/investment-estimates-for-2020-continue-to-point-to-a-record-slump-in-spending.

One tool that multiple participants noted could help mitigate risk in power sector investment is a power purchasing agreement (PPA). As part of Thailand's Energy Reform Plan, the Energy Regulatory Commission has established a regulatory sandbox for energy sector innovations, which is intended 'to promote innovations in [the] energy sector by relaxing some rules and regulations within [a] limited area and period' and to help the economy prepare for and navigate technology disruptions.[87] This initiative is currently focusing on six areas: peer-to-peer energy trading, microgrids, battery storage, net metering and billing, new business models for load aggregators, and natural gas trade, distribution, and utilisation. Workshop participants observed that peer-to-peer trading, in particular, holds promise to reduce inefficiencies and increase small-scale renewable energy penetration. Thailand's peer-to-peer trading scheme allows wider utilisation of the Provincial Electricity Authority state grid so that private firms generating renewable energy can sell directly to consumers while prosumers can sell excess electricity from rooftop solar to their neighbors.

In Indonesia, ADB is conducting a study on building incentives and tax structures to increase renewable energy capacity.[88] The study proposes a renewable energy subsidy mechanism that bridges the difference between the cost of a renewable energy project and the cost the Perusahaan Listrik Negara (PLN) would have otherwise paid if the renewable project had not been constructed. Well-designed PPAs play an integral role in ensuring the effectiveness of the subsidies by reducing risk and contract delays, a critical area of focus moving forward. Previous attempts at PPAs have struggled, with less than half the proposed agreements in 2017–18 moving into the construction phase.[89] By developing a production cost model that sets the PPA price, this renewable subsidy mechanism could relieve PLN and the project developer from having to negotiate and thereby speed up the contracting process.

Utilising subsidies as a tool remains a key point of deliberation, however, and participants noted the importance of distinguishing how subsidies can be leveraged to reduce inefficiencies. While some subsidies exist in a magnitude that prevents growth or unnecessarily distorted markets, there are opportunities to reduce or cap subsidies to generate investment in critical sectors. In the case of Indonesia, the country has been working to phase out established subsidies from around $20 billion to $10 billion. However, subsidies dedicated specifically for low-income liquefied petroleum gas consumers remain a successful program, and new efforts to encourage renewable energy development remain in the toolkit. In the case of the plans for reducing risk in PPAs, ADB recommends direct subsidies to PLN. The values can be allocated and delivered during the annual budget process, which both ensures that the cost differences are fully met and

[87] 'Regulatory Sandbox for Energy Sector Innovations (ERC Sandbox),' presentation by the Energy Regulatory Commission of Thailand for the US Agency for International Development (USAID), http://usaidcleanpowerasia.aseanenergy.org/download/3630.

[88] ADB, 'Renewable Energy Tariffs and Incentives in Indonesia: Review and Recommendations,' September 2020, https://www.adb.org/sites/default/files/publication/635886/renewable-energy-tariffs-incentives-indonesia.pdf.

[89] Ibid., 2.

reduces concerns about misuse of funds. These can also be paired with existing tax allowances and holidays.[90]

In addition, fiscal and nonfiscal incentives, such as streamlining licensing processes and providing tax holidays, could be considered to boost the attractiveness of these projects. One recent example includes the Omnibus Law enacted by the Indonesian government in November 2020.[91] In order to stimulate economic growth amid the ongoing challenges posed by the pandemic, this law aims to increase investment and create jobs by simplifying the licensing process and increasing the ease of doing business in Indonesia. As workshop participants noted, such efforts can help streamline government efforts to reduce risk and encourage investment. As recently concluded by the IEA, a focus on value and quick delivery, as well as environmental gains, could provide an opening for utilisation of some cleaner technologies.[92] However, in order to fully integrate and deploy new technologies into existing energy systems, it is necessary to have the right personnel to execute these efforts.

[90] ADB, 'Renewable Energy Tariffs and Incentives in Indonesia: Review and Recommendations,' 12.
[91] UN Conference on Trade and Development, ''Omnibus Law' on Job Creation Has Been Enacted,' November 2, 2020, https://investmentpolicy.unctad.org/investment-policy-monitor/measures/3567/indonesia-omnibus-law-on-job-creation-has-been-enacted.
[92] IEA, 'World Energy Outlook 2020,' https://www.iea.org/reports/world-energy-outlook-2020.

Chapter 6

Challenge Four: Strengthening Human Capacity

The prior challenges have largely focused on needs for new physical systems, energy supplies, or financial resources. Yet as several recommendations above have implied, weak governance in generation and delivery of electricity are also undercutting South and Southeast Asian development ambitions. As one measure of this, the World Bank estimates that distortions in South Asia's power sector are decreasing the subregion's GDP by 4%–7%.[93] Findings from NBR's Pacific Energy Summit have also suggested that human capacity shortfalls have discouraged more aggressive adoption of renewable energy in various parts of the region, undercutting clean energy ambitions. A McKinsey Global Institute and Oxford study estimates that globally up to 375 million workers will need to reshape or upgrade their skills in the next decade, driven by automation and the demands of technological advances.[94] As countries in developing Asia seek to expand and upgrade their power sector, they must prepare for this coming shift in the labor market. Lags in skill training and other knowledge transfers, for example, have contributed to misconceptions amongst grid operators about existing means for managing greater reliance on variable sources.

Strengthening local- and national-level capacities in power sector management is thus critical to how South and Southeast Asia might be able to navigate (and take advantage of) recent market and technological breakthroughs. Energy storage, increased use of digitisation, and smart grid technologies hold immense promise for transforming the power grid, but such transformation must begin at the training and development level. These kinds of technologies can only work effectively when handled by well-trained workers, coupled with clear direction and coordination from policymakers to incorporate them.

As a starting point, workshop participants noted that related efforts may include discrete actions such as skill training or people-people exchanges that explore a wide range of topics (e.g., technical information, regulatory best practices, and operational management). Speakers emphasised the important role of universities in bridging the gap between the science and policy realms, particularly through public–private partnerships. Successful cooperative programs managed to synchronise the research vision of a public university with the viability of a private-sector business and establish trust between partners early in the process.

[93] Zhang, 'In the Dark,' 4.

[94] James Manyika et al., 'Jobs Lost, Jobs Gained: What the Future of Work Will Mean for Jobs, Skills, and Wages,' McKinsey Global Institute, November 28, 2017, https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages#.

Other participants noted that improved access to and investment in scaling up local datasets and technical resources should complement efforts. These provide power sector stakeholders with critical tools for improving decision-making.[95] Developing Asia contains a wide range of economies, with an associated range of power sector needs. Especially for electricity grids that span international boundaries, such as the proposed ASEAN power grid, collaboration and data sharing will be key to realising all the benefits that such regional integration can bring. Building a generalised, multilateral power market in the region will mean ensuring institutional capacity and updated training as much as grid harmonisation and other engineering requirements.

In terms of how these activities are executed, one workshop participant noted that acknowledging the human element in human capacity development is critical. More specifically, well-designed initiatives must take into account factors such as an individual's or group's potential resistance to change (e.g., the reluctance of experienced workers to learn new systems or institutional inertia when moving to a market-based power sector). The ability of operators and bureaucrats to grasp new knowledge and turnover amongst talented, highly competitive employees was also mentioned. One participant noted that this initiative could lead to opposition from trade unions if not handled properly. Institutional-level programs that focus on shifts in organisational culture and management – for example, that help identify and support rising stars and provide opportunities for mentoring – can yield significant, longer-term dividends that go beyond any one competency or skill set.

Finally, others noted that human capital development needs to be understood as an ongoing process rather than a series of one-off events. Providing initial training is important, but ensuring that insights and new techniques are absorbed and implemented requires follow-up actions. The accelerating pace of sector transformation also presents an ever-changing challenge. Consequently, workshop participants recommended that select tasks be thought of in terms of near-term and long-term needs.

In the near term, the impetus will largely lie in training those already on the job by focusing on new skills such as the ability to understand systems in real time, direct route supplies to where they are needed, and better integrate new technical knowledge. In the long term, there is a need to integrate new technology skills into early education and hold larger training sessions to adapt and transition existing skill sets across industries. Participants also suggested that the role for countries like the United States and Japan, as well as international organisations, would be to serve as models of successful modernisation, bringing high-level and technical exposure to how these investments would benefit developing Asia.

[95] Workshop discussions.

Chapter 7

Promoting Collective Energy Security: Strengthening Regional Collaboration

While many of the efforts above could be championed by stakeholders operating within a single country, workshop participants noted that some of the more ambitious plans for strengthening power sector outlooks may only be viable or reach critical mass when executed in tandem with other partners. For example, workshop participants noted that although an ASEAN power grid could greatly contribute to the region's energy security, it would require several countries to work in tandem to harmonise technical standards and pass various market and policy reforms. Others noted the positive role that countries outside developing Asia – such as the United States, Japan, and the Republic of Korea – have (and could play) in leveraging additional financial and knowledge resources.

Over the past decade several new regional and minilateral initiatives in the Asia–Pacific have been established to address the above concerns. These include nationally championed initiatives that incorporate significant elements focused on energy and infrastructure, such as Japan's and the United States' Indo–Pacific strategies, the Republic of Korea's New Southern Policy, and China's Belt and Road Initiative; bilateral efforts, such as the Japan–India Energy Dialogue or JUSEP; and minilateral initiatives, such as the Japan–US–Australia Trilateral Infrastructure Partnership and ASEAN's Outlook on the Indo–Pacific.

To date, many of these efforts have sought to overcome specific obstacles or bottlenecks in power sector development by engaging public- and private-sector support to catalyse investment in new supplies, technologies, and infrastructure.[96] To that end, as of February 2021, Japan has committed $20 billion in financing for LNG development as part of JUSEP. It also aims to mobilise $200 billion for its Expanded Partnership for Quality Infrastructure and increase its relationship with the United States' Development Finance Corporation (DFC).[97] The creation of the DFC expanded funding authority for up to $60 billion in Asia and replaced the Overseas Private Investment Corporation.[98] (See Appendix I for additional analysis of strategic initiatives put forth by the United States.)

[96] Herberg, 'High-Quality Infrastructure and the Free and Open Indo-Pacific Vision.'

[97] Japan Bank for International Cooperation, 'JBIC Signs MOU with US International Development Finance Corporation: Strengthening Cooperation for Promoting Collaborative Project between Japan and United States in a Wide Range of Regions and Sectors,' January 14, 2021, https://www.jbic.go.jp/en/information/press/press-2020/0114-014177.html.

[98] US International Development Finance Corporation, 'US International Development Finance Corporation Begins Operations,' January 2, 2020, https://www.dfc.gov/media/press-releases/us-international-development-finance-corporation-begins-operations.

Several initiatives have also hit on the idea of promoting and advancing standards that support the development of 'high-quality infrastructure.' Notable amongst these has been a trilateral initiative supported by the United States, Japan, and Australia known as the Blue Dot Network, which is a 'multi-stakeholder initiative...to promote…trusted standards for global infrastructure development in an open and inclusive framework.' [99] The US State Department says that the Blue Dot Network 'builds on the success of Japan's G20 leadership in building consensus on the Principles for Quality Infrastructure Investment.'[100] Although minimal progress has been made thus far, the initiative is open to other countries that share similar views and priorities for HQI investment.

The Republic of Korea is one example of a country whose efforts to achieve carbon neutrality and a circular economy will both better utilise existing infrastructure and resources and identify ways to ensure that new projects meet certain criteria for green growth. These efforts began in earnest with the enactment of the Framework Act on Resource Circulation in 2018 and have garnered significant attention given the push to reduce global strain on natural resources and find more efficient ways to recycle and meet energy and electricity demand.[101] The Republic of Korea, like several other nations in the Indo–Pacific, relies on imports to meet its energy needs. The circular economy presents an opportunity to improve sustainability across sectors, including industry and waste management, and also reduces dependence on disruptive technologies to accelerate decarbonisation efforts.[102] Materials such as scrap metals, plastic, and concrete are being reprocessed and used as input materials in new construction or products. Maximising the benefits of a circular economy will partly require improved infrastructure and policies for waste collection and sorting; however, success will also depend on the participation of the public and private businesses. Potential tools the government could use to increase participation include mandates for a certain percentage of recycled content in input materials for new products and limitations on the colors of materials to make recycling simpler.

Looking to larger structural challenges with HQI investment and the expansion of energy access more broadly, the United States and Japan issued a joint statement on the one-year anniversary of JUMPP in which they outlined their continued support of cross-border power trade and belief in the importance of optimising the use of energy resources in the region. This sentiment could prove critical to the success of renewables and LNG in the region.[103]

Meanwhile, Japan and the United States also jointly held workshops in various parts of Southeast Asia over the course of the past three years, including a workshop on energy infrastructure in Ho Chi Minh City in December 2018 and on LNG in Jakarta in March

[99] Herberg, 'High-Quality Infrastructure and the Free and Open Indo-Pacific Vision.'
[100] US Department of State, 'Blue Dot Network,' https://www.state.gov/blue-dot-network.
[101] Government of the Republic of Korea, '2050 Carbon Neutral Strategy of the Republic of Korea,' 88.
[102] Ibid., 50.
[103] 'Japan-US Joint Ministerial Statement on Japan-US-Mekong Power Partnership (JUMPP),' US Department of State, September 2020, https://www.state.gov/japan-u-s-joint-ministerial-statement-on-japan-u-s-mekong-power-partnership-jumpp.

2019.[104] The former focused on identifying financing tools and opportunities for private-sector engagement, while the workshop in Jakarta scoped out possibilities for cooperation on LNG procurement, distribution, electrification, and financing, as well as strategic plans for national energy mixes.[105]

Additional activities in this series hosted by the US International Trade Administration and Japan's Ministry of Economy, Trade, and Industry include an August 2019 JUSEP meeting in Bangkok on regional connectivity and an October 2019 meeting in Singapore on public–private financing opportunities. Alongside these events, both countries have established people-to-people exchange programs, academic scholarships (such as those convened by the Japan International Cooperation Agency), and other mentoring opportunities (such as NBR's Asia EDGE fellowship program) to support South and Southeast Asia's next generation of energy security specialists.

During workshop discussions, participants affirmed the idea that the free and open Indo–Pacific concept as initiated by Japan has positively contributed to efforts to advance digital connectivity, infrastructure, and energy security in South and Southeast Asia through a number of means (including via cooperation with the United States and Australia) and should continue to inform efforts to enhance regional prosperity. Yet in terms of how these efforts can better respond to regional interests, workshop participants suggested that more could be done to intentionally amplify existing regionally led frameworks within these initiatives.

ASEAN, for example, is already coming up with a strategy to embrace new technologies and modernise energy systems in line with accelerating actions on climate change , which could be further amplified by the Biden and Suga administrations. Meanwhile, several countries (including Indonesia and Thailand) have detailed additional priorities for strengthening bilateral and multilateral coordination on power sector development within the region. These include enhancing multilateral funding for soft loans, improving bilateral investment schemes, promoting debt-swapping initiatives, and enhancing a blended financing scheme (e.g., philanthropic and private funds).

In terms of capacity building, the ASEAN Declaration on Human Resources Development provides one template for moving forward.[106] Adopted in June 2020 at the 36th ASEAN Summit, this declaration by the Southeast Asian member states emphasises the importance of adapting the human resources of these countries to the coming changes in the global economy, citing 'technological advances, the demographic transition and greening economies' as drivers of this change. To this end, the initiative highlights vocational and educational skills for technology development and adaptation, outlines

[104] Ministry of Foreign Affairs (Japan), 'Factsheet: Recent Efforts of Japan and the United States in Energy, Digital and Infrastructure Sectors toward Achieving a 'Free and Open Indo-Pacific,'' https://www.mofa.go.jp/files/000482895.pdf.

[105] US International Trade Administration, 'Fostering Commercial Cooperation under the Japan-US Strategic Energy Partnership (JUSEP) to Advance a Free and Open Indo-Pacific,' January 27, 2020, https://blog.trade.gov/2020/01.

[106] The full declaration may be found at https://asean.org/storage/ASEAN-Declaration-on-Human-Resources-Development-for-the-Changing-World-of-Work-and-its-Roadmap_Final_19Feb2021.pdf.

pathways for more inclusive education and employment opportunities, and matches existing and potential skill sets to growing areas of need through public–private partnerships.

The ASEAN Declaration on Human Resources Development represents a continuation of years of related commitments by ASEAN. The founding charter's goals of cooperation in education and the current Vision 2025 'people-centered ASEAN community' signal the importance of human capital. Some flexibility is built into the declaration, with member nations aiming to produce individual frameworks for developing human resources. Possible actions account for the differing levels of development within ASEAN and range from identifying the highest-impact training and vocational programs to establishing incubators for kick-starting small businesses and integrating these with institutions of higher education.

Additionally, the declaration pays special attention to disadvantaged groups who run the risk of being left behind in a swiftly evolving economy, such as women and girls, people with disabilities, and workers in rural or remote settings. Particularly relevant during the ongoing Covid-19 pandemic is the promotion of online learning opportunities, which have the added benefit of increasing access to and the efficacy of re-skilling efforts across the region. Building a responsive labor force is a key goal of the declaration that seeks to tie the direct government actions in education and human development to greater benefits in the private sector and overall economy. Countries are encouraged to foster a closer partnership with the private sector and guide decisions to address industry needs, such as through technical and on-the-job training.

Finally, the declaration calls on ASEAN members to cooperate with international organisations 'to facilitate the sharing of models, good practices, and experiences' to improve human resources. This includes exploring a central funding source with international partners and corporations to help keep research and best practices updated and flexible as the demands of the 21st century labor market continue to evolve.

Forums such as the East Asia Summit can also bring together stakeholders from countries across the region to review and share any emerging best practices in stimulating reforms and mitigating impacts on vulnerable communities. As noted by workshop participants, this could be a constructive role for the Energy Cooperation Task Force and ERIN, in particular, both of which have regularly operated in these roles. The 15th EAS held on November 14, 2020, underscored the role that the institution can play to overcome previous gaps in regional cooperation and connectivity.[107] The discussion unsurprisingly focused on the impacts of the Covid-19 pandemic and options for the region to build out plans for recovery and growth.

[107] Ministry of Foreign Affairs (Japan), 'East Asia Summit Leaders' Statement on Cooperation to Promote Steady Growth of Regional Economy,' November 14, 2020, https://www.mofa.go.jp/files/100115537.pdf.

Commitments to enhance the sharing of information, promote investment, implement fiscal and monetary reform, and support ASEAN-led mechanisms for regional stability and development are important in combating infectious diseases. Yet they also can factor in significantly to preparing for and managing the aftermath of climate-related disasters, strengthening energy security, and creating environments for innovation and collaboration in clean technology development, amongst other areas. Indeed, Nguyen Xuan Phuc, prime minister of Viet Nam and 2020 ASEAN chairman, emphasised in his statement that opportunities exist for adopting an inclusive recovery plan that promotes clean and green technologies and improves cooperation.[108]

[108] Nguyen Xuan Phuc, 'Chairman's Statement of the 15th East Asia Summit,' November 14, 2020, https://asean.org/storage/45-Final-Chairmans-Statement-of-the-15th-East-Asia-Summit.pdf.

Chapter 8

Conclusion

Success in strengthening power sector outlooks in South and Southeast Asia will ultimately depend on realising three key conditions. The first is strengthening the intraregional capacity to leverage and mobilise large amounts of capital. The second is improving national- and regional-level energy policymaking and sector management tools.[109] The third is more broadly reducing barriers to greater regional trade and integration, so that individual countries are able to better take advantage of existing supply diversification and achieve a balanced power mix that does not rely solely on fossil fuels.

Each of these efforts could be significantly reinforced and enhanced via greater engagement by the EAS. For the first and third tasks, in particular, success will likely depend on the pace of energy market reform. This presents a challenge for policymakers, as many reforms will require vast social and political capital. Consequently, a key role that the EAS can play in addressing these challenges is helping amplify, support, and champion ongoing reform efforts both by directly engaging with individual countries and by supporting multilateral coordination on sequenced reforms. This includes support for specific tasks, such as reducing or eliminating fuel subsidies, as well as large undertakings, such as ending state-backed monopolies, tackling industry and government corruption, and improving overall market transparency.[110] Ongoing EAS initiatives to liberalise markets, discourage the politicisation of energy, and strengthen regional energy architecture to reduce any one country's exposure to price or supply shocks should also be reinforced and strengthened.

A key challenge will be coordinating such efforts with on-the-ground realities and specific needs and priorities as directed by decision-makers in South and Southeast Asia. Regarding US approaches, Nikos Tsafos notes that in the past effective policies have included 'a standardised checklist – a 'gold standard' – that projects must meet in order to secure private investment or US economic support.'[111] Early statements and executive orders by the Biden administration seem to suggest a different and potentially more challenging approach to achieving the goals of promoting green growth and climate mitigation as they relate to investment in fossil fuels.

[109] Herberg, 'High-Quality Infrastructure and the Free and Open Indo-Pacific Vision,' 24.
[110] Gillispie, 'US-Australia Energy Cooperation in the Indo-Pacific'.
[111] Tsafos, 'The Outlook for Power Generation in Southeast Asia and the Geopolitics of the Indo-Pacific,' 11.

Although such standards are important, in practice they often exclude countries from participating in initiatives or receiving support. As Tsafos argues, technical assistance can help a country meet that gold standard, but there is also something to be gained from a more flexible approach with greater risk that could free up more capital and come closer to meeting the on-the-ground needs. In the United States, the recommitment to global efforts to combat climate change and achieve sustainable energy access is encouraging for new public and private opportunities for collaboration on investment in and development of clean energy supplies. Moving forward, better integrating national concerns into larger regional and international strategies and efforts will ensure that these standards align with what is both desirable and feasible.

Appendix I: Current Trends in the United States

Current Trends in the US Power Mix

As South and Southeast Asia navigate the coming energy transition, the United States and other international stakeholders can play an important role in helping regional countries progress toward their energy security and climate goals. With US energy exports to developing Asia growing in recent years, US energy policy has a direct bearing on the energy mix and development pathways of its trade partners in the region. Within this context, the following analysis surveys trends in US electricity demand.

Since 2008, partly spurred by the financial crisis, total US electricity demand has plateaued at around 4 trillion kilowatt-hours. The US Energy Information Administration (EIA) estimates an average increase of around 1% per annum to 5 trillion kilowatt-hours by 2050, driven by steady economic growth outpacing efficiency improvements over that time period. While some of this increase is expected to come from vehicle electrification, the EIA estimates that this will not exceed 3% of total electricity demand by midcentury.

According to the EIA, the United States will effectively double its share of renewable electricity generation from 21% in 2020 to 42% by 2050.[112] While this figure includes solar, wind, hydropower, and biofuel sources, solar and wind have primarily driven and are expected to continue driving the shift toward cleaner electricity. Nuclear and hydroelectric projects offer additional options for achieving zero or near-zero emissions, but public opposition and higher regulatory hurdles have limited the growth of these power sources. According to the EIA, 2021 will see over 5 gigawatts of nuclear generating capacity retired when three plants close in the fall.[113] Hydroelectric capacity has stayed relatively constant since the turn of the century.[114]

Though coal was historically a major source of electricity generation and is fairly abundant in the United States, coal generation has decreased over the past ten years. As the shale revolution led to low gas prices, natural gas became the predominant source of electricity in 2016.[115] This increase in natural gas production began in the middle of the first decade of the 2000s as hydraulic fracturing and other advanced extraction technologies rose to prominence. In addition to increasing domestic use of natural gas for power generation, this boom in production boosted exports of liquefied natural gas (LNG). From 2015 to

[112] US Energy Information Administration (EIA), 'EIA Projects Renewables Share of US Electricity Generation Mix Will Double by 2050,' February 8, 2021, https://www.eia.gov/todayinenergy/detail.php?id=46676#.

[113] EIA, 'Nuclear and Coal Will Account for Majority of US Generating Capacity Retirements in 2021,' January 12, 2021, https://www.eia.gov/todayinenergy/detail.php?id=46436#:~:text=According%20to%20the%20US%20Energy,Nuclear.

[114] EIA, 'Table 10.1 Renewable Energy Production and Consumption by Source,' March 2021, https://www.eia.gov/totalenergy/data/monthly/pdf/sec10_3.pdf.

[115] EIA, 'Electricity Explained: Electricity in the United States,' March 18, 2021, https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php.

2020, US exports of LNG increased by more than 80 times.[116] Although much of this trade is with more developed Asian economies such as the Republic of Korea and Japan, developing Asian nations such as Thailand and India have seen significant increases in imported US LNG.[117]

While the past decade has been a story of natural gas replacing coal generation in the United States, in coming decades renewables are expected to largely replace retiring coal and nuclear plants. By 2030, renewable sources are expected to pass natural gas as the predominant source of electricity in the United States. Natural gas, for its part, is projected to retain a relatively constant share of electricity production out to 2050.

US Energy Policy Instruments

The United States uses a mixture of policy instruments to achieve its energy goals. While legislation such as the Clean Air Act regulates air pollutants like lead and ozone more directly, greenhouse gas emissions have not been regulated directly by federal laws. Some states, such as California, have implemented carbon cap-and-trade schemes or other ways of regulating emissions. However, the federal government uses other tools such as tax credits, regulatory access, and research funding to promote renewable energy.

Tax credits, either to incentivise production or investment, are a key driver of the power mix in the United States. Wind producers received a production tax credit (PTC), which in 2020 was $0.018 per kilowatt hour, that could reduce their tax burden. In its 2021 electricity outlook, the EIA predicted that 'more than two-thirds of cumulative wind capacity additions from 2020 to 2050 occur before the PTC expires at the end of 2024.'[118] While wind has outpaced solar for the past ten years, the loss of the PTC will limit its cost-competitiveness with solar.[119]

This trend is partly driven by the rapidly decreasing cost of solar power compared to wind power, but also because current investment tax credits of at least 10% provided to solar power projects are still maintained past 2024 in the EIA's modeling predictions. The expected shift from wind to solar predominance demonstrates the utility that tax credits can play in developing a renewable energy mix.

The United States can also exercise regulatory discretion on federal lands or in federally controlled waters, where it has more direct control to promote renewables. Federal lands require leasing agreements between the federal government and a private corporation. By approving leases only for wind or solar projects instead of oil and gas exploration, the federal government can influence some of the energy makeup. This tool is particularly

[116] EIA, 'US Natural Gas Exports and Re-exports by Country,' February 26, 2021, https://www.eia.gov/dnav/ng/ng_move_expc_s1_a.htm.

[117] As noted by workshop participants, Japan re-exports some of its imported natural gas, and as a result, US LNG products also find their way to developing Asia via more developed neighbors.

[118] EIA, 'Annual Energy Outlook 2021,' February 3, 2021, https://www.eia.gov/outlooks/aeo/electricity/sub-topic-02.php#:~:text=More%20than%20two%2Dthirds%20of,the%20current%2030%25%20phases%20out.

[119] Ibid.

useful in western US states, where much of the federally administered land is located, and in maritime projects, where oil wells or wind farms could be in federally controlled waters.

As seen with the Biden administration's revoking of the Keystone XL pipeline, the executive branch can exert control over international energy agreements as well. The Federal Energy Regulatory Commission, which oversees interstate transport of oil, gas, and electricity, can help create an electricity market that facilitates the growth of renewables and stored energy through pricing, trade, and infrastructure requirements.[120]

Finally, federal support comes from direct research funding through programs such as the Department of Energy's Energy Office of Efficiency and Renewable Energy and the Advanced Research Project Association–Energy (ARPA-E) program. The former provides hundreds of millions of dollars in funding, including for research facilities for improving energy storage and industrial energy efficiency.[121] ARPA-E received $427 million in funding in 2021, including $100 million specifically meant to meet the Biden administration's climate goals, and targets high-impact, transformative technologies, such as solid-state batteries, superconductors, and advanced software to predict spikes in demand or outages.[122] These projects can then be commercialised after receiving initial government funding. Nearly $5 billion in private investment has followed the $2.4 billion in public investment in ARPA-E projects since 2009.[123]

New Goals for the Biden Administration

Since assuming office in January, President Biden has shifted many US policy stances. The following discussion considers changes affecting renewable energy and international development.

Renewable energy. During the campaign, Biden's Plan for a Clean Energy Revolution and Environmental Justice was central to his bid for president. Styled as an economic revitalisation plan, as well as a means of addressing climate change, the proposed $1.7 trillion plan focused on domestic infrastructure and renewable energy projects instead of fossil fuel exports.[124] It also included a pledge to realise a 'carbon pollution-free power sector' by 2035 through doubling offshore wind by the end of the decade, prioritising wind and solar development on federal land, and renewing or extending tax credits to wind and solar producers, amongst other measures. Wind and solar power have experienced

[120] Federal Energy Regulatory Commission, 'What FERC Does,' https://www.ferc.gov/about/what-ferc/what-ferc-does.

[121] US Department of Energy, 'DOE Launches Design and Construction of $75 Million Grid Energy Storage Research Facility,' March 10, 2021, https://www.energy.gov/articles/doe-launches-design-construction-75-million-grid-energy-storage-research-facility.

[122] US Congress, 'House Resolution 133,' January 3, 2020, 1428-9, https://www.congress.gov/116/bills/hr133/BILLS-116hr133enr.pdf.

[123] ARPA-E, 'US Department of Energy Announces $100 Million for Transformative Clean Energy Solutions Supporting President Biden's Climate Innovation Agenda,' February 11, 2021, https://arpa-e.energy.gov/news-and-media/press-releases/us-department-energy-announces-100-million-transformative-clean.

[124] 'The Biden Plan to Build a Modern, Sustainable Infrastructure and an Equitable Clean Energy Future,' Biden-Harris Campaign, 2020, https://joebiden.com/clean-energy.

remarkable growth in the US market over the past decade, driven by plummeting prices. However, incorporating these variable renewable sources will require upgrading US infrastructure, which is another key aspect of Biden's proposed plan. At the end of March 2021, he proposed the American Jobs Plan, which includes massive infrastructure spending alongside support for renewable energy. The plan includes a $100 billion investment from Congress and mobilisation of private capital to upgrade the electrical grid. It also would establish a Grid Deployment Authority in the Department of Energy to leverage existing access and rights of way to expand the high-voltage transmission network across the country.[125]

Alongside modernising electricity transmission infrastructure, the proposal includes a significant focus on improving battery storage. This goal will likely be buoyed by efforts to electrify the transportation sector, which is necessary to achieve carbon neutrality by 2050. Research and development to improve battery technology for electric vehicles could help the power sector improve its ability to store energy from variable renewable sources. Biden has ordered that the federal fleet of over 600,000 vehicles begin transitioning to zero-emission electric vehicles, offering a direct boost to demand. While the immediate effects will be in the transportation and auto manufacturing sectors, the electrification of a significant portion of vehicles will have implications for the entire energy sector.[126]

International energy development. Under former president Donald Trump and his export-based strategy of energy dominance, US international energy development focused on LNG and natural gas. Through executive orders, appointments of key personnel, and the decision to officially rejoin the Paris Agreement, the Biden administration is signaling a shift in focus toward combating climate change. In one of the earliest statements from a senior official, Ambassador Atul Keshap, the principal deputy assistant secretary of the Bureau of East Asian and Pacific Affairs at the Department of State, emphasised the importance of the United States' commitment to the Mekong–US Partnership for combating climate change. He also noted the administration's intention to work with India and the other Quad countries to promote investment and development efforts in the Mekong subregion.[127]

[125] 'Fact Sheet: The American Jobs Plan,' White House, March 31, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan.

[126] 'Remarks by President Biden before Signing Executive Actions on Tackling Climate Change, Creating Jobs, and Restoring Scientific Integrity,' White House, January 27, 2021, https://www.whitehouse.gov/briefing-room/speeches-remarks/2021/01/27/remarks-by-president-biden-before-signing-executive-actions-on-tackling-climate-change-creating-jobs-and-restoring-scientific-integrity.

[127] Atul Keshap, 'Remarks at the Mekong-US Partnership Track 1.5 Policy Dialogue Opening Plenary,' US State Department, March 18, 2021, https://www.state.gov/remarks-at-the-mekong-u-s-partnership-track-1-5-policy-dialogue-opening-plenary.

On January 27, Biden issued an executive order under the title 'Tackling the Climate Crisis at Home and Abroad.'[128] The order developed a climate finance plan to utilise channels such as USAID, the US Trade and Development Agency, and the National Security Council to refocus international efforts on more climate-friendly policies. The order included a re-evaluation of overseas financing for carbon-intensive fossil fuel energy infrastructure across departments and the Export–Import Bank. It shifted focus instead to opportunities for international collaboration that promoted clean energy technologies. The order also put a pause on leasing new oil and gas rights to public land.

Regarding LNG and natural gas, Biden has indicated support for both as transition fuels. During the campaign, both Trump and Biden supported natural gas producers, partly driven by the importance of the issue in the key swing state of Pennsylvania. Since assuming office, Biden has stated that he has no intention of completely banning hydraulic fracturing, or 'fracking,' against the wishes of many members of his own party. The January 27 executive order pauses new oil and gas development and leases on federal land, which would include fracking, but does not halt existing projects (with the exception of a temporary moratorium on the Coastal Plain Oil and Gas Leasing Program in the Arctic National Wildlife Refuge).[129] The newly appointed secretary of energy, Jennifer Granholm, has indicated that she supports US LNG exports as well as renewable energy development. She stated during her confirmation hearing, for example, that LNG has 'an important role to play in reducing international consumption of fuels that have greater contribution to greenhouse gas emissions.'[130]

Despite having only been in office for three months, President Biden's focus on energy transitions is already clear. Through the various avenues available to the executive branch, the new administration is showing support for greener electricity, while slowing but not stopping the use of some transitional fossil fuels. As the Biden administration finalises its domestic stances on energy, the international community will await the outcome of the Leaders' Summit on Climate, scheduled for late April, to see how these national policies translate into NDCs and international climate cooperation.

[128] 'Executive Order on Tackling the Climate Crisis at Home and Abroad,' White House, January 27, 2021, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad.

[129] 'Executive Order on Protection Public Health and the Environment and Restoring Science to Tackle the Climate Crisis,' White House, January 20, 2021, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackle-climate-crisis.

[130] US Senate Committee on Energy and Natural Resources, 'The Nomination of the Honorable Jennifer M. Granholm to be Secretary of Energy Responses to Questions for the Record Submitted to the Honorable Jennifer M. Granholm,' January 27, 2021, https://www.energy.senate.gov/services/files/126F0A25-8274-4980-AD74-8011CAA0E5EB.

Appendix II: NBR–ERIN Workshop Agenda

STRENGTHENING EMERGING ASIA'S POWER SECTOR: NEEDS, REQUIREMENTS, AND POTENTIAL ROLES FOR

EAST ASIA SUMMIT ENGAGEMENT

Virtual Workshop

January 20, 2021 | 11:00 a.m.–1:30 p.m. Japan Standard Time

January 22, 2021 | 11:00 a.m. – 1:00 p.m. Japan Standard Time

Growth in electricity demand in South and Southeast Asia is amongst the fastest in the world. Yet questions remain about how countries across this region might be able to individually or collectively meet their demand requirements while navigating complex economic, environmental, and energy security considerations. Major market shifts, such as the shale revolution in the United States and the impacts of the Covid-19 pandemic, have had a profound impact on the availability and affordability of a range of energy supply options. However, capitalising on these opportunities is often deeply constrained by rigid, opaque, and uncompetitive energy markets (particularly for natural gas and LNG); unresponsive energy pricing arrangements; weak and inadequate transmission infrastructure; and the need to broadly strengthen energy sector policymaking, governance, and technical and local capacity. How might stakeholders from across the region come together to address these issues, and what specific facilitating roles can fora such as the EAS play in this process?

Day One | January 20, 2021

11:00–11:10 Welcome and Introduction

11:10–12:25 *Powering Emerging Asia: Supply and Demand Outlooks and Paths Forward*

This panel will outline the current outlook for rising power demand and supply prospects across this region and potential scenarios for how the next 20 years of energy development might proceed. What are the region's energy development trajectories under business as usual and pandemic-adjusted scenarios? How are stakeholders and policymakers across the region seeking to reshape power markets to balance the need to boost supplies while moving towards a cleaner energy mix? Where do initiatives like the Indo–Pacific Strategy, the Japan–US–Mekong Power Partnership, and the Belt and Road Initiative fit into this picture? How might innovative partnership strategies help to

better jumpstart any necessary sector reforms? What role does the East Asia Summit currently play in these processes, and what new roles might it be able to take on?

12:30-1:30 ***Resourcing the Toolkit: Building Technical and Human Capacities for Power Sector Transformation***

Strengthening local- and national-level capacities in power-sector management – whether via skill trainings, improved access to data or technical resources, or other people-people exchanges – is critical to how South and Southeast Asia might be able to navigate (and ultimately, take advantage of) recent market and technological breakthroughs. Meanwhile, the World Bank estimates that distortions in South Asia's power sector are already decreasing the sub–region's GDP by 4%-7%, and weak governance in generation and delivery of electricity is a key factor in these losses. This panel will discuss ongoing efforts, emerging best practices, and potential new recommendations for strengthening technical and human capacity at a national-, sub-regional, and regional-level. How have longstanding international efforts driven by Japan's METI, USAID, or sub-regional fora such as ASEAN approached these challenges? What gaps remain? Where might efforts be more effective or better amplified via the East Asia Summit? How could a range of stakeholders contribute to a truly regional framework for knowledge sharing, and what might this look like?

Day Two | January 22, 2021

11:00–11:05 Welcome and Opening Remarks

11:05–12:30 ***Mobilising Energy Sector Investments***

As recently noted by the IEA, slowing global economic growth, the collapse in oil and gas prices, combined with disruptions brought on by Covid-19 have resulted in a historic drop in energy investment. At the same time, the Asian Development Bank estimates that Asia and the Pacific will require $1.7 trillion per year in infrastructure investments through 2030, with more than half of the total need in the power sector. Moreover, energy industries and markets in emerging Asia were already straining to meet demand and mobilise investment before the pandemic. Nevertheless, global financial markets are awash with cheap capital looking for investment opportunities in a near-zero interest rate world. Pension funds, insurance companies, large investment funds, sovereign wealth funds, and global energy companies are looking for 'bankable' energy infrastructure investment opportunities. What might it take to seize on the opportunity to 'reset' approaches? This session will examine the potential to mobilise capital and investment partnerships to help fully unlock the potential of public and private financing for power sector and infrastructure investments. What does it look like to 'leverage development finance and export credit to catalyse private investment' under Asia's new normal? What are the necessary financial, contractual, and policy preconditions to ensure that energy projects currently proposed or under construction are financially viable?

12:35–1:00 ***Crafting the Call to Action***

This session will kick-off with the sharing of a draft 'call to action' that aims to synthesise preliminary workshop findings and identify opportunities for greater EAS engagement to play a positive role in strengthening Emerging Asia's power sector. All participants will then be invited to join in a facilitated discussion designed to further refine, test, and strengthen recommendations.

Appendix III: The 1st ERIN Statement on the East Asia Energy Forum[131]

1. Background

Energy is indispensable for people's life and for the prosperity of any national economy. Nevertheless, East Asia Summit (EAS) countries face serious energy challenges in terms of Energy Security, Economy, Environment, and Safety (3E+S).

In terms of energy security, rapid economic growth in the region has resulted in many energy importing countries increasing their energy import dependency and some energy exporting countries reducing their energy export capacity. Consequently, energy importing countries have become more exposed to supply fluctuations and greater market risks than in the past. To illustrate the trends, the crude oil import rate in the EAS region (except for Japan) increased from 44% in 2000 to 63% in 2012. Energy exporting countries have also suffered from reduced income as export volumes have declined. Further energy security risks in the region include: uncertainty of energy supplies from the Middle East and volatile energy prices.

Combined with the overall rise in energy imports over time, higher energy costs have the capacity to undermine EAS economies, the living standard of people and the competitiveness of the industries in the region. In particular, highly variable and uncertain international energy prices are a contributing factor holding back investment required for energy resource development and infrastructure improvement.

From an environmental perspective, growing energy consumption has led to an increase in carbon dioxide (CO2) and other emissions that have negative long-term and short-term effects on people. As a ratio of global CO2 emissions, the EAS region increased its contribution from around 28% in 2000 to 43% in 2012, and in 2014 it totaled some 1.36 billion tons.

The Fukushima nuclear accident in Japan in 2011 caused many people in the region to become much more sensitive to the issues of energy safety, and in particular nuclear safety. While there are risks with all forms of energy, without nuclear power it will be difficult for countries in the EAS region to respond to future demands of energy security, economy and environment.

Currently, the nuclear power generation capacity in Asia is expected to more or less triple from the present 89 GW to 274 GW over the next 25 years. To realise this growth people's trust in nuclear safety must return. This requires dissemination throughout the EAS region of nuclear safety technologies, planning and culture. In Japan, following a highly detailed safety review, its nuclear power plants are expected to resume operation gradually from

[131] The original statement may be found at https://www.eria.org/uploads/media/ERIN/The_1st_ERIN_Statement.pdf.

2015 onwards, with an expectation its share of nuclear power in electricity generation by 2030 will be between 20 to 22%.

2. Achieving resilient energy systems

In response to changing circumstances inside and outside of the EAS region, each country needs to strengthen its own energy system and capacity which is resilient to future change of social structure, economical condition, and environmental circumstances such as climate change. This can be accomplished by setting balanced policy goals and through deploying comprehensive policy approaches.

Four key elements of setting balanced policy goal for a resilient energy system include:

- Enhanced energy efficiency;
- Lower cost renewable energy;
- Reduced carbon emissions and particulates from fossil fuel use; and
- Safer nuclear power.

Five key elements of deploying comprehensive policy approach for a resilient energy system include:

- Mutual policy support;
- Financial support;
- Technological development and transfer
- Human resource development; and
- Innovative thinking responding to future needs

2.1 Setting balanced policy goal

To achieve a resilient energy system all energies including fossil fuels, renewable energy and nuclear power need to be integrated to maximise benefits to energy users, to the economy and the environment.

Enhanced energy efficiency

Energy consumption, typically, increases with economic growth. The experiences of developed countries, such as Japan, show how to decouple these linkages and, thus, mitigate exhaustion of energy resources, reduce dependence on energy imports, and minimise environmental deterioration. Emerging economies also need to, where possible and appropriate, disconnect future economic growth from higher energy consumption. Where 'energy-growth' decoupling occurs, appropriate technologies will be required to increase energy efficiency. Where appropriate, developed countries with the technologies and successful energy efficiency experiences can assist emerging economies improve energy efficiency over time in the EAS region.

Lower cost renewable energy

Renewable energy can assist with energy security and its use is projected to increase in most EAS countries. Unfortunately, many renewable energies have a higher levelised cost

of energy than existing baseload generation sourced from fossil energy and nuclear power. To make maximum use of the advantages of renewable energy, generation costs needs to decline. To reduce these costs, lower-cost renewable technology needs to be developed along with market opportunities that permit economies of scale associated with larger volumes of renewable energy production.

An obstacle to further expansion of renewable energy is that solar power generation and wind power generation are intermittent power sources. Thus, to maintain the stability of a power supply system with increased renewables there needs to be an improvement of a power supply-demand adjustment system. This can be promoted by backup power sources, power storage facilities, and demand response, plus an appropriate electric power industry's structure. These developments take time and should be done in a phased manner, paying attention to possible spillover costs of rapid changes in energy structures.

Cleaner use of fossil fuel

A key advantage of fossil fuels is that they have higher energy density, are of relatively low cost, and are convenient to use. Their principal disadvantage is that they emit pollutants, including CO2, in their combustion. In the EAS region, where energy demand is expected to increase substantially over coming years, large increases in fossil fuels use pose environmental challenges. Thus, cleaner utilisation of fossil fuels is important to respond to this problem. Specifically, what is required is reduced emissions of pollutants by using existing and to-be-developed technologies to respond to energy-related emissions. The challenge is that clean utilisation technologies are currently costly, and they require a certain capacity in terms of human resources for their deployment.

Safer nuclear

Nuclear power promotes national energy security because it requires very small amounts of fuel. Further, it has benefits for the environment (CO2 emission free) and has low operational costs for existing plants. Its adoption is underway, or is being considered, in EAS countries which are highly dependent on energy imports, or have a large population and a high energy demand.

Nuclear accidents at the Chernobyl Nuclear Power Plant and Fukushima Daiichi Nuclear Power Plant, have affected the social licence to use nuclear power. Thus, improving safety is the highest priority if nuclear power use is to grow. As with any other technology, there are always risks. To mitigate nuclear risks, continuous efforts to enhance nuclear safety should be a top priority and, in particular, reducing the risks to health at both a national and international level.

2.2 Deploying comprehensive policy approach

To achieve a resilient energy system, all type of policies are important and should be supported in an integrated way to promote energy resilience in the EAS region.

Mutual policy support approach

Mutual policy support requires integrated decision-making and consideration of the unintended consequences. For instance, some policies that support growth in renewables, such as Feed in Tariffs are costly, and alternatives exist to achieve the same outcome at lower cost. Better and more cost effective policies require consideration of negative and positive spillovers and cross-sectoral considerations.

Financial support approach

Energy structure reform requires both adequate investment and financial support. Ideally the private sector should make the necessary energy investments, but many projects will be left unsupported if based solely on private returns, even if the public benefits are large. As a result, for high-risk investment, some public funding may be required. Possible areas for public support include the development of a strategic oil stockpile and research and development costs for immature energy technologies.

Technological development and transfer approach

Energy supply and technologies are interconnected. This is because technologies influence energy supply stability, safety and cost, and development while the use of better technologies is essential to realise a cleaner, more reliable and cost effective energy supply system.

Technology levels and development capabilities differ greatly, depending on the country and energy company. Given technologies are indispensable in the reform of energy systems, technology transfers from one country to another are highly desirable. In addition to helping the recipient country, technology transfer provides indirect benefits to a technology possessing country through enhanced regional energy security, in addition to direct export benefits.

Desirable short and medium-term technology developments include cleaner utilisation of fossil fuel, reduction in renewable energy costs, and enhanced safety for existing nuclear power, amongst other benefits. Over time, zero-carbon technology, and artificial photosynthesis, and fourth-generation nuclear power technology capable of cooling nuclear plants without power should be developed, and be part of future technology transfer.

Human resource development approach

Energy systems need capable human resources to make full use of them. Thus, simultaneous with technology transfers and mutual policy support, energy progress should include the development of human resources. Fortunately for the EAS region, the human resources exist to support the development of improved energy systems and capacity building.

In some cases, knowledge is already available about energy efficiency and conservation technologies and cleaner utilisation technologies for fossil fuels to build capacity in the region. For other technologies, such as, nuclear power safety technologies, human resource must be developed over time.

Innovative thinking approach responding to future needs

Necessity for seeking appropriate energy system is continuously changing. For instance, emergence of decentralised electricity supply system based on renewable energy is being observed. This is a different type of energy system that requires new type of policy and innovative technology from existing centralised electricity planning. Innovative approaches are sought to foresee and respond to changing future needs.

3. East Asia Energy Forum and Role of ERIN

Energy cooperation in the EAS region is a key to achieving the '3E +S'. It requires a comprehensive approach with the four policy measures to accelerate robust economic development in the EAS region, and to support co-prosperity. In addition, such cooperation needs to account for characteristic and uniqueness of the region which may call as the East Asia Energy Forum.

The East Asia Energy Forum must represent the diversity of the region and account for:

- size of economies;
- stages of economic development;
- energy resources;
- technological capability;
- financial accessibility;
- human resources; and
- social systems.

These considerations avoid 'off-the-shelf' cooperation that may ignore the realities of the region or a country, and fail to deliver the full benefits of energy transformation. For instance, energy deregulation, as practiced in the US and Europe, may not work in an EAS country where its energy infrastructure is growing rapidly or with fewer human resource capacities. Thus, the full benefits of deregulation or other possible approaches need to be tailored to the particular energy circumstances of each EAS nation.

The EAS region needs the East Asia Energy Forum that accounts for the diversity of member countries and to respond to their joint and particular energy challenges. Four features that characterise the cooperation include:

- Respect for differences;
- Learning from each other;
- Common challenges addressed in an attentive and inclusive manner; and a
- Balance between market mechanisms and government leadership.

ERIN is expected to play an important role by assisting ERIA to make policy recommendations. ERIN needs to function as a network center for high level knowledge and experiences in energy policy. To this end, it will draw from the think-tanks and/or universities in the EAS region. Each member organisation of ERIN has expertise not only for their country, but also for the region and global market. ERIN, together with ERIA, will contribute to the robust development of energy markets, co-development of the region and co-prosperity under the concept of East Asia Energy Forum.

4. Mid-term roadmap of ERIN

ERIN is expected to deliver valuable policy messages to ERIA, and eventually to Energy Ministers in EAS countries. These deliverables include:

- Three year time frame:
    - 1st year: conceptual vision making;
    - 2nd year: detailed design making; and
    - 3rd year: start of implementation.
- This will be around four key policy areas:
    - More efficient use of energy;
    - Lower cost renewable energy;
    - Cleaner use of fossil fuel; and
    - Safer nuclear energy.
- In turn this will be developed around four major approaches:
    - Mutual policy support approach;
    - Financial assistance approach;
    - Technological development and transfer approach; and
    - Human resource development approach.

A roadmap of ERIN activity which built on above mentioned elements can naturally share fundamental philosophy with a roadmap which will be formed by ERIA under the jurisdiction of 9th EAS Energy Ministers Meeting, 'EAS Mid- and Long- Term Energy Policy Research Roadmap'. ERIN will support ERIA to form the roadmap and take affirmative action according to the roadmap together with ERIA.

Through a phased step-by-step approach, ERIN and the East Asia Energy Forum will make practical and valuable policy advances within the region for the benefits of its citizens.