Welcome to Black & Veatch’s first-ever formal report dedicated to the electric industry in Asia. We are facing uncertain times, rife with challenges from financial constraints and operational disruption due to the global pandemic, but also buoyed by new opportunity to integrate more renewable energy and emerging sustainability technologies into the grid.

Economic realities will hold court, however, and have a significant influence on future direction over the next investment cycle. Over the short term, we expect more investment diverting to existing assets compared to new assets, and renewables look likely to receive investment boosts over more established technology categories. Indeed, the declining cost of renewables emerges as its biggest driver for deployment, pointing to its growing regional importance, while most respondents are confident about the important role of gas on electric grids in Asia beyond 2035.

Much progress has been made in closing the electrification gap over the past 20 years throughout Asia. As we look to 2021, many challenges lie ahead as we work through a period of unprecedented transformation. We are grateful for the expertise and insights from 35 of our senior clients and partners — with portfolios of responsibility on national levels or across multiple geographies throughout East Asia, South Asia and Southeast Asia — in helping us compile this special report.

We believe in sharing these insights to the market as we see a need for more joined-up thinking and solutions across generation, transmission and distribution, and a rising voice for large commercial and industrial electricity consumers to influence our industry’s future.

We welcome your questions and comments regarding this report and Black & Veatch services. You can reach us at MediaInfo@bv.com.
Resilient, affordable and green: Asia’s electric industry must balance multiple factors post-pandemic

Is there a future for gas-fired generation in Southeast Asia?

Technical advances, lowering costs will drive renewables in Asia, but integration and regulatory challenges remain.

Managing Asia’s future grid
Resilient, affordable and green: Asia’s electric industry must balance multiple factors post-pandemic

By Narsingh Chaudhary
“How” is the big question facing the electric industry across Asia as we look ahead to 2021 and a world post-COVID-19.

Over the past 20 years, considerable progress has been made towards achieving universal, reliable and affordable access to electric power. Whether the region will enable the transition to less carbon-intensive energy sources — principally through a step-change in the amount of renewable energy generation on the grid — is a question that will challenge all parties in the months ahead.

Two major challenges dominate our first-ever survey of opinion leaders in the electric industry in Asia, which occurred during the height of the pandemic. Significantly, 1) uncertainty of investment caused by a financial downturn; and 2) renewable energy generation clearly stands ahead of other issues, with more than one out of every three respondents identifying them as a top three challenge (Figure 1). These two critical issues must be addressed together, not separately.

As governments across Asia consider economic recovery, there is an opportunity to balance complementary goals of increasing affordable access, realizing more resilient and reliable generation, and achieving sustainable outcomes that reduce carbon and promote economic opportunities for more people in the region. That said, such solutions — while keeping renewable energy targets on track for many nations — would still demand considerable policy, financial and market adaptation.

How could the energy mix change?

Thanks to many years of growth and prosperity, the past two decades have seen power generation ramp up, using a full range of technologies. While overall energy demand has grown by greater than 80 percent in Southeast Asia, for example, most of this growth has been met by increasing fossil fuel use. Considerable capacity growth in renewables — namely solar photovoltaic (PV) and wind — is underway in China and India, for example, and a number of countries in Southeast Asia have made progress on frameworks that have improved the deployment of renewable energy.

By the end of 2019, Vietnam’s feed-in tariff program saw 5.6 gigawatts (GW) of solar and 900 megawatts of wind installed while Thailand’s cumulative capacity was nearing 5 GW. Large Southeast Asian countries like Malaysia, Indonesia and the Philippines were set for further capacity additions pre-COVID-19. It is inherent on leaders globally to consider the importance of a balanced generation portfolio and how a mix of fuel sources contributes to reliable power supplies.
Asia’s electric grid is growing, maturing

Contrasting with our annual U.S. electric report, few respondents in Asia identified aging infrastructure as a major concern (Figure 2), reflecting the growth characteristics of electricity capacities and systems in the region. Most other concerns reflect significant framework change ahead including economic regulation, market structure (both joint third) and environment regulation (joint sixth) alongside systems changes including energy storage (joint third), grid congestion (joint sixth) and distribution system upgrade and modernization (seventh).

Expectation for new coal-fired generation is on the wane. As recently as 2018, Southeast Asia saw an increase in coal’s share of the power mix. However, respondents hold relatively strong views on coal’s future investment decline, with more than 70 percent seeing much less (Figure 3). Along with government, the investment community in Asia is the most influential stakeholder in driving change, and pre-COVID-19 it was already becoming more difficult to secure competitive financing for new coal facilities.

Views on the role of gas-fired generation remain more varied and positive across a number of survey questions (see “Is There a Future for Gas-Fired Generation in Southeast Asia?” on page 9).

This will likely leave room for renewable energy. Land-based solar, energy storage, microgrids and other distributed energy resources (DER) are the top three technologies set to gain the most from coal’s waning investments (Figure 4). This creates a compelling picture of Asia’s future grid where storage technology — which itself has seen major advances in both efficiency and cost reduction — will work dynamically with solar PV at either utility scale or as part of microgrids (see “Technical Advances and Lowering Costs Will Drive Renewables in Asia” on page 14).

Financial sustainability post COVID-19

The question on how to fund these next generation of renewable investments as well as the level of funding, however, requires further consideration given the current milieu.

*According to the International Energy Association, Southeast Asia Energy Outlook 2019
Disruption to supply chains and day-to-day operations as well as workforce controls at projects under construction will have inevitable knock on financial impacts. There are difficulties forecasting demand, and shifting load curves from increased residential use are producing daily loads similar to weekend patterns. There is less commercial and industrial sector consumption leading to revenue declines, and either increases in rates for customers or the need for further cost recovery support from governments. These constraints will tighten the ability of many of the region’s electricity providers to finance and deliver an affordable energy transition, particularly where struggles to recover cost will affect credit ratings and make borrowing in debt markets more challenging.

COVID-19 also has fundamentally changed how the electric industry thinks about the workforce as well as asset management. More than 80 percent believe it has either probably or definitely changed this viewpoint (Figure 5), and there is a significant acknowledgement that remote asset performance monitoring is needed, with health screening and monitoring systems also scoring high in potential usefulness (Figure 6).
A focus on operational efficiency ahead

Utility modernization could be at an inflection point in the region (see “Managing Asia’s Future Grid” on page 19). The pandemic may serve as a catalyst for regional utilities, regulators and policymakers to begin implementing measures to modernize traditional models.

A shift to an operationally digital and more flexible grid would align with an increasingly distributed renewable energy system. This would also support a drive to more efficient electricity consumption, where significant opportunity exists throughout Asia, as well as more resilient generation and transmission systems capable of weathering ever-present risks of natural disasters prevalent in many locations.

While uncertainty prevails, the biggest drivers of any change in the electric industry will be from government, followed by the influence of the investment community and then customers (Figure 7). In the near term, electricity providers will continue to recalibrate their infrastructure planning and operations, which is likely to see rising renewable capacities but limited change to the overall generation mix.

For significant and sustainable change to be realized over the mid-to-long term, upcoming policy decisions — as well as the influence of the investment community and some large customers — will be critical. If these powerful forces come together, Asia can integrate new and more efficient technologies, and achieve more affordable, resilient and greener electricity supply.

ABOUT THE AUTHOR

Narsingh Chaudhary is Black & Veatch’s executive vice president in the company’s Asia power business leading solutions across conventional and renewable generation, transmission and distribution. Chaudhary joined Black & Veatch in June 2019 and has more than 25 years of experience leading various energy businesses in the Asia region and globally. In his former role with Siemens, he developed and implemented energy projects in multiple countries.

Figure 6
What workforce management and remote operations solutions would you find most useful? Include any you’re currently using. (Select all that apply)
Source: Black & Veatch

1. On-site health screening and diagnostic facilities
2. Remote asset performance monitoring
3. Digital check-in and health monitoring of workforce on site
4. Remote command and control
5. New workflow procedures (including more staggered hours)
6. Remote asset condition monitoring
7. Predictive health and risk indexing

Figure 7
Which groups do you feel apply the most relevant pressure or most influence on your business to listen and change? (Select up to three)
Source: Black & Veatch

65.6% Government regulators
56.3% Financial and investment sector
50.0% Customers
25.0% Shareholders
18.8% Employees
15.6% Interest and lobby groups
15.6% Technology sector
Large gas-fired power plants have a future in Southeast Asia. As countries continue on their journey to full electrification and more sustainable operations, combined cycle facilities will play a critical role in stabilizing ever-more complex grids, complementing variable renewable energy assets and, in some cases, transitioning to hydrogen as a zero-emissions fuel source over the long term.

While the region’s power industry clearly intends to improve levels of environmental sustainability, the pace of transition away from baseload coal and gas-fired power generation will be challenging. Operational and financial sustainability factors also must be managed head-on.

When asked about the biggest threats to grid operations and performance, the top four concerns reveal underlying operational issues that go beyond financial challenges post-COVID-19. Network capacity not keeping pace with demand, underinvestment in more reliable transmission networks, introduction of too much intermittent renewable energy
and not enough energy storage capacity are all top of mind for the industry in the region (Figure 8). While many countries around Southeast Asia have done an incredible job over the past 20 years narrowing the electrification gap, these findings point to a greater focus on grid stabilization issues in the years ahead.

The future of gas and coal
This is where gas-fired generation plays a critical role regionally. When asked about the future of fossil-fuel generation beyond 2035, two-thirds of all respondents believe gas will feature as a significant component of the grid (Figure 9). With financing an ever-increasing challenge, more than 80 percent do not see any role for coal after 2035.

Before we get to 2035, however, gas undoubtedly will remain prominent. Although domestic gas production and supply is declining in the region, the long-term cost model for liquefied natural gas (LNG) importation as a fuel source looks favorable. A lot of capital is also tied-up in Southeast Asia’s relatively young gas-fired power infrastructure. The large majority of the region’s 90-plus GW of facilities are well within their operational lifespans with approximately a

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**Figure 8**

*What are the biggest threats to reliable grid operations and performance in your region? (Select up to three)*

**Source: Black & Veatch**

<table>
<thead>
<tr>
<th>Threat</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network capacity investment not keeping pace with demand</td>
<td>41.9%</td>
</tr>
<tr>
<td>Underinvestment in more reliable transmission networks</td>
<td>38.7%</td>
</tr>
<tr>
<td>Introduction of too much intermittent renewable energy</td>
<td>32.3%</td>
</tr>
<tr>
<td>Not enough energy storage capacity</td>
<td>29.0%</td>
</tr>
<tr>
<td>Natural disasters</td>
<td>29.0%</td>
</tr>
<tr>
<td>Aging infrastructure</td>
<td>25.8%</td>
</tr>
<tr>
<td>Cybersecurity threats</td>
<td>19.4%</td>
</tr>
<tr>
<td>Government policies</td>
<td>16.1%</td>
</tr>
<tr>
<td>Lack of adequately trained manpower and appropriate tools</td>
<td>12.9%</td>
</tr>
<tr>
<td>Lack of reliable network data and ability to analyze/act</td>
<td>6.5%</td>
</tr>
<tr>
<td>Introduction of other distributed energy resources</td>
<td>6.5%</td>
</tr>
</tbody>
</table>

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**Figure 9**

*Is there a future for fossil fuel generation (utility-scale coal and gas generation) in your region(s) of operation beyond 2035? Select the scenario that best applies.*

**Source: Black & Veatch**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Yes, both coal and gas will remain important components of the grid beyond 2035 (18.2%)</td>
<td>66.7%</td>
</tr>
<tr>
<td>• Yes, investment in gas will remain long term, but coal will be gradually phased out with little new development (48.5%)</td>
<td>12.1%</td>
</tr>
<tr>
<td>• We will see limited investment in coal, and gas investment will focus mostly on upgrading existing facilities only</td>
<td>12.1%</td>
</tr>
<tr>
<td>• No, we will see limited investment in gas, and we will also start seeing increased decommissioning of coal facilities</td>
<td>9.1%</td>
</tr>
<tr>
<td>• No, we will see limited investment in both gas and coal</td>
<td>6.5%</td>
</tr>
</tbody>
</table>
one-third of generation capacity less than 10 years old. Investors will seek to improve the returns and revenues from these facilities and extend their lifecycle.

**Investments expected to improve existing asset efficiencies**

In the face of impacts from COVID-19, more industry respondents believe that investment will be reprioritized to existing assets (36 percent) compared to new assets (30 percent) or deferral (24 percent) (Figure 10). In addition, two-thirds of respondents see COVID-19 having no impact on the generation mix or that the changes to the mix will be slowed (Figure 11); the transition to renewables is unlikely to outstrip what will be a continued demand for baseload gas-fired generation.

This bodes well for investment in existing gas-fired facilities and does not dissuade against investment in new gas-fired facilities such as integrated LNG-to-power facilities. Electric utilities and independent power producers will be looking for increased operational efficiency gains, long-term cost savings and new revenue sources post-pandemic, all while maintaining an important focus on a more balanced generation portfolio. With expertise in both LNG and gas power technologies, Black & Veatch is uniquely positioned to help clients achieve maximum returns on investments by providing integrated LNG-to-power solutions.

**Gas plus storage will increase operational efficiencies and revenues**

Gas turbines have long played a central role in helping supply meet demand, given their ability to quickly flex, ramping up or down following demand peaks and valleys. Highly flexible gas turbine plants offer unlimited energy...
storage while on-line. Investing in additional battery energy storage systems (BESS) at existing or new assets will enhance this capability further for non-spinning reserve support, just as variable load and generation from more wind and solar begins impacting the grid.

Combined cycle facilities augmented with BESS will function as a new kind of reserve that springs to life immediately to smooth and optimize turbine performance levels. This will translate to less turbine starts and stops, leading to longer operating life (measures in years) and reduced wear and tear (measured in lower costs).

Attractive for owners is that when not called to operate for the gas turbine, the BESS also can participate in an ancillary services market for grid support, providing power quality services, frequency regulation, and primary and secondary frequency reserves. Such future capabilities depend on local electricity market rules and may require potential reform, primed for enhancement as we emerge from the pandemic.

Either way, we expect owners of gas-fired facilities to explore retrofitting assets with BESS while also considering converting simple- to combined-cycle configurations or repowering facilities with more advanced gas turbines that extend the life of the facility, especially given these facilities' role in grid resilience and stabilization over the mid- to long-term. Additionally, opportunities exist for asset management services that not only monitor but diagnose opportunities to improve fuel performance, operations and maintenance of generating assets.

**Hydrogen as a fuel source for generation**

The global decarbonization drive has intensified in recent years. Natural gas still is viewed as an important bridging fuel on this journey but, in recent years, green and blue hydrogen have emerged as a potential replacement fuel that would take advantage of existing infrastructure. “Green” hydrogen is produced through the electrolysis of water using an electric from a carbon free source such as renewable, nuclear or hydroelectric power. “Blue” hydrogen is produced through natural gas reforming with carbon capture. With many original equipment manufacturers developing turbines to use increasingly efficient levels of hydrogen and pioneering work underway in select...
Sixty-two percent of the survey respondents believe hydrogen will take off as a clean and affordable alternative to existing gas generation. A healthy 28 percent remain on the fence, meaning that understanding how to convert gas facilities and its feasibility will be high on owners’ agendas (Figure 12). Not one respondent believed there was definitely no future for hydrogen.

Similar to the process that will be necessary to integrate sustainable emerging technologies, these journeys will mandate working with a variety of stakeholders across the oil, gas, chemical and transportation industries in new ways. Gas has a future in Southeast Asia’s electric industry, but the industry must keep pace with change and evolve and improve the operationally effectiveness of its assets.

**ABOUT THE AUTHOR**

Lee Mather is vice president and director of Black & Veatch’s global conventional generation power business in Asia. Based in Indonesia, Mather has more than 20 years of experience working for Black & Veatch across multiple global locations. He oversees the growth of Black & Veatch’s services and EPC solutions for power generation facilities in the region.
Renewable energy is critical to Asia’s future, but delivering on its promise will require a coordinated effort between the energy sector, regulators and other critical stakeholders. In fact, Black & Veatch’s Strategic Directions: Electric Industry Asia 2021 respondents place renewables second among the most-challenging issues facing Asia’s electric industry, just behind uncertainty of investment caused by financial downturn. Energy storage — a crucial element in the successful deployment of renewables at both utility scale and for DER — is the third most-challenging issue; level with economic regulation and market structure (Figure 13).

The renewables challenge can be construed as one of change management, rather than a challenge rooted in the technical aspects of decarbonizing Asia’s power infrastructure. The theme of managing change, often through the prism of government policy, regulation and socio-economic factors, is a trend across survey responses.
Asian renewables investments to increase

The most significant investment growth is anticipated in solar: 60 percent of respondents believe land-based solar would attract “much more investment than today,” and 28.6 percent say it would receive “somewhat more investment than today” (Figure 14). Floating solar ranks third in terms of new generation capacity investments with 34 percent of respondents anticipating “much more investment,” and 46 percent foreseeing “somewhat more investment.”

Sandwiched between land-based and floating solar, in terms of predicted investment, is energy storage. Given that storage is vital for the successful adoption of solar it is reasonable to interpret investments in storage as going hand-in-glove with investments in solar generation.

Other forms of renewable energy in ascendance are onshore and offshore wind, DERs and waste-to-energy. A noteworthy trend is floating/offshore renewables investments. In many Asian countries — especially Southeast Asia — drivers include competition for landbank suitable for large-footprint solar and wind arrays, coupled with land acquisition challenges.

Regulation, investment community to drive change

The changes Asia’s energy sector has to manage are driven from the top. Respondents cite government regulators as having the greatest influence, followed by the financial and investment sector then customers. In further evidence that change in Asia’s power sector is led by socio-economic and policy factors, rather
than technology-driven, the technology sector is cited as joint last as an influence for change (Figure 15).

The drivers for Asia’s renewable energy investments show that the renewables challenge is one of change management rather than technical implementation (Figure 16). Of the factors behind renewable energy investments, only two are technical: improved competitiveness and efficiencies from new technologies, and battery storage making it easier to manage and reduce losses (ranked third and seventh, respectively).

With the exception of changes in the levelized cost of energy (LCOE), all of the other factors driving change are rooted in socio-economics and/or government policy. Lower LCOE, which sits at the nexus of technical advances and socio economics and/or government policy, is the factor respondents feel is most important in driving renewable energy investments.

Technical advances contributing to solar’s lower LCOE include:

- Bifacial photovoltaic technology offers higher electricity production from a module that incurs almost no additional balance of system cost; allows sub-prime locations to maintain the amount of required generation using less land and fewer development costs.
- Bifacial gain factors — that can be engineered to optimize performance — include adjusting the surface albedo or reflectance of the surrounding ground, the row pitch, module height and backside shading levels. Most of these are new factors, not relevant previously to solar facility design.

A combination of lower LCOE and increased owner/shareholder desire for decarbonization is likely to motivate the sectors most vocal in demanding renewable electricity sources. These are typically newer tech-related sectors or large-scale users of the services these tech-related sectors provide: data centers, banking and large IT companies. Demand for change from more established, traditional sectors — e.g., food and beverage, pharmaceutical and mining — is lower (Figure 17). Another socio-economic factor driving the change towards a digital economy and the growing significance of the companies and sectors facilitating that change is driving the demand for renewables.
Figure 16
What factors are driving renewable energy investments in your region? (Select all that apply)
Source: Black & Veatch

61.3%
Lower levelized cost of energy

51.6%
Increased shareholder pressure and drive for sustainability goals

48.4%
Improved competitiveness and efficiencies from new technologies

38.7%
Increased pressure from governments

38.7%
Attractive government incentives and/or policy

35.5%
Fewer options to finance traditional / easier to finance renewables

19.4%
Battery storage making it easier to manage and reduce losses

12.9%
Increased demand from industrial clients to offset commercial tariffs

12.9%
Lower development/delay risks compared to traditional solutions

6.5%
Increased demand from residential customers

Figure 17
Which sector(s) do you think are or will be most vocal in demanding renewable sources of electricity in your region? (Select all that apply)
Source: Black & Veatch

1 Data Centers
2 Banking
3 Large IT companies
4 Industrial manufacturing, chemical or oil and gas
5 Food and beverage manufacturing
6 Other large users
7 Other manufacturing
8 Pharmaceutical
9 Mining

Storage is key to renewable integration
A significant part of the challenge posed by renewables lies in managing solar and wind’s variable generation. Although investment issues — network investment not keeping pace with demand, and underinvestment in more reliable transmission networks — are seen as the biggest threats to reliable grid operations and performance, the introduction of too much intermittent renewable energy is the third biggest threat. The flip side of the variable generation coin — not enough storage capacity — is seen as the joint fourth biggest threat. DER, which frequently encompasses small-scale renewables and storage, is not seen as a major risk to grid performance (Figure 18).

On a technical level, managing the introduction of significant amounts of renewable energy is being managed with ever-greater success and efficiency, but this requires significant storage capacity investments. Battery energy storage systems (BESS) are gaining favor due to lowest-ever capital costs. BESS share the lithium-ion
cells used in cell phones and electric vehicles; economies of scale from these industries are lowering the cost for BESS in power systems. In the past decade, the cost of lithium-ion energy storage in terms of U.S. dollar per kilowatt hour has fallen by more than 75 percent. The cost 10 years hence is predicted to be half current levels.

A future of more efficient and integrated renewables

The prospects for more solar deployments in Asia look promising, given expected levels of investments and declining costs of complementary BESS. This combination will be significant in overcoming technical challenges of integrating utility-scale solar and other variable generating renewables, but the biggest challenges overall regarding the decarbonization of Asia’s power sector are predominantly rooted in government policies, or lack thereof, and broader socio-economic factors.

To help them prosper in a decarbonized future, power and grid companies need partners familiar with every aspect in the lifecycle of generation, transmission and distribution assets. Such partners also need to be expert in integrating these assets — especially storage — to create a stable, efficiently functioning whole. The best partners will be able to marry technical expertise with the ability to help the power sector navigate and influence regulations and advise on investment strategies along each point in the asset lifecycle.

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Managing Asia's future grid

By Harry Harji and Yatin Premchand

Asia's energy transition is extensive and rapid. Google's commitment to use excess renewable energy from rooftop solar panels of 500 public housing blocks to power its Singapore operations is a clear indication of the shift to sustainable development. Google has two data centers in Singapore and is constructing a third one.

The growth in corporate power purchase agreements (PPAs) reflects the findings of our first-ever survey of opinion leaders in the electric industry in Asia. Respondents anticipate that data centers (50 percent), banking (43 percent) and large IT companies (40 percent) will be the most vocal in demanding renewable sources of electricity (Figure 19).

As explored in “Technical advances and lowering costs will drive renewables in Asia (page 14),” decarbonizing Asia's power infrastructure is not seen as a major technical challenge. Respondents believe government policy, regulation and socio-economic factors will drive investments more than the technology itself. This suggests the possibility that large commercial and industrial users — driven by sustainability commitments — will demand more renewable generation and, where possible, build their own solutions.

Distributed energy resources (DER) such as microgrids offer large users the reliability and resilience of supply they require alongside direct control in meeting environmental targets.

Figure 19
Which sector(s) do you think are or will be most vocal in demanding renewable sources of electricity in your region? (Select all that apply)
Source: Black & Veatch

1 Data Centers
2 Banking
3 Large IT companies
4 Industrial manufacturing, chemical or oil and gas
5 Food and beverage manufacturing
6 Other large users
7 Other manufacturing
8 Pharmaceutical
9 Mining
Key survey findings include:

#1: Much more investment in microgrids and other DER
Of all generation technology categories, survey findings suggest a significant investment jump in microgrids and other DERs over the next three to five years. Respondents ranked microgrids third in terms of receiving “much more investment,” reflecting the category’s potential for use both by large users as well as remote and island communities throughout Asia that lack connection to reliable, resilient and sustainable supply (Figure 20). “Much more investment” in microgrids and DERs ranks just behind solar and energy storage — which are likely components of many microgrid solutions, particularly in Southeast Asia’s sunny and archipelagic locations.

Implications: Introducing greater levels of renewable energy and DERs — such as microgrids — will increase the complexity of grid management and operation throughout Asia. Higher penetration of variable generation will require increased grid flexibility to respond to sudden increases and decreases of supply due to changes in season, weather and time of day.

#2: Mindset change post-pandemic
Add variable load to increasingly variable supply and challenges facing future grid management come clearly into view. Recent lockdowns due to the COVID-19 pandemic — where load curves shifted from industry and offices to people’s homes — have completely changed the way Asia’s power industry views operations, asset management and its workforce (Figure 21).
Respondents see the biggest threats to reliable grid operations and performance as network capacity investment not keeping pace with demand (41 percent); underinvestment in more reliable transmission networks (38 percent); and introduction of too much intermittent renewable energy (32 percent). Also prominent and tied for fourth are not enough energy storage capacity and natural disasters (29 percent) (Figure 22).

**Implications:** Better grid flexibility could be achieved by deploying BESS, increasing the capacities of existing transmission systems and integrating and upgrading flexible generation such as gas-fired facilities. Informed and rigorous investment prioritization will be required to deliver integrated grid solutions that target system gaps with the right opportunities.

#3: Existing assets, digital systems to receive investment boost

Our industry’s changing mindset to asset management and operations — while facing inevitable financial constraints — will see short term investment reprioritized to existing assets and channeled to the replacement of existing units, conversion of analog systems to digital systems, and increased remote monitoring and diagnostics (Figure 23).

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**Figure 22**

What are the biggest threats to reliable grid operations and performance in your region? *(Select up to three)*

Source: Black & Veatch

- **41.9%** Network capacity investment not keeping pace with demand
- **38.7%** Underinvestment in more reliable transmission networks
- **32.3%** Introduction of too much intermittent renewable energy
- **29.0%** Not enough energy storage capacity
- **29.0%** Natural disasters
- **25.8%** Aging infrastructure
- **19.4%** Cybersecurity threats
- **16.1%** Government policies
- **12.9%** Lack of adequately trained manpower and appropriate tools

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**Figure 23**

You selected re-prioritizing investments to existing assets. More specifically, where do you see this investment going? *(Select up to three)*

Source: Black & Veatch

1. Replacement or upgrade of existing generating units
2. Conversion of analog systems to digital systems
3. Increased remote monitoring and diagnostics
4. Rehabilitation of equipment to extend plant’s life
5. Reducing emissions (e.g., air quality control systems)
6. Automating operations
7. Meeting new and future environmental compliance requirements (other than emissions)
8. Upgrading transmission and substations
In the face of specific COVID-19 restrictions, both remote asset management performance monitoring, and remote command and control also feature as two of the top five solutions respondents would find most useful in managing through the pandemic; others were related to health and workflow management (Figure 24).

**Implications:** While the power sector had started assessing digital solutions before the global health crisis, survey findings suggest that the pandemic is likely to accelerate the digital transformation of Asia’s power sector.

**Benefits of digitization**
Transforming Asia’s power sector through technology is a compelling business case. Optimizing the impact of individual technologies to enhance grid performance is one such digital application. For example, starting with data collected by smart sensors is particularly useful for renewable energy applications. With wind and sunlight affecting power generation production, sensors and smart grids ensure that renewable energy plants are operating to their optimal potential.

Operationally, adoption of predictive asset maintenance monitors equipment performance in real-time, forecasting and optimizing maintenance schedules. Such advances will help mitigate costly outages and other equipment failures across entire systems and extend the equipment lifecycles. Further still, prescriptive analytics will enable autonomous management, where machines act on the information the artificial intelligence (AI) has extracted, offering even further operational savings long term.

These roll up to asset performance management (APM) solutions in which the health, performance and optimization of multiple critical generation, transmission or distribution assets can be managed. The APM approach will minimize failures and improve the operational efficiency of power facilities, ultimately reducing the cost of energy production over time.

Digitization will enable the holistic management of DER assets across different capacities and installations. For example, insights can help identify the weakest link in the distributed energy portfolio. If one project is not performing on a rooftop, how will that affect the entire portfolio in terms of revenue? With respect to project returns, if projects start generating different half-hourly performances, how does that impact the grid?

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**Figure 24**

What workforce management and remote operations solutions would you find most useful? Include any you’re currently using. *(Select all that apply)*

Source: Black & Veatch
Digitizing improves project bankability

With financing at the core of Asia’s energy transition success, improving the bankability of infrastructure projects is critical to achieving grid resilience.

Digitizing power assets will make it easier for investors to assess the planning, returns and risk allocation of projects. Data analytics across complex grids will provide insights that will help investors visualize risks across many interdependent factors that determine financial success. These factors include grid stabilization, peak load management, system flexibility and reliability.

Next steps

Digitizing power systems will support investments in decarbonized grids and enable a more efficient and flexible grid operation. This will, in turn, reduce the cost to investors, operators and ultimately consumers.

Digitizing the grid requires an integrated strategy and execution across generation, transmission and distribution, as well as prioritized planning that factors both capital and operational expenditures.

To achieve energy transition success, Asia’s power and commercial and industrial sectors need technology-agnostic partners with global best practices and regional execution teams that can provide integrated strategy, transaction advisory, business operations, regulatory and technology solutions. Partners experienced with every aspect in the lifecycle of generation, transmission and distribution assets and the complex integration of these assets will be well-positioned to optimize grid synergies.

ABOUT THE AUTHORS

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The pandemic is likely to accelerate the digital transformation of Asia’s power sector.
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