



HOW COVID-19 IS CHANGING THE PACE OF ENERGY TRANSITIONS

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IN THE PRE-COVID-19 PANDEMIC environment, the contours of energy transitions toward low-carbon sources were becoming clear. Europe and North America were driving much of the initial adoption of renewable power generation and electrification of energy consumption. Asian countries were generally slower to ramp up low-carbon energy technologies, although their adoption of wind, solar, battery, and electric vehicle (EV) technologies was rapidly accelerating. Still, any decline in oil and natural gas consumption in Europe and North America seemed likely to be offset by growth in Asia, where increasing oil and gas imports would fuel economic growth for the coming decades.

Now, however, all bets are off. COVID-19 has changed the strategic and economic calculus for many governments. In any given country, the severity of the outbreak, coupled with the government's ability to respond to the virus and its economic impact, is influencing the form and structure of substantial economic stimulus measures. And aspects of these stimulus decisions, in

turn, may affect the speed and trajectory of energy transitions in surprising ways.

To understand how the pandemic may alter energy transitions, BCG conducted a deep dive, region by region, into the still-evolving implications for the energy industry of COVID-19 stimulus measures. We found that while Europe is poised to continue moving in a green direction, some hard-hit countries in Latin America, South Asia, and Africa may be weakened so significantly by COVID-19 that their ability to promote energy transitions will be severely constrained—assuming that it was a policy priority in the first place. In addition, one entirely unanticipated trend emerged from our analysis: in the wake of COVID-19, the pace of energy transitions—specifically, the adoption of renewables and electrification of transport—may increase in some North-east Asian and Southeast Asian countries.

Several factors support this conclusion. First, many leading Asian economies—including China, Japan, South Korea, Malaysia, and Singapore—have suffered relatively few

adverse health and economic impacts from COVID-19. As a result, they are in a good position to make the substantial investments in energy infrastructure needed to facilitate energy transitions. Second, they stand to gain the most by shifting to renewable energy generation and to electrified energy consumption, particularly in the transportation sector via heightened EV adoption. And third, the stimulus measures and policy reforms that these Asian countries have adopted so far, although ostensibly aimed at buoying industrial competitiveness, are also likely to hasten energy transitions.

If this shift occurs, oil and gas companies will have to revise their investment and operational plans to navigate a landscape in which Asia does not function as the significant growth engine in coming years that they had expected. In particular, such a shift could quicken the arrival of peak oil demand and heighten uncertainty in an already heavily disrupted industry. In China and South Korea alone, policies announced in response to COVID-19 could reduce oil demand by up to 3 million barrels per day in 2040, according to our estimates.

Although companies that had anticipated sustained growth in oil and gas demand in Asia may find this potential trend challenging, it will create new opportunities for investments in low-carbon energy sources. In any event, energy companies throughout the world will need to reassess their exposure to markets in response to the impacts of COVID-19, associated government policy measures, and the resulting pace of future energy transitions.

Learning from an Earlier Crisis

Looking back to the global recession of 2007–2009, we can see how powerfully government responses to an economic crisis can influence the energy industry’s trajectory, chiefly because energy infrastructure is interwoven with industrial policy and economic performance. At that time, multiple governments implemented green stimulus programs, reasoning that a greater commitment to renewable energy development could jolt economic development in

the short run while providing long-term competitive benefits. (See Exhibit 1.)

These policy measures aimed at advancing energy transitions were not motivated entirely by concerns about climate change. In large part, US and European governments directed stimulus spending toward renewables to generate new domestic construction, installation, and manufacturing jobs. In the US, loans, grants, and tax credits helped trigger growth in solar capacity that has averaged 50% per year over the past decade and encouraged tens of billions of dollars in private investments in solar-related projects. Similarly, in Europe, direct stimulus investment in offshore wind power development programs and subsidized payments to wind power producers has driven 1000% capacity growth since 2009 and helped make Europe the global leader in wind energy.

By contrast, countries in Northeast Asia adopted renewables-related stimulus policies that emphasized improving global economic competitiveness in manufacturing and exports. For instance, a focus on “green industrial policy” in China, South Korea, and Japan helped those countries develop greater efficiency and lower-cost supply chains for solar photovoltaic (PV) and battery technologies, helping their domestic firms cement an international leadership position in these areas. Chinese subsidies for domestic solar manufacturers increased domestic production of PV panels by more than 100%, leading to sharply reduced costs and increased sales around the world. A parallel success story occurred in South Korea with respect to battery technologies. Due in part to government support, Korean firms now lead the global market for lithium-ion batteries and have played a key role in research efforts to make EV batteries more affordable, reducing EV prices to a level closer to those of internal combustion engine (ICE) cars.

Is COVID-19 Different?

At first blush, the COVID-19 pandemic might seem so unlike the 2007–2009 recession that its impact on the energy transition

EXHIBIT 1 | Economic Recovery Measures in the 2007–2009 Recession Facilitated the Take-Off of Renewables and Battery Technologies

Renewables adoption: Stimulus and policy measures facilitated rapid growth in capacity

 European offshore wind policy led to ~10x growth over a decade

Policy	Implementation	Impacts
<ul style="list-style-type: none"> Stimulus of €565 million in support of offshore wind projects Wind feed-in tariffs totaling \$25 billion 	<ul style="list-style-type: none"> Direct support helped to advance project maturity Feed-in tariffs made other offshore wind projects economically viable 	<ul style="list-style-type: none"> Europe is the world leader in offshore wind power, with 22 GW installed as of 2019, representing ~10x growth since 2009

 Solar generation grew by 50% per year in the US from 2008 to 2019

Policy	Implementation	Impacts
<ul style="list-style-type: none"> ITC extension Cash grant for 30% of capital expenditures Loan guarantees for large-scale projects 	<ul style="list-style-type: none"> Policy stability Thousands of small projects used grants \$5 billion in guarantees supporting 1.5GW of capacity 	<ul style="list-style-type: none"> Private investment followed, with 5GW of privately funded projects from 2012 to 2014 Solar generation grew at 50% per year from 2008 to 2019

Technology: Green industrial policy fostered innovation and cost improvements

 China PV subsidies helped the cost of solar plummet

Policy	Implementation	Impacts
<ul style="list-style-type: none"> Direct support to PV manufacturing sector starting in 2009 Development of a domestic market for solar 	<ul style="list-style-type: none"> Chinese solar panel production ramped up from <400,000 KW to 75 million KW in 2017 Subsidies promoted domestic installation of solar 	<ul style="list-style-type: none"> PV solar panel costs fell 80% from 2008 to 2013 Global installed PV capacity increased 14x from 2010 to 2019 China is now the leading PV producer

 South Korean battery investment supported key breakthroughs

Policy	Implementation	Impacts
<ul style="list-style-type: none"> Green Growth Strategy Support for early battery storage projects 	<ul style="list-style-type: none"> R&D investment to enable breakthroughs in stable multicycle charging Project support for early integrated battery deployment 	<ul style="list-style-type: none"> Lithium-ion battery costs declined nearly 90% from 2010 to 2019 South Korean battery producers took a leading market share by 2013

Source: Wind Europe; Center for the Study of Democracy; AEIC; PV Magazine; Scientific American; IRENA; BNEF; Global Green Growth Institute; BCG analysis.

Note: GW = Gigawatts; ITC = investment tax credit; PV = photovoltaic.

would be quite different, too. In the earlier crisis, the clear goal for governments was to stimulate and sustain new economic activity. But in today's pandemic, the primary challenge for governments is to respond to a health crisis while minimizing the impacts of unprecedented short-term unemployment. Governments are also more constrained now, having to cover huge medical and social welfare expenses while anticipating much smaller tax revenues. In short, COVID-19 fiscal responses are less about jump-starting new economic activity and more about keeping drowning elements of the economy afloat.

Still, despite very clear differences between today and 12 years ago, many COVID-19-driven government stimulus measures have the potential to accelerate energy transitions. Although the coronavirus pandemic

has touched virtually every part of the world, its fiscal and economic impact has varied significantly from region to region. In addition, renewables, batteries, and electrification of energy consumption have become key drivers of economic growth in their own right in some regions—and as a result, these sectors pose attractive options for further boosting economic activity to governments that have the fiscal latitude to pursue them.

To gauge how governments' COVID-19 responses may affect their countries' energy transitions, we assessed 35 countries on four different dimensions:

- **The Impact of COVID-19 on Health, Society, and the Economy.** The worse a country is affected by the pandemic, the less likely its government and

businesses are to be able to focus on altering its energy infrastructure. Energy transitions require stable social and economic environments to effectively deploy substantial amounts of capital.

- **The Ability to Respond.** Because investments and fiscal support for new energy technologies are expensive, they are feasible only when governments and key energy sector actors—including leading utilities and national oil companies—have relatively strong balance sheets and access to healthy capital markets.
- **Incentives to Shift Course.** Countries that see greater economic benefit and opportunities for improved competitiveness as a result of shifting their energy mix and supporting lower carbon pathways are more likely to adopt or maintain that strategy even during difficult periods.
- **Early Indicators.** Initial COVID-19 stimulus measures and other policy changes can provide hints about the future trajectory of energy transitions as the world moves out of crisis mode and into economic recovery.

Which Regions Stand Out?

When we used this four-part framework to assess the G20 countries and other large emerging markets, we found that shifting toward renewables and electrification of energy consumption has the most potential to accelerate in European and in various Northeast Asian and Southeast Asian countries. These regions have weathered COVID-19 relatively well—when viewed through the lens of health, social, and economic impact—and their fiscal positions are sufficiently strong to adopt a creative and forward-looking COVID-19 stimulus plan. (See Exhibit 2.) Globally, South Korea, Germany, Japan, and China are among the leaders on both of these criteria.

By responding quickly to the health challenges of COVID-19, these countries have enabled themselves to focus more immedi-

ately on the economic challenges generated by the pandemic. As a result, the GDP and capital market impacts from the coronavirus have been somewhat muted in these nations, resulting in stronger public and private balance sheets. Moreover, their public and private sectors tend to have a high borrowing capacity, as government interest rates are relatively low and corporate bond ratings are strong. As a result of these advantages, governments and energy sector actors can more freely invest in innovation and growth strategies.

For European countries, promoting innovation to drive energy transitions is not new. But by maintaining relatively strong economic health during the pandemic, they are now in an excellent position to continue their shift toward renewables. So while the European Commission's Green Deal—which aims to achieve a 50% reduction in carbon emissions in the euro bloc by 2030 (compared to 1990 levels) and net zero carbon emissions by 2050—and green stimulus measures have significant implications, they reflect deepening support for policies designed to shift the region onto a lower-carbon pathway.

For Northeast Asian and Southeast Asian countries, the story is different. Many of these countries have been slower to adopt renewables and were expected to depend heavily on oil, natural gas, and coal for years to come. Yet many Asian economies have much to gain from facilitating swifter energy transitions.

For one thing, their energy intensity—the amount of energy consumed per unit of economic output—is on the high end, largely because manufacturing is such a substantial segment of their economies, especially in China, South Korea, and Vietnam. And to meet their energy needs, these countries generally are depend on fossil-fuel imports to a greater extent than do countries in many other regions. (See Exhibit 3.) As a result, any shift toward domestically produced renewable energy would simultaneously improve their energy efficiency and strengthen their economies' balance of payments.

EXHIBIT 2 | Asian and European Countries Have the Greatest Potential to Accelerate Energy Transitions



Source: BCG analysis.

Another important consideration is the improvement in the cost competitiveness of renewables in the region in recent years. In China, solar and wind power now costs less than coal on a levelized basis, which measures the average net present cost of electricity generation for a generating plant over its lifetime; and in South Korea and Japan it is rapidly approaching parity with coal. (See Exhibit 4.) The declining cost of renewables, together with the energy intensity and import dependence of many Asian economies, provides a meaningful incentive for those countries to consider facilitating a faster transition to renewables in the power sector.

The Asian EV Strategy

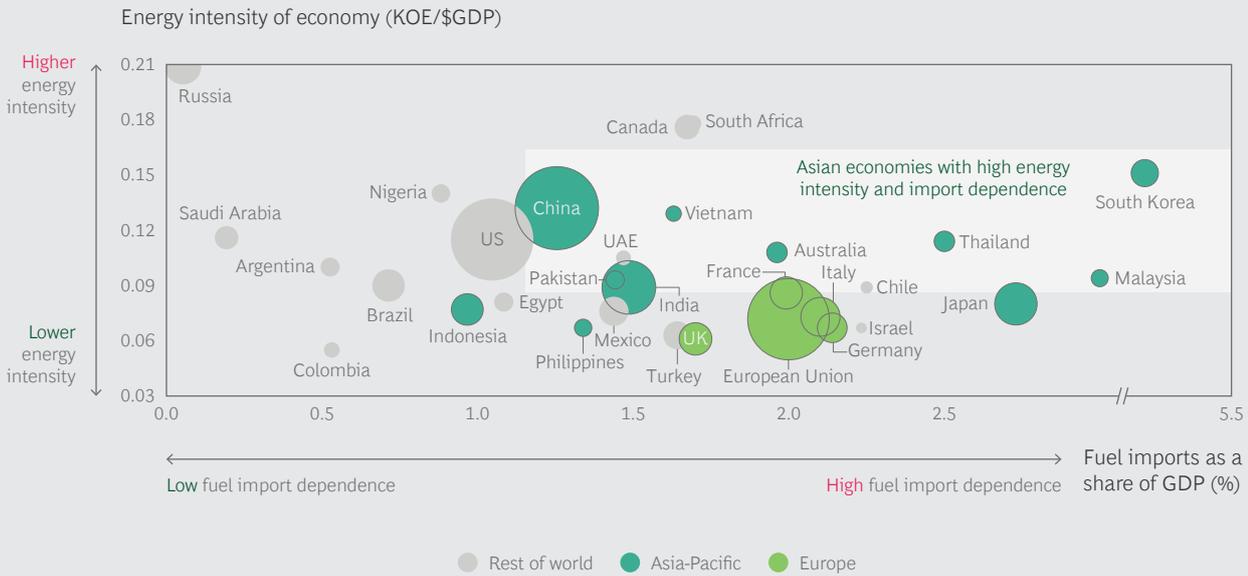
Although Asian governments have logical reasons to pursue faster energy transitions, the paths that they are taking are not necessarily similar to those used in other regions or in the past recession. In particular, the strategy emerging this time appears to focus on EVs.

So far, of the more than \$600 billion of “green” government stimulus measures that have been announced globally, China has committed to \$200 billion and South Korea to \$60 billion. Within these stimulus measures, the promotion of EV technology innovation and adoption is a key priority. (See Exhibit 5.)

For example, a signal feature of China’s stimulus package involves funding to increase its EV charging infrastructure by 50% and to improve its power grid capacity and stability in support of faster growth of the EV market. In South Korea, the so-called Green New Deal allocates money for innovation in EV and battery production.

EXHIBIT 3 | Several Large Asian Economies Stand to Gain the Most from Accelerated Energy Transitions

Energy intensity of GDP vs. energy import dependence

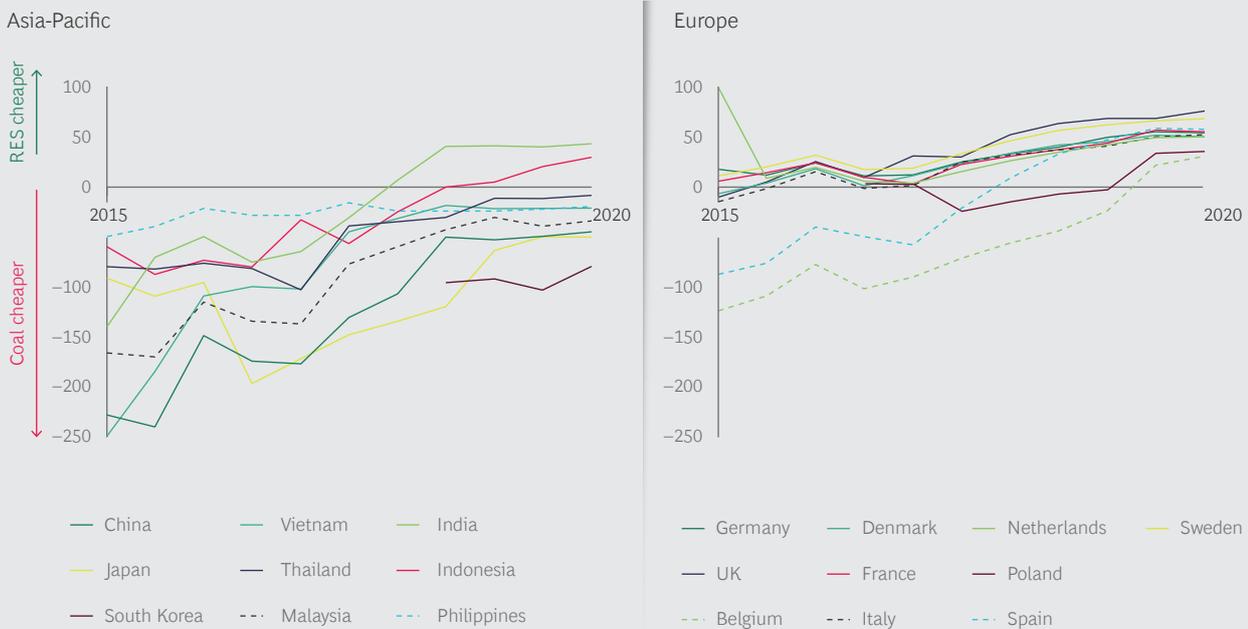


Sources: Enerdata; World Bank; BCG analysis.

Note: As a category, "Fuel imports" consists of coal, petroleum, natural gas, lubricants, and related materials. KOE = kilogram of oil equivalent.

EXHIBIT 4 | Wind and Solar Are Becoming More Cost Competitive in Asia

Competitiveness index for solar and onshore wind vs. coal, 2015–2020



Sources: Bloomberg New Energy Finance; BCG analysis.

Note: Competitive index scores are calculated as the percentage difference in coal LCOE versus the lower of onshore wind LCOE or solar LCOE for each country, multiplied by 100. LCOE = levelized cost of energy; RES = renewable energy source.

Beyond adopting stimulus spending measures directed at innovation and infrastructure, Asian governments are pursuing other policies to accelerate EV adoption. For instance, South Korea has extended its EV subsidy program and increased its 2025 targets for EV and hydrogen vehicle adoption. Similarly, China has extended its EV subsidy scheme and has announced a new “cash for clunkers” program to encourage new vehicle adoption. In February, before the pandemic started, Singapore announced that it would be phasing out ICE vehicles by 2040, as well as offering new subsidies for EV sales and expanding charging facilities. In the wake of the pandemic, Singapore has recommitted to these policies.

The emphasis on EVs by various large Asian countries reflects, in part, their interest in competing in the rapidly growing global EV market. The cost of EVs has already begun to decline dramatically in recent years, and [BCG projects](#) that the total cost of ownership of EVs will likely be lower than that of ICE vehicles by the mid-2020s in many markets. Automotive OEMs and component suppliers that establish a foothold in the market now will be well situated to gain from rapid market growth in

coming years. Although EVs account for only 1% of global car registrations, they are the fastest-growing segment of the automotive market, with year-on-year growth of 40%. For export-dependent Asian countries, directing COVID-19 stimulus spending toward further enhancing their position in the global EV market looks like win-win opportunity.

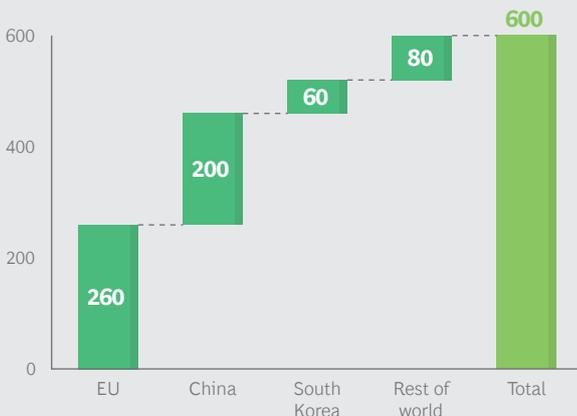
The Asian Implications

From a macro perspective, the most disruptive outcome of our analysis for the energy industry lies in the potential acceleration of transportation electrification in Asia. This shift could significantly affect the future trajectory of oil demand. The International Energy Agency had forecast that the Asia-Pacific region would contribute around 80% of oil demand growth (7.6 million barrels) through 2040, with China alone responsible for more than one-third of that increase in oil usage. That estimate had assumed that EVs would not become prevalent in Asia until the 2030s. But if EVs become mainstream before the end of this decade, the global peak in oil demand would come sooner. Indeed, our analysis indicates that the policies adopted in China

EXHIBIT 5 | Green Stimulus and Policy Measures in Asia Are Substantial, with a Strong Focus on Electric Vehicles

Announced Chinese and South Korean green stimulus packages are as large as the EU's

Approved and announced global green stimulus (\$billions)



Transportation sector and EVs are a major focus of stimulus measures

-  China EV and infrastructure spending
 - EV charging infrastructure
 - HV transmission and other infrastructure
 - EV subsidy extension and "cash for clunkers"
-  South Korea Green New Deal stimulus
 - R&D funding for EVs and batteries
 - EV subsidy extension
 - Acceleration of targets for EV and hydrogen
-  EU Green Deal
 - Hydrogen investment
 - Energy efficiency support
 - Low-carbon vehicle support

Sources: BNEF; Vivid Economics; Energy Policy Tracker; press reports; BCG analysis.

and South Korea alone in the wake of COVID-19 could reduce oil demand by up to 3 million barrels per day in 2040.

At the same time, natural gas demand growth, which Asian markets were also expected to drive, could take a hit as wind and solar power grow in the region, sustained by a quickened focus on renewable generation and battery storage. Coal demand, on the other hand, may be more stable if stimulus measures do not include provisions designed to drive down greenhouse gas emissions overall. Coal is less expensive than natural gas in the region and is likely to remain more competitive with renewables for a longer period of time unless governments impose a surcharge on CO₂ emissions. Both China and Japan have indicated that they will continue to implement plans for additional new coal capacity. Consequently, as we move into the next decade, coal plus renewables may well be the fastest-growing sources of power generation in the region.

How Companies Should Respond

Given the scale of market impacts that can result from governments' policy responses to COVID-19, energy companies may need to reconsider their assumptions about the pace of energy transitions and the resulting impact on demand. In our view, oil and gas companies in particular should take three main steps in response to the new realities posed by the post-COVID-19 environment:

- As they revise their economic planning assumptions to reflect market shifts brought about by COVID-19, oil and gas companies should carefully consider the potential for accelerating energy transitions, especially in Asia. This may have significant implications for some companies, impacting strategies, portfolios, and investment decisions.
- They should also revisit capital allocation processes in new demand scenarios. For instance, many refining capacity investments assume downstream oil market growth in Asia. Although

petrochemicals demand will likely remain strong in this region, energy companies must address the risk of weaker demand for ground fuels. Meanwhile, if natural gas usage in power generation is less robust than expected, the importance of marketing liquefied natural gas (LNG) directly to industrial and utility customers will rise. But such a marketing effort represents a more complicated and capital-intensive business model than LNG sellers are accustomed to. As a result, oil and gas companies' capital allocation plans should identify risks as well as new opportunities.

- Oil and gas companies need to take a nimble and flexible approach to investment in low-carbon-energy technologies if they are to adapt to the new environment. Increased public-sector R&D investments could alter the development pathway of different low-carbon energy technologies. In particular, greater government funding for electrification of medium- and heavy-duty transportation could accelerate the adoption of electric powertrains over biofuel or hydrogen alternatives. This, in turn, could upend companies' technology strategies based on previous assumptions about the pace of technology development and the probable allocation of government research dollars. Determining which technologies to provide seed money for will be critical for energy companies navigating a rapidly shifting future.

Of course, as oil and gas companies face a more challenging landscape, companies or investors that participate in power value chains may identify new opportunities. COVID-19 stimulus spending and policy reforms could rapidly create or advance markets for wind, solar, and battery supply chains; and automakers, already anticipating a period of more rapid EV adoption, may find that the market matures even more quickly than they expected.

In turn, these developments could promote the emergence of other low-carbon tech-

nologies, particularly the production and use of green hydrogen from renewable power generation.

The value of new business opportunities from accelerating energy transitions in Asia could be substantial. Aside from investments in new renewable and battery capacity, modernizing power grids to better integrate renewables and expanding transport electrification can create incremental value pools worth billions of dollars. The possibilities for international utilities or investors to participate in these growth opportunities will vary by region and time horizon, however, as many countries have yet to go through the process of power market liberalization. Consequently, in seeking to profit from the energy transition, companies and investors must assess the opportunities and associated risks country by country.

LOOKING BACK, WE can see that government responses to the 2007–2009 recession and its aftermath helped usher in a decade of remarkable advances in renewable power and battery technology. Those advances involved less than \$500 billion in green stimulus spending globally, demonstrating how well timed the contributions were and how well poised renewable technologies were to take off.

Already, in response to COVID-19, governments have committed at least \$600 billion to total green stimulus, with more likely to come. And as occurred during the last global recession, Asian countries seem ready to play a central role in accelerating the energy transitions. Energy companies must take this possibility seriously and prepare for both risks and opportunities that may accompany it.

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