

## [After Trump Series 2] Prospects for U.S.-South Korea Cooperation in an Era of U.S.-China Strategic Competition

Retreat from the Rock: How a Pullback in Coal Lending by China, Korea, and the United States Could Change Geopolitics and the Climate

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In late October 2020, South Korean Prime Minister Moon Jae-In announced that his country would become net "carbon-neutral" by 2050. His vow came two days after a similar promise from Japan, a month after one from China, and a year after one from the European Union. South Korea, Moon promised, would work "with the international community" to achieve its ecological goal.<sup>1</sup>

That won't be easy, because Moon's government continues to work with the international community in the opposite direction. South Korea is, by at least one count, the world's third-largest exporter of technology to build coal-fired power plants in emerging economies.<sup>2</sup> South Korea generates 40% of its electricity by burning coal, and its biggest banks and industrial firms earn an outsized portion of their profits by selling machinery to turn the black rock into juice. Just three weeks before Moon's climate pronouncement, South Korea's government-owned utility, Korea Electric Power Corp., or Kepco, announced it would spend \$189 million for a 40% slice of a 1,200-megawatt coal-fired power-plant project in Vietnam.<sup>3</sup> Kepco will acquire the stake from China Power & Light, a Hong Kong-based firm that, in a sign of the times, announced in December 2019 that it would stop

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McCurry, Justin. 2020. "South Korea vows to go carbon neutral by 2050 to fight climate emergency," *Guardian*, October 22. <a href="https://www.theguardian.com/world/2020/oct/28/south-korea-vows-to-go-carbon-neutral-by-2050-to-fight-climate-emergency">https://www.theguardian.com/world/2020/oct/28/south-korea-vows-to-go-carbon-neutral-by-2050-to-fight-climate-emergency</a>.

<sup>&</sup>lt;sup>2</sup> "Global Coal Public Finance Tracker," EndCoal.Org, <a href="https://endcoal.org/finance-tracker/">https://endcoal.org/finance-tracker/</a>.

<sup>&</sup>lt;sup>3</sup> "Vietnam: Kepco greenlights controversial Vung Ang 2 coal power plant project," IEA Clean Coal Centre, October 5, 2020, <a href="https://www.iea-coal.org/vietnam-kepco-greenlights-controversial-vung-ang-2-coal-power-plant-project/">https://www.iea-coal.org/vietnam-kepco-greenlights-controversial-vung-ang-2-coal-power-plant-project/</a>.

investing in coal-fired electricity, concluding the sector was both environmentally untenable and economically unappealing.<sup>4</sup> Kepco's board voted to buy into the deal despite vocal objections not just from a raft of environmental groups but also from shareholders including some of the world's whitest-shoe institutional investors, among them Switzerland's UBS Asset Management and the Netherlands' APG Asset Management.<sup>5</sup>

Why would the Moon government's power-producing firm invest in solidifying coal's hold on the developing world just days before Moon was to pledge his country's deep commitment to slashing planet-warming emissions? One clue is the roster of South Korean financial behemoths that stand to profit from the Vietnam plant, Vung Ang 2. The list includes Samsung C&T Corp. and Doosan Heavy Industries & Construction Co., two lions of the South Korean industrial establishment, which will oversee the project's construction; the government-controlled Export-Import Bank of Korea, which will provide loans for the deal; and the Korea Trade Insurance Corp., also a government firm, which will proffer financing guarantees.

Seoul's soul lies with coal. So does much of the world's, which is why the tussle in South Korea epitomizes a fight engulfing the planet. At issue is how fully and quickly industrialized nations should pull back from coal and push into cleaner technologies including renewable sources such as solar and wind power – not just at home, but, far more importantly for the planet, in their marketing and financing of energy infrastructure in developing nations. Those nations are the ones where energy demand, and thus carbon emissions, are growing fastest, which means they are the places in which the slog to slash carbon emissions deeply enough that the world avoids the most dangerous effects of climate change will be won or lost. The bid to shift development in emerging economies onto this radically lower-carbon path will have massive economic, environmental, and geopolitical repercussions both for them and for the countries whose industries have for decades been supplying them.

The nature of this decarbonization challenge, however, is widely misconstrued. For years, the issue that has gotten the most attention is whether a shift from coal to renewables could be done affordably. But over the past decade, as a result of generous public subsidies to the renewables industry and of innovations both in the technological designs of these products and in the business models

<sup>&</sup>lt;sup>4</sup> Ha, Tim. 2019. "Hong Kong power giant CLP quits coal," Eco-Business, December. <a href="https://www.eco-business.com/news/hong-kong-power-giant-clp-quits-coal/">https://www.eco-business.com/news/hong-kong-power-giant-clp-quits-coal/</a>.

<sup>5 &</sup>quot;International investors: KEPCO should reconsider supporting new overseas coal power plants," Media Release, Asia Investor Group on Climate Change, March 27, 2020, <a href="https://www.aigcc.net/wp-content/up-loads/2020/03/27032020\_AIGCC\_MR\_Kepco-coal\_FINAL.pdf">https://www.aigcc.net/wp-content/up-loads/2020/03/27032020\_AIGCC\_MR\_Kepco-coal\_FINAL.pdf</a>.

used to scale them up, their cost has plummeted and their use has soared, far beyond the levels even many of their biggest fans had dared hope. In 2019, fully 72% of electricity capacity added in the world came from renewables, and more than half of that amount came from solar.<sup>6</sup> To be sure, much remains to be done to make renewable energy economic at scale: batteries and other energy-storage options need to be improved so that power can be preserved after the wind dies down and the sun sets, and vast electric-transmission grids need to be redesigned and rebuilt to optimize power sources that are variable and decentralized. Already, however, in much of the world, adding electricity-generating capacity with solar or wind now is less expensive than doing so is with coal.

But the trajectory of renewables isn't on track to solve the climate threat. Because the established energy system is so gargantuan, the sorts of renewable energy that are growing fastest remain tiny components of the global energy mix. Fossil fuels continue to dominate: They accounted for 80% of all energy and 72% of electricity production in 2019 and are expected to continue to account for 72% of all energy and 56% of electricity production in 2040, according to the International Energy Agency. Coal was the world's single biggest electricity source in 2019, and it is expected to remain so in 2040.<sup>7</sup> It is little wonder, then, that global greenhouse-gas emissions continue to rise. According to the Intergovernmental Panel on Climate Change, the United Nations body whose pronouncements represent the scientific consensus on global warming, in order to prevent particularly dangerous climate change, global greenhouse-gas emissions would have to fall to "net zero" by 2050. That would constitute an unprecedented economic transformation, a path that would require emissions to have plummeted about 45% below 2010 levels by 2030.<sup>8</sup> And that is but a decade from now. A decade is a fraction of the expected life of a typical coal-fired power plant.

All of which points to the knottier dilemma in the climate fight: What to do about the massive amount of dirty-energy infrastructure that exists or is on the drawing board, particularly the swath that burns coal, the most-carbon-intensive fossil fuel. That infrastructure includes much more than just metal, which is to say the power plants themselves. The coal juggernaut includes people: the web of companies, banks, and employees whose livelihoods for generations have depended on coal's hegemony.

<sup>&</sup>lt;sup>6</sup> "Renewable capacity highlights," International Renewable Energy Agency, March 31, 2020, <a href="https://www.irena.org/media/Files/IRENA/Agency/Publication/2020/Mar/IRENA\_RE\_Capacity\_High-lights">https://www.irena.org/media/Files/IRENA/Agency/Publication/2020/Mar/IRENA\_RE\_Capacity\_High-lights</a> 2020.pdf?la=en&hash=B6BDF8C3306D271327729B9F9C9AF5F1274FE30B.

<sup>&</sup>lt;sup>7</sup> World Energy Outlook 2020 (Paris: International Energy Agency, October 2020), <a href="https://www.iea.org/reports/world-energy-outlook-2020/outlook-for-energy-demand#abstract">https://www.iea.org/reports/world-energy-outlook-2020/outlook-for-energy-demand#abstract</a>.

<sup>8 &</sup>quot;Headline Statements from the Summary for Policymakers," in *Global Warming of 1.5°C: An IPCC Special Report* (Geneva, Switzerland: Intergovernmental Panel on Climate Change, October 2018), <a href="https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15\_Headline-statements.pdf">https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15\_Headline-statements.pdf</a>.

The global-warming challenge is less and less whether green energy can compete on cost. It's more and more how to facilitate the transition for the massive part of the global economy that has depended on the dominance of a system of dirty energy — a system that essentially everyone agrees is on the wane. The nations likeliest to win from the clean-energy shift won't be those that merely dangle generous subsidies for the installation of solar panels and wind turbines. They will be those that help their traditional energy industries, and the people who depend on them, pivot to a more-sustainable business model.

The coal sector today faces a trifecta of woes that just a decade ago would have been unthinkable. The first is rising concern by regular citizens about climate-related disasters that are affecting their everyday lives — from wildfires to storms to floods. The second is coal's cratering economics, the result both of a surge in production of cheap natural gas, a fossil fuel markedly cleaner than coal, and of the rise of renewables. The third, the result of the first two, is a backlash against coal by investors who have concluded that coal is a dying commodity and who are pressuring policymakers to hasten coal's death.

That pressure puts essentially every international power in a painful squeeze. Each owes a good deal of its global influence to the industrial corporations within its borders that sell coal-fired power-plant equipment beyond them. (A short list of these multinational giants, besides South Korea's Samsung and Doosan: Japan's Mitsubishi, America's General Electric, and Germany's Siemens.) One worry in these countries is domestic: that if they pull back support for their coal-technology sector too quickly, they will spur unemployment and intensify political unrest. Another concern is geopolitical: that if they pull back their financing for foreign coal projects more quickly or completely than China does, they could hand China even more global influence.

That is no idle concern at a time when China is executing the largest infrastructure-building program that emerging economies from Asia to Africa to Latin America ever have seen. The push comes in the form of the so-called Belt and Road Initiative, which includes as a core component the construction by Chinese firms of coal-fired power plants around the developing world. The framework of the program is relatively simple: China's diplomats scout alliances that prompt deals in which China's government-affiliated banks finance projects that Chinese companies build. Other countries widely criticize China for how effectively China uses this playbook. But those countries — notably the United States, Japan, and South Korea — for decades used essentially the same manual to seed foreign markets for their own homegrown, and largely coal-focused, firms. China is different in two

important respects. One is scale: China is building infrastructure abroad with tighter strategic coordination and a bigger checkbook than other countries have used — a result both of its autocratic system of government and of its vast financial resources. The other difference is that China is going on its coal-heavy global infrastructure-building spree in an era when climate change has come to be understood as an existential threat.

China is, by far, the largest funder of coal-fired power-plant technology, overwhelmingly to emerging economies. According to one estimate, thus far China's public institutions have financed 53 gigawatts of coal-fired power-plant capacity around the world, more than double the amount financed by No. 2 Japan (21 gigawatts) and more than five times the amount financed by No. 3 South Korea (9.6 gigawatts). According to another estimate, coal projects accounted for fully 45% of the investment in power generation abroad by China's two policy banks, the China Development Bank and the Export-Import Bank of China, between 2000 and 2018. 10

But just as it is the world's largest builder of coal-fired power plants, China also is the biggest producer of an array of clean-energy equipment, from solar panels to wind turbines to batteries. At home, it has slashed coal-fired power-plant construction, part of a campaign that has vastly reduced its once-infamous urban air pollution. In 2014, Chinese President Xi Jinping pledged that its carbon emissions would peak "around" 2030 and then start to fall;<sup>11</sup> in September, in a speech before the United Nations, Xi went further, announcing that China will achieve net-zero carbon emissions by 2060.<sup>12</sup>

What that means for China's foreign-infrastructure investments remains unclear. In a handful of developing countries in which Chinese entities were planning to build coal-fired power plants, international and local opposition has torpedoed the projects. Xi himself has stepped up general calls to green the Belt and Road Initiative, and certain influential government advisers are advocating publicly that China to implement specific policies restricting coal investments abroad. For now, though,

<sup>&</sup>lt;sup>9</sup> "Global Coal Public Finance Tracker."

Kong, Bo and Kevin Gallagher. 2020. "Chinese development finance for solar and wind power abroad," GCI Working Paper no. 9 (Boston, MA: Boston University Global Development Policy Center, February). <a href="https://www.bu.edu/gdp/2020/02/13/chinese-development-finance-for-solar-and-wind-power-abroad-2/">https://www.bu.edu/gdp/2020/02/13/chinese-development-finance-for-solar-and-wind-power-abroad-2/</a>.

<sup>&</sup>lt;sup>11</sup> Zhou, Na. et al. 2019. "A roadmap for China to peak carbon dioxide emissions and achieve a 20% share of non-fossil fuels in primary energy by 2030," *Applied Energy* 239 (April 1). <a href="https://www.sciencedirect.com/science/article/pii/S0306261919301424">https://www.sciencedirect.com/science/article/pii/S0306261919301424</a>.

Harvey, Fiona. 2020. "China pledges to become carbon neutral before 2060," *Guardian*, September 22. https://www.theguardian.com/environment/2020/sep/22/china-pledges-to-reach-carbon-neutrality-before-2060.

<sup>&</sup>lt;sup>13</sup> Goh, Brenda and Cate Cadell. 2019. "China's Xi says Belt and Road must be green, sustainable," Reuters, April 24. <a href="https://www.reuters.com/article/us-china-silkroad-idUSKCN1S104I">https://www.reuters.com/article/us-china-silkroad-idUSKCN1S104I</a>.

Chinese banks and firms remain top global funders and builders of coal-fired power plants in developing countries, which for the planet perpetuates environmental risk and for China underscores global influence.

For the next-largest funders of coal-fired power plants in developing nations, Japan and South Korea, pressure to pull back from coal presents challenges that are at least as harrowing.

Both countries lack the heft that China has been able to harness to establish dominance, at least so far, in the fast-growing clean-energy sector.

Yet both countries, economically, rely heavily on the export of coal-burning technologies. Japan and South Korea lack significant domestic deposits of coal and other fossil fuels. As a result, during the peak of their industrialization, in the second half of the  $20^{th}$  century, both were forced to prioritize the innovation of energy-efficient technologies. That led both governments to nurture domestic manufacturers that built particularly advanced coal-fired power plants — technologies that the companies, with support from their domestic government, then began exporting.

Over the past few years, however, as climate concerns have risen globally, Japan's and South Korea's coal-technology exports have attracted intensifying heat. In recent weeks, as a result of their own domestic political shifts, both countries have bowed to that pressure, pledging deep long-term cleanups. But those promises elide continued reliance on income from overseas coal-fired power plants by important players in both nations.

Japan typifies the contradiction. On Oct. 26, 2020, its new prime minister, Yoshihide Suga, pledged that the country would become net carbon-neutral by 2050. "It needs to be understood that global-warming countermeasures could transform the economy and foster growth, not hinder it," he told the country's parliament in making the pledge. Like China, Japan already was feeling rising pressure to curtail its support for foreign coal-fired power plants. In July, under former prime minister Shinzo Abe, the country released a document saying that "in principle" the country would not support coal-fired power-plant construction abroad. Despite that rhetoric, key Japanese institutions with deep ties to the government remain important actors in financing and building coal-fired power plants in developing countries. One example: The Vung Ang 2 coal-fired power plant project in Vietnam that is backed by an array of South Korean interests also includes an array of Japanese players:

<sup>&</sup>lt;sup>14</sup> Takahashi, Rysei. 2020. "Suga aims for greener Japan with carbon pledge, but details lacking," *Japan Times*, October 26. <a href="https://www.japantimes.co.jp/news/2020/10/26/national/yoshihide-suga-carbon-pledge-japan/">https://www.japantimes.co.jp/news/2020/10/26/national/yoshihide-suga-carbon-pledge-japan/</a>.

<sup>&</sup>lt;sup>15</sup> Ishii, Toru and Mutsumi Mitobe. 2020. "Koizumi: No new state funding for coal-fired plant technology," *Asahi Shimbun*, July 25. <a href="http://www.asahi.com/ajw/articles/13576760">http://www.asahi.com/ajw/articles/13576760</a>.

Mitsubishi Corp. is one of the project's co-owners; Mitsubishi, Mizuho, and Sumitomo-Mitsui are among its financiers; and the Japan Bank for International Cooperation is providing part of the project's credit guarantee.<sup>16</sup>

South Korea's squeeze is similar. In March 2020, as it sought in the run-up to parliamentary elections to retain its power, Moon's ruling Democratic Party of Korea proposed a "Green New Deal" that would include a plan to achieve net carbon neutrality in South Korea by 2050, a trajectory in line with the IPCC's global guidance.<sup>17</sup> In August 2020, also as part of the broad green plan, legislators from Moon's party proposed a bill that would bar financing of overseas coal-fired power plants by the four government institutions primarily involved in facilitating that business: Kepco, the Korean Development Bank, the Export-Import Bank of Korea, and the Korea Trade Insurance Corp. 18 Yet in early October 2020, Kepco's board approved its plan to buy the \$189 million stake in the Vung Ang 2 coal-fired power plant in Vietnam. That decision drew widespread criticism, both within South Korea and abroad. Within days, chastened executives of Kepco and of Samsung, the conglomerate that is one of Vung Ang 2's South Korean contractors, told government officials that their companies planned no future overseas coal-fired power-plant projects. 19 Nevertheless, both companies also said they planned to continue with Vung Ang 2 project. (Bailing on it would be problematic, the Samsung executive told a legislative hearing, given that the deal "has involved the country." <sup>20</sup>) A week later, Moon formally announced that South Korea would pursue the 2050 net-carbon-neutrality goal that his party had floated earlier in the year. But details on how the country proposes to reorient its economy to meet that target remain sparse. Meanwhile, there remains no official prohibition on the country's financial institutions backing coal-fired power plants abroad.

The United States' role in reducing funding for coal-fired power plants in emerging economies is potentially less important and certainly less clear. U.S. public funding for overseas coal is smaller than China's, Japan's, or South Korea's. The World Bank, whose presidency is filled by the United States and whose decisions Washington has the power to veto, instituted a policy in 2013,

<sup>&</sup>lt;sup>16</sup> "Vung Ang II coal power plant," BankTrack, <a href="https://www.banktrack.org/project/vung">https://www.banktrack.org/project/vung</a> ang ii thermal power plant vietnam#about.

<sup>&</sup>lt;sup>17</sup> Farand, Chloe. 2020. "South Korea to implement Green New Deal after ruling party election win," Climate Home News, April 16, 2020, <a href="https://www.climatechangenews.com/2020/04/16/south-korea-implement-green-new-deal-ruling-party-election-win/">https://www.climatechangenews.com/2020/04/16/south-korea-implement-green-new-deal-ruling-party-election-win/</a>.

<sup>&</sup>lt;sup>18</sup> Kang, Kyung-min. 2020. "South Korea moves in on overseas coal project financing ban," *Korea Economic Daily*, Global Edition, August 24. https://www.kedglobal.com/newsView/ked202008240003.

<sup>&</sup>lt;sup>19</sup> "South Korea's KEPCO cancels foreign coal power investment," Power Engineering International, October 20, 2020, <a href="https://www.power-eng.com/2020/10/20/south-koreas-kepco-cancels-foreign-coal-power-investment/">https://www.power-eng.com/2020/10/20/south-koreas-kepco-cancels-foreign-coal-power-investment/</a>.

<sup>&</sup>lt;sup>20</sup> "Samsung admits brand damage in building coal plant, won't build another," Global Construction Review, October 8, 2020, <a href="https://www.globalconstructionreview.com/news/samsung-admits-brand-damage-building-coal-plant-wo/">https://www.globalconstructionreview.com/news/samsung-admits-brand-damage-building-coal-plant-wo/</a>.

essentially on the orders of the Obama Administration,<sup>21</sup> that it would directly finance only those coal-fired power plants in countries that have "no feasible alternatives" to the dirty energy source. Five years later, then-World Bank President Jim Yong Kim said the bank would cease to consider financing a coal-fired power plant in Kosovo, the only coal plant the bank was then mulling.<sup>22</sup> Environmental critics continued to criticize the bank for indirectly supporting coal-fired power plants through third parties financed by the International Finance Corp., the bank's private-sector arm.<sup>23</sup> In September 2020, the IFC, which owns stakes in many commercial banks globally, announced it would stop investing in entities that lack a plan to phase out coal.<sup>24</sup> Also that month, General Electric, which environmental campaigners had targeted, announced it would stop selling equipment for new coal-fired power plants and would focus instead on energy sectors "that have attractive economics and a growth trajectory."<sup>25</sup> Then, in November 2020, Americans elected as their next president Joe Biden, who has proffered the same promise as South Korea's Moon and several other leaders of industrial-ized nations: that his country, in Biden's case the world's No. 2 carbon emitter, behind China, would achieve net carbon neutrality by 2050.<sup>26</sup>

A pullback from coal-technology financing in emerging economies, if done intelligently, need neither upend the global balance of power nor unleash mass unemployment. Which industrialized powers would win and lose from coal's decline and renewables' rise will depend on which governments act most strategically, taking realistic stock of their national strengths in the energy transition and then structuring their policies — from research and development, to manufacturing, to deployment — to exploit their comparative advantages.

Though no fix will be easy, two will be critical. The first is for each of these economic

<sup>&</sup>lt;sup>21</sup> Plumer, Brad. 2013. "The U.S. will stop financing coal plants abroad. That's a huge shift," *Washington Post*, June 27. <a href="https://www.washingtonpost.com/news/wonk/wp/2013/06/27/the-u-s-will-stop-subsidizing-coal-plants-overseas-is-the-world-bank-next/">https://www.washingtonpost.com/news/wonk/wp/2013/06/27/the-u-s-will-stop-subsidizing-coal-plants-overseas-is-the-world-bank-next/</a>.

<sup>&</sup>lt;sup>22</sup> Mathiesen, Karl. 2018. "World Bank reconsidering support for its last coal plant," Climate Home News, June 13. <a href="https://www.climatechangenews.com/2018/06/13/world-bank-reconsidering-support-last-coal-plant/">https://www.climatechangenews.com/2018/06/13/world-bank-reconsidering-support-last-coal-plant/</a>.

<sup>&</sup>lt;sup>23</sup> Chen, Han. 2018. "Is the World Bank Ending Financing for Coal? Only in Kosovo…" Natural Resources Defense Council expert blog, October 11, 2018, <a href="https://www.nrdc.org/experts/han-chen/world-bank-ending-financing-coal-only-kosovo">https://www.nrdc.org/experts/han-chen/world-bank-ending-financing-coal-only-kosovo</a>.

Green, Matthew. 2020. "World Bank's IFC adopts new climate rules to deter lenders from backing coal," Reuters, September 23. <a href="https://www.reuters.com/article/climate-change-coal-idUSKCN26F06Y">https://www.reuters.com/article/climate-change-coal-idUSKCN26F06Y</a>.

<sup>&</sup>lt;sup>25</sup> "GE to pursue exit from new build coal power market," Press Release, General Electric, September 21, 2020, https://www.ge.com/news/press-releases/ge-pursue-exit-new-build-coal-power-market.

<sup>&</sup>lt;sup>26</sup> Bradner, Eric and Arlette Saenz. 2019. "Joe Biden's climate plan targets net-zero emissions by 2050," CNN, June 4. https://www.cnn.com/2019/06/04/politics/joe-biden-2020-climate-plan/index.html.

powers to shift financial incentives so that various crucial players based on their turf, from multinational corporations to international-development banks, can foresee profits from clean energy that are as alluring as those they long have inked from dirty energy.

To the extent that countries that reduced their financing of coal ramped up their financing of cleaner energy technologies, they could end up with more, not less, pull in developing economies. South Korea, Japan, and the United States all have promoted their companies' coal-plant technologies around the world on the argument that the technologies they design and make are particularly efficient, meaning that, compared to others' less-sophisticated machinery, they emit less pollution for every bit of electricity they produce. The same calculus that has been true with coal will remain true with renewables: The countries that corner the global market will be those who proffer not just cheap capital but also leading technology. In clean energy just as much as in dirty energy, innovation at home will yield influence abroad.

That is why China, Japan, South Korea, and the United States, among many other nations, are racing against each other to develop better and cheaper solar panels, wind turbines, batteries, and electric cars. That race has slashed these technologies' cost and ballooned their sales.

One notable result is that renewable energy, a sector once laughed off as insignificant, already is sparking international fights. They include a nearly-decade-old tariff war between Beijing and Washington over solar panels. The underlying dynamic is that the United States, which birthed the technology nearly 70 years ago but wasn't much interested in scaling it up, resents the resolve of China, which started about 15 years ago to harness its manufacturing might to scale up solar — and, in the process, learned to innovate the technology too. China's current dominance of global battery and electric-car production takes a page from its earlier solar playbook — and provokes similar concern on the part of the United States and other industrial powers.

That greening market is challenging coal. But it almost surely won't topple coal quickly enough to achieve net-zero emissions by 2050. And that frames the need for the second fix: policies in major coal-technology-exporting countries to cushion the blow of a clean-energy transition on companies and regions that for decades have depended on coal and will have to find another business if the world has any chance of averting the most dangerous effects of global warming.

Such policies would include a national assessment of where in tomorrow's clean-energy economy today's dirty-energy companies are likeliest to be able to competitively play. It would include a significant increase in research-and-development spending to help them get there. And it would include forthright acknowledgment that shifting today's fossil-fuel-based economy meaningfully to renewable energy — not just in a few test spots, but broadly — would require buy-in from constituencies far beyond the manufacturers and banks and people engaged in the business of coal.

If a truly low-carbon world is to materialize, the politically powerful who have profited from the coal sector will have to support the shift. Many of these behemoths have themselves begun diversifying into selling lower-carbon-energy technologies, including solar and wind, persuaded that diversification will decide their survival. But they, like the world, are just beginning their clean-energy shift. For a company, as for a country, it is one thing to make grand pronouncements about ending emissions three decades from now, a point at which today's executives and policymakers will be long gone from the scene. It is quite another to hammer out a realistic plan for the transition — one with intermediate targets that are both achievable and sufficiently ambitious, and one backed by enough money, to make the environmental goal more than a political smokescreen.

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Date of Issue: 7 December 2020

Retreat from the Rock: How a Pullback in Coal Lending by China, Korea, and the United States Could Change Geopolitics and the Climate

ISBN 979-11-6617-072-0 95340

The East Asia Institute #909 Sampoong B/D, Eulji-ro 158, Jung-gu, Seoup 04548, South Korea Tel. 82 2 2277 1683 Fax 82 2 2277 1684 Email eai@eai.or.kr Website www.eai.or.kr

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