



Comparing the Carbon Neutral Strategies of Four East Asian Countries

A Mix of Cooperation and Competition



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CONTENT	2
SUMMARY	3
BACKGROUND : WHY NOW AND WHY FOCUS ON THE EAST ASIA FOUR?	4
1.1 INTERNATIONAL CLIMATE POLICY: THE MODEL SHIFT AND THE GAP	4
1.2 THE EU'S CLIMATE DRIVEN TRADE POLICY AND ITS IMPACTS	6
1.3 AMERICAN CLIMATE POLICY UNDER BIDEN ADMINISTRATION AND ITS IMPACTS	6
1.4 STRATEGIC PARTNERSHIP OPPORTUNITIES: FROM RENEWABLE ENERGY TO BATTERY ELECTRIC VEHICLES	8
CARBON NEUTRALITY PATHWAYS: A COMPARATIVE ANALYSIS	9
2.1 DECISION MAKING ON THEIR NDCs: THE PROCEDURES AND THE STATUSES	9
2.1.1 <i>China</i>	9
2.1.2 <i>Japan</i>	10
2.1.3 <i>South Korea</i>	11
2.1.4 <i>Mongolia</i>	12
2.2 CARBON NEUTRAL TARGETS: THE LONG-TERM CLIMATE COMMITMENT UNDER COVID-19 PANDEMIC	12
2.2.1 <i>China: A surprising move</i>	13
2.2.2 <i>Japan: Following the European Union</i>	13
2.2.3 <i>South Korea: The most ambitious target in East Asia</i>	14
2.3 ROADMAPS TO CARBON NEUTRALITY	14
2.3.1 <i>Green recovery under COVID 19 global pandemic</i>	14
2.3.2 <i>Energy policy</i>	16
2.3.3 <i>Pathways to carbon neutrality for China, Japan and South Korea</i>	21
2.3.4 <i>Energy transition in the power sector</i>	28
2.3.5 <i>Prospects and opportunities for the electrification of road transport</i>	34
2.3.6 <i>Carbon pricing development: Emission trading schemes or carbon tax</i>	37
MAIN CHALLENGES TOWARD CARBON NEUTRALITY	40
3.1 FINANCING ENERGY TRANSITION UNDER THE CARBON NEUTRALITY GOAL	40
3.2 COAL PHASE-OUT: THE PATH TO CARBON NEUTRALITY, BUT HOW SOON?	41
3.3 PUBLIC INVESTMENT FROM EAST ASIA ON OVERSEAS ENERGY INFRASTRUCTURE	43
3.4 JUST TRANSITION: A TOPIC CHINA AND MONGOLIA SHOULD NOT IGNORE	44
CONCLUSION	46

Summary

China, Japan, and South Korea announced its carbon neutrality targets in late 2020, providing a new round of national commitments to support a global target of 1.5 °C temperature increase scenario by the end of 21st century. Comparably, the economic development progress, the nature of Mongolia's energy dependence on coal, and the significance of export-oriented mining industry, however, make its climate mitigating effort less ambitious. By examining the backgrounds, policy measurements, and impacts of carbon neutral strategies, this policy brief showcases these three important points. First, there is potential for the four nations to cooperate in various areas such as technological exchanges, trading opportunities, and financial supports. This cooperation may help the countries achieve their climate neutrality targets more cost-effectively and develop quicker decarbonization pathways, particularly in Mongolia. Second, the four neighbors may have different approaches to seek their targets due to their disparities in political system, policy capacities, economic situations, and energy profiles. Therefore, it is worthy of closely observing and analyzing each country's approaches to achieve their climate targets. This presents a valuable opportunity to learn and reflect on relevant and critical inputs surrounding the international climate cooperation. Third, a potential new era of global climate governance may accelerate the climate actions and shorten the period of achieving carbon neutrality for China, Japan and South Korea. The European Union's pioneering commitment to 2050 carbon neutral target in 2019, the updated climate commitments by some big economies including the U.S. at the Leaders' Summit on Climate in April 2021, and the collective climate commitments by G7 countries in Cornwall, U.K. in June 2021 imply an upcoming era of climate competition, in which the most developed economies will take more active actions to cut carbon emission and put added pressure on other large emitters. Under this new era of climate competition that may be facilitated by bilateral and multilateral trading policies and schemes, the peer pressure between the three neighbors and the built-up pressure from international community towards these three countries, particularly China, will play a role in determining future climate actions in the region.

Background : Why Now and Why Focus on the East Asia Four?

The announcements of carbon neutral strategic targets in September and October 2020 by China, South Korea, and Japan are a result from various factors, including the evolution of international climate policy, European Union's forward-thinking trade strategy integrated with international climate collaboration, national economic growth strategy, as well as environmental and climate partnership among the four East Asian countries. The four countries' climate commitments will put long-term energy and economic transition as priority in its policy agenda, which may generate significant social and economic impact among their trading partners in the region and beyond. This section is to examine the impact factors and provide a context for comparing the different implementation pathways or roadmaps for their commitments and assessing the potential opportunities and barriers of collaboration for the East Asia Four to achieve their climate ambitions.

1.1 International climate policy: The model shift and the gap

After a long and ineffective period of top-down and legally bounding international climate policy embedded in the Kyoto Protocol (1997), ¹the Paris Agreement (2015) opens a new chapter of international climate governance based on voluntary Nationally Determined Contributions (NDCs). This grand shift not only uplifts the states' willingness to take more actions to mend their disparities in mitigation and adaptation, but also encourages the involvement of additional non-state actors in a bottom-up climate action approach. The periodic renewal of NDCs is a dynamic mechanism to nudge parties, especially big economies, to continuously improve their carbon emission reduction targets as a result of both cost-benefit analysis and peer pressuring.

Overall, the model shift of international climate governance can excite its signatory parties. However, the accumulated carbon emission reduction targets from the submitted NDCs do not necessarily suggest that the world is on track to comply with the 1.5 °C temperature increase scenario, where the global net carbon emissions needs to decline by approximately 45% by 2030 against 2010 levels.² Instead, according to the International Energy Agency (IEA), the global energy-related carbon emissions increased by 9.5%, from 30.4 Gt CO₂ in 2010 to 33.3 Gt CO₂ in 2019.³ At the COP26 in 2021, at least 23 countries, including South Korea, Indonesia and Vietnam, made the new

¹ The Climate Club: How to Fix a Failing Global Effort., William Nordhaus, 2020. Foreign Affairs, May/June 2020.

² "Headline Statements from the Summary for Policymakers," in Global Warming of 1.5°C: An IPCC Special Report, 2018. Link: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Hheadline-statements.pdf

³ Global CO₂ emissions in 2019, IEA. Link: <https://www.iea.org/articles/global-co2-emissions-in-2019>

commitments to phase out coal-fired power.

Due to the time constraints and the dominance of fossil fuels in the global energy system, the next three decades will be a critical time frame for energy transition across the world. Major economies and carbon emitters have irrefutable responsibility to reduce their carbon emissions. The three East Asian countries are among top 10 carbon emission contributors around the world in 2019, China (No.1, 10.2 Gt CO₂), Japan (No.5, 1.1 Gt CO₂) and South Korea (No.9, 0.6 Gt CO₂) according to the data from Global Carbon Atlas.⁴

The urgency of tackling climate change and European Union's leadership in committing to achieve carbon neutral by 2050 have built up policy and public pressure for their peers including the three East Asian countries and the United States. To pursue a leading position in the post-COVID-19 pandemic international climate governance, in September 2020, China committed to achieve carbon neutrality goal by 2060. Surely China's claim is related to the consideration that carbon neutral strategy can be beneficial to its domestic economic growth. In October 2020, Japan and South Korea also announced their own new climate targets, reaching carbon neutrality by 2050.

In recent years, apart from the ongoing climate collaborations, a competitive approach in the global climate governance may be building momentum. European Union's pioneering commitment to 2050 carbon neutral target in 2019 and the updated climate commitments by certain major economies, including the U.S., at the Leaders' Summit on Climate in April 2021, imply an increasingly competitive global climate governance arena. The most developed economies, led by the United States, will be more proactive in cutting carbon emissions and building up pressure towards other large emitters, particularly China, to cut their carbon emissions in accordance with 1.5 degrees Celsius scenario.⁵ The collective climate commitments by G7⁶ and the Initiative of Build Back Better World (B3W) proposed by the U.S. during the G7 Summit in Cornwall, the U.K. in June 2021 seem to strengthen a trend of climate competition.

Under this new era of climate competition, which may be facilitated by bilateral and multilateral trading policy and schemes, the peer pressure in the three neighboring countries in East Asia and the built-up pressure from the international community towards the three countries, particularly China, will encourage more active and ambitious future climate actions.

⁴ Total Annual Carbon Emission by country in 2019. Global Carbon Atlas. Link: <http://www.globalcarbonatlas.org/en/CO2-emissions>

⁵ Competition with China Can Save the Planet., Andrew S. Erickson and Gabriel Collins., 2021. Foreign Affairs, May/June 2021

⁶ The Group of Seven (G7) is an inter-governmental political forum consisting of Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

1.2 The EU's climate driven trade policy and its impacts

The European Union (EU) was the first major economic bloc to make the commitment to achieve carbon neutral by 2050 in the European Green Deal while other large economies such as China and the U.S. have yet to catch up. To address the challenge of the lack of climate ambitions from other leading carbon emitters, EU has been considering using trade policy, specifically the Carbon Border Adjustment Mechanism (CBAM), to mitigate the risk of carbon leakage as well as encourage its major trade partners to improve their climate goals.⁷

China, as the biggest carbon emitter since 2007, is EU's top target in raising climate ambitions under the Paris Agreement. Some argue that EU urged China to raise its climate ambitions during the virtual summit between China and EU on 14 September 2020, which played a significant role in China's announcement of carbon neutral goal by 2060 during the UN Assembly in September 2020.⁸

China's improved climate action generated swift advancements in EU-China trade talk. The EU-China Comprehensive Agreement on Investment (CAI) was reached between the Chinese government and European Commission in December 2020, which needs to be approved by EU Parliament to become EU law. The review process of the CAI in European Parliament has not gone well as planned due to international relation dispute among the two parties. Meanwhile, a resolution passed by European Parliament in March 2021 requires European Commission to submit a legislative proposal on CBAM in the second quarter of 2021.⁹ On July 14, 2021, the European Commission published its "Fit-for-55" package to introduce a CBAM action plan, which would be implemented from 2026, after a three-year pilot period starting in 2023 and would initially cover five carbon-intensive sectors, including iron and steel, cement, fertilizer, aluminum and electricity.¹⁰ With the recent turbulent international climate, it's worthy of monitoring how the CAI legal review process and CBAM legislation may influence the climate corporation of EU and China in the next decade.

1.3 American climate policy under Biden Administration and its impacts

From the beginning of his presidency, President Biden has raised climate policy to a priority in his political agenda. The administration appointed the former secretary of state, John Kerry, as presidential climate envoy, to resume American leadership position in the international climate diplomacy. Gina McCarthy, the former administrator of the U.S. Environmental Protection Agency under the Obama Administration, filled in another new cabinet post as the national climate policy

⁷ Making trade work for EU climate policy: Carbon border adjustment or product standards, 2020. Institute for European Environmental Policy.

⁸ Europe Urges China to match its climate ambitions, EURACTIVE.com, September 14, 2020. Link:

<https://www.euractiv.com/section/energy/news/europe-urges-china-to-match-its-climate-ambitions>

⁹ MEPs: Put a carbon price on certain EU imports to raise global climate ambition, 10 March 2021. European Parliament News. Link:

<https://www.europarl.europa.eu/news/en/press-room/20210304IPR99208/meps-put-a-carbon-price-on-certain-eu-imports-to-raise-global-climate-ambition>

¹⁰ Carbon Border Adjustment Mechanism: Questions and Answers, European Commission. Link:

https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3661

coordinator. Ms. McCarthy is in charge of domestic climate coordination across both federal governmental agencies, as well as local and state level governments. Mr. Kerry and Ms. McCarthy have played significant roles in formulating America's new climate commitments by 2030, including facilitating the virtual Leaders' Summit on Climate on April 22-23, 2021. Through the summit, Mr. Biden mobilized international community to either improve NDC targets or commit to additional climate actions. Although no more detailed carbon emission reduction policy measures were disclosed, the Biden administration used the U.S.'s new NDC goal, reducing carbon emissions by 50-52% by 2030 against 2005 levels, to encourage other big emitters to make similar commitments. Many argue that Mr. Biden has played a significant role in Japan's enhanced climate commitment, reducing carbon emissions by 46% by 2030 against the 2013 level, a rise from the previous goal of 26%.

The U.S. and Japan strategic cooperation in climate actions will be beneficial to the climate corporative relationship in East Asia. Though Japan's climate move may be attributed to American peer pressure, Japan is also heavily influenced by other member states of G7 who have announced carbon neutrality by 2050. When considering the geopolitical competition between Japan and China, Japan prioritizes its alliance with the U.S. and G7 member states and hopes to resolve its climate tension with the U.S. and the EU by increasing its climate ambition.

The U.S. determined 2005 as its emissions reduction baseline year, though it was only second highest to 2007 level, its carbon emissions peaking year. For Japan 2013 is the peaking year for its national carbon emission.

South Korea will possibly take a similar step forward in its climate commitment for 2030. In April 2021, South Korea made commitments to haul state-backed overseas coal finance at Climate Summit hosted by President Biden.¹¹ One month later, Japan joined the other G7 countries to stop international coal financing by the end of 2021.¹² In December 2021, the Biden Administration has ordered to end financial support for new carbon-intensive projects overseas and will promote global cooperation to deploy clean energy technology.¹³

The Biden administration have high expectations on China to peak early and achieve carbon neutral closer to 2050. However, the complex geopolitical situation and declining relationship between the two nations may bring uncertainties towards the bilateral climate cooperation. Nevertheless, the two

¹¹ South Korea Shuns Coal-Power Financing Amid Rising U.S. Pressure, Bloomberg. Link: <https://www.bloomberg.com/news/articles/2021-04-22/south-korea-shuns-coal-power-financing-amid-rising-u-s-pressure>

¹² In climate push, G7 agrees to stop international funding for coal, Reuters. Link: <https://www.reuters.com/business/energy/g7-countries-agree-stop-funding-coal-fired-power-2021-05-21/>

¹³ Biden orders U.S. to stop financing new carbon-intense projects abroad, Reuters. Link: <https://www.reuters.com/business/energy/biden-orders-us-stop-financing-carbon-intense-overseas-fuel-projects-2021-12-10/>

largest carbon emitters formed the US-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s, which was released during the second week of COP26 in the UK. In November 2021. The two intends on putting aside its many differences and to cooperate on climate regulatory standards, clean energy transition, decarbonization and electrification technology and circular economy. Specifically, the two nations agree to advance its control on methane production, after recognizing the significantly larger warming potential of methane as a Greenhouse Gas.¹⁴ The Biden administration's re-engagement with international climate governance will play a significant role in mobilizing more climate actions in the three nations of East Asia.

1.4 Strategic partnership opportunities: From renewable energy to battery electric vehicles

To make economy-wide low carbon transition affordable, China, Japan and South Korea has the potential to collaborate and compete in different areas such as deploying renewable energy in power systems, decarbonizing transportation sector via zero emission vehicles and developing carbon free hydrogen technology. The comparative technology advantages, mass manufacturing capacity and gigantic consumer markets are main features that the three economies share. The collaboration and competition in both supply chain and corporate manufacturing capacity may contribute to the higher penetration of renewable power and battery electric vehicles. Their green growth strategies may help South Korea and Japan to catch up to China's pace in installing wind and solar power at scale. The manufacturing bases and technology know-hows of the East Asia Three in battery electric vehicles may speed up the phase out of oil use in the road transport sector. The successful collaboration between these three dynamic economies may produce positive consequences for other nearby nations, such as Mongolia, to seek a cost-effective approach to energy transition.

¹⁴ U.S.-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s, U.S. Department of State. Link: <https://www.state.gov/u-s-china-joint-glasgow-declaration-on-enhancing-climate-action-in-the-2020s/>

Carbon Neutrality Pathways: A Comparative Analysis

In this section, we compare the carbon neutral strategies of four nations from the following major factors: how medium-term national climate targets such as NDCs are determined; how long-term national climate strategy by 2060 or 2050 are created; and how the roadmaps to carbon neutral are presented.

2.1 Decision making on their NDCs: The procedures and the statuses

The East Asia Four had all submitted its NDCs at COP26 to showcase their commitments to advance their climate actions. Each country's NDCs reflect not only their approach towards climate policy, but also their strength in economic development and international cooperation. Though every player will act differently due to its individual motivations, climate change is the challenge that can only be tackled through continuous global cooperation.

2.1.1 China

A top-down approach has been applied in China's climate policy development, where the top leadership decides the ambition of the national climate commitment. With governmental research institutes, such as the Energy Research Institute (ERI) affiliated to the National Development and Reform Commission (NDRC) and Tsinghua University, playing a role in policy recommendations. To demonstrate China's leadership in global climate governance and gain impact across the international community, China has engaged with climate diplomacy more actively, particularly during 2009-2015 when China had a warm relationship with the U.S. under the Obama Administration. China's domestic boom in renewable energy and low carbon technology such as battery electric vehicles also contribute to its increasing influence in global climate negotiation and cooperation.

In December 2020, Chinese President Xi Jinping announced an updated 2030 carbon targets at the Climate Ambition Summit, representing a part of China's new Nationally Determined Contributions (NDC). Details are as follows¹⁵:

- Reduce carbon emissions per unit of GDP by over 65% against the 2005 level;
- Increase non-fossil fuels in primary energy consumption to around 25%;
- Increase the forest stock volume by 6 billion cubic meters from the 2005 level;
- Increase wind and solar power generation capacity to at least 1,200 GW.

¹⁵ Are China's new 2030 climate targets ambitious enough? China Dialogue. Link: <https://chinadialogue.net/en/climate/are-chinas-new-2030-climate-targets-ambitious-enough/>

China submitted its updated NDCs and the Long-term Greenhouse Gas Emission Development Strategy to the Secretariat of the UNFCCC ahead of COP26. At the COP26, China also added its commitment to stop all the overseas coal investments and to reduce its methane production as part of the US-China Joint Declaration. The climate targets are not new but are now officially incorporated into China's NDCs and related strategies. In the updated NDCs, China reaffirms its goal to increase the share of non-fossil fuels in primary energy consumption to around 25% by 2030.

2.1.2 Japan

Industries' lobbying power and external pressure from strategic alliances such as the U.S. are very important factors in determining Japan's climate commitment apart from the influence of the central government, led by the Liberal Democratic Party (LDP). Industrial lobbying from power, steel and automotive manufacturing sectors slowed down Japan's climate engagement continuously. The country's economic performance has significantly improved under the administration of Shinzo Abe.¹⁶ The success of "Abenomics" provided a more capable Japan to take on more ambitious actions against climate change. In October of 2021, Fumio Kishida, the country's former foreign minister under the Abe administration took office as Prime Minister, replacing the outgoing¹⁷ Prime Minister Yoshihide Suga, the former right-hand of Abe, who has sustained the economic policy and national strategy of his predecessor. Under new geopolitical dynamics, Kishida hopes to enhance Japanese ties with its traditional alliance - the U.S. - by strengthening bilateral economic partnership, while also taking major steps in political partnership with India. Prime Minister Suga regarded fighting climate change as a strategic opportunity to win long term economic growth and mitigate the uncertainty of political competition. Japan has long been known to have its energy policy tightly bound to its economic advancements, with industries taking a vast interest at both the national and local level. Even though the CEO of Toyota Motor, Akio Toyoda, voiced his high-profile complaint on banning new gasoline-only car sale by 2035 in Japan, Suga has continued his ambition towards a low carbon economic transition. However, he was criticized for his lack of control of the COVID-19 pandemic in Japan, which has led to an economic slump in the past years. The Japanese hope to see more political stability within its cabinets in the coming years, to help effectively boost its economy and its growing inequality¹⁸.

On April 22, 2021, Prime Minister Suga announced a new 2030 greenhouse gas (GHG) emissions reduction target, revising Japan's target from a 26% GHG reduction to a 46% reduction below 2013

¹⁶ Abe Shinzo's Legacy: how he changed Japan., Economist, September 5, 2020. P7.

¹⁷ Fumio Kishida takes office as Japan's new Prime Minister. CNN World. Link: <https://edition.cnn.com/2021/10/04/asia/japan-prime-minister-kishida-intl-hnk/index.html>

¹⁸ Will Kishida Uphold Suga's Climate Commitment? New Cabinet Cool to Carbon Tax Renewables. Nippon Japan. Link: <https://www.nippon.com/en/in-depth/d00764/>

levels by 2030, while continuing its effort towards a 50% reduction.¹⁹ The new announcement of the 2030 climate target was submitted in October 2021 as an updated NDC²⁰, likely following the revision of the nation's Basic Energy Plan, which will lay out sector-level implementation plans to achieve the new target. With the incoming Prime Minister Kishida, it is questionable how much of the previous commitment will be put into action, as Kishida is less knowledgeable and less vocal on climate change issues than his predecessor.

The new Basic Energy Plan that is consistent with this 46% target might contain a roadmap to phase out coal-fired power plants or keep some coal power capacities with Carbon Capture Utilization and Storage (CCUS), at the same time, accelerate renewable power capacity deployment, and implement necessary transformational measures in all energy end-use sectors.

2.1.3 South Korea

South Korea's multi-party system offers space for stakeholders to participate in various policy debates. Both industrial groups and civil society groups have access to public policy discussions through members of the National Assembly. The governing party since 2017, the Democratic Party, is a central-left liberal party, and has promoted very active climate and environmental policies.

The Moon Jae-in administration held a state conference on 15 December 2020 to finalize the "2050 Long-term Low Emission Development Strategy" (LEDS) and the 2030 Nationally Determined Contribution (NDC) target jointly formulated by the Ministry of Environment and related departments in response to the global climate crisis. Both plans have gone through extensive expert panel and national public discussions. The Green Growth Committee and the fifteen government departments involved in a "pan-government consultation mechanism" all played a significant role in the formulation of these climate policies.

In December 2020, South Korea submitted an updated NDC and its long-term low emission strategy to the Secretariat of the U.N. Framework Convention on Climate Change (UNFCCC). The updated target aims to reduce 24.4% of total national greenhouse gas (GHG) emissions by 2030 against 2017 levels, which was 709.1 MtCO₂e.²¹ This absolute emissions reduction target is more predictable and transparent than its previous NDC target. The once again updated NDC announced at COP26 in November 2021 set a target of a 40% reduction from 2018 levels by 2030. This target is a significant

¹⁹ Japan vows deeper emission cuts as Biden holds climate summit, Reuters. Link: <https://www.reuters.com/business/environment/japan-government-propose-new-target-cutting-greenhouse-gases-by-46-nikkei-2021-04-22/>

²⁰ Carbon Neutrality, The Government of Japan. Link: https://www.japan.go.jp/sustainable_future/carbon_neutrality/index.html

²¹ The Republic of Korea's Update of its First Nationally Determined Contribution, UNFCCC. Link: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Republic%20of%20Korea%20First/201230_ROK%27s%20Update%20of%20its%20First%20NDC_editorial%20change.pdf

improvement compared to South Korea's previous NDC (24.4% reduction from 2017 levels).²²

On August 31, 2021, South Korea legislated a "Carbon Neutrality Act" after the National Assembly passed the bill, making Korea the 14th country in the world to legislate a carbon neutrality act. The bill became legislated on September 24th, 2021 and will enter into force on March 25th 2022.²³ The bill requires the government to cut greenhouse gas emissions in 2030 by 35% or more from 2018 levels and consists of policy measures to achieve carbon neutrality by 2050.²⁴

2.1.4 Mongolia

Mongolia accounts for 0.14% of global emissions.²⁵ Mongolia first submitted its NDCs in November of 2019, where the mitigation targets include 22.7% reduction in total national greenhouse gases (GHG) emissions by 2030, comparing to its predicted Business as Usual (BAU) scenario from 2010 as base year levels. If conditional mitigation measures are implemented, including carbon capture and storage technology and waste-to-energy technology, Mongolia can potentially achieve 27.2% reduction of total national GHG emissions. The BAU emissions is at 74.3 MtCO₂e, and the target emission is 57.4 MtCO₂e.

Mongolia's economy heavily depends on its mining industry. In 2018, coal products accounts for 43.7% of its total exports.²⁶ The energy sector will play a large role in its GHG emission reductions, while other areas such as agriculture, manufacturing industries and waste management will also make large contributions. The national development policy document, "Vision-2050", includes developmental frameworks that are imperative for the development of national carbon roadmap to achieve its NDCs. These include guidelines for actions and measure in various sectors, and financial support from national budget and international cooperation.²⁷

2.2 Carbon neutral targets: Initiating the long-term climate commitment under COVID-19 pandemic

Carbon neutral targets are important for each country's decarbonization roadmap, especially critical for keeping players on track the 1.5 Celsius temperature increase scenario under the Paris Agreement. In 2021, the updated IPCC report specifies that the globe must reach carbon neutral by 2050 to avoid

²² Korea makes emissions reduction pledges at COP26, Korea JoongAng Daily. Link:

<https://koreajoongangdaily.joins.com/2021/11/02/national/environment/COP26-Moon-Jaein-climate-change/20211102154524400.html>

²³ Carbon Neutrality and Green Growth Act for the Climate Change. IEA. Link: <https://www.iea.org/policies/14212-carbon-neutrality-and-green-growth-act-for-the-climate-change#:~:text=Korea%20passed%20the%20Carbon%20Neutrality%20Bill%20%28%20Carbon%20Neutrality,will%20enter%20into%20force%20on%2025th%20March%202022.>

²⁴ Carbon Neutrality Act Passed by National Assembly Herald Economic and Social Transition Towards 2050 Carbon Neutrality, Ministry of Environment, South Korea. Link: <http://eng.me.go.kr/eng/web/board/read.do?menuId=461&boardMasterId=522&boardId=1473610>

²⁵ Climate and Clean Air Coalition. <https://www.ccacoalition.org/en/partners/mongolia>

²⁶ Renewable Energy and Electricity Interconnection for a Sustainable Northeast Asia.

²⁷ Mongolia's Nationally Determined Contribution to the UNFCCC. Link:

<https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Mongolia%20First/First%20Submission%20of%20Mongolia%27s%20NDC.pdf>

a possible climate disaster.²⁸ The report outlines the impacts of climate change as "unavoidable". The East Asia Three have already determined various carbon neutral targets while Mongolia hasn't committed to a time frame for its economy to reach net zero carbon emissions.

2.2.1 China: A surprising move

In September 2020, China's President Xi Jinping pledged that China would aim to peak carbon emissions before 2030 and strive to achieve carbon neutrality by 2060 (a.k.a the "dual carbon" targets). With China accounting for 28% of global CO₂ emissions in 2019, its carbon neutral commitment represents a positive climate effort and an important step for the world to achieve the net-zero emissions target by 2050.

Some feasibility studies suggest that China can reach carbon neutral by the middle of the century. The most often cited study was conducted by Tsinghua University's Institute of Climate Change and Sustainable Development (ICCSA). The institute is directed by Mr. Xie Zhenhua, the former chief of China climate negotiation delegation and China Envoy of Climate Affairs. Mr. Han Zheng, who sits on the Politburo's Standing Committee and oversees the Ministry of Environment, read the report and informed the top leadership. The report might have played a key role in Xi's carbon neutral target statement.²⁹

2.2.2 Japan: Following the European Union

In October 2020, former Prime Minister Yoshihide Suga declared that Japan will achieve economy-wide carbon neutrality by 2050. Japan had come under pressure to strengthen its original climate commitment, which aims to achieve 80% carbon emissions reduction by 2050. The policy shift brings Japan in line with the European Union, which announced its 2050 carbon neutral target in 2019.

In Japan, there are several existing scenarios assuming an 80% reduction by 2050 but not many studies estimating 100% emissions reduction. Suga devoted to setting up a more ambitious climate target than expected, but many suspect the current Kishida administration would struggle to sustain the same momentum, and potentially even back-peddle in its climate policies. There have been a few experts who support the carbon neutral target by 2050.³⁰ In December 2020, the Japanese government panel discussing growth strategy unveiled a "Green Growth Strategy Through Achieving Carbon Neutrality" (hereafter named "Green Growth Strategy") to achieve its target of going carbon neutral by 2050.

²⁸ Climate Change 2021: The Physical Science Basis. IPCC. Link: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

²⁹ The Secret Origins of China's 40-Year Plan to End Carbon Emissions, Bloomberg. Link: <https://www.bloomberg.com/news/features/2020-11-22/china-s-2060-climate-pledge-inside-xi-jinping-s-secret-plan-to-end-emissions?sref=UXGbB6iF>

³⁰ Making Japan carbon neutral by 2050 is huge challenge, Nikkei Asia. Link: <https://asia.nikkei.com/Spotlight/Comment/Making-Japan-carbon-neutral-by-2050-is-huge-challenge>

2.2.3 South Korea: The most ambitious target in East Asia

South Korea has close economic ties with the EU, the U.S. and Japan. To catch up with the climate commitments of industrialized countries and continue to enjoy the trading opportunities among its peers such as OECD member states, South Korea has recently issued its most ambitious climate target for 2050, despite the fact that coal accounts for 28% of its primary energy mix in 2019 while renewables only 2%.³¹

In October 2020, President Moon Jae-in announced that South Korea will reduce carbon emissions to net zero by 2050, in an effort to transform the country's fossil-fuel reliant economy into an eco-friendly one. In October 2021, South Korea's presidential committee on carbon neutrality unveiled two upgraded roadmaps, including the abolition of coal-fired power generation, to achieve the country's net-zero emissions target by 2050.³²

2.3 Roadmaps to carbon neutrality

2.3.1 Green recovery under COVID 19 global pandemic

Despite the dip COVID-19 pandemic has caused on global carbon dioxide emissions, Emission Gap Report 2020 suggests that the global economy is still heading for a trajectory in which the global temperature rise on average is over 3 °C this century, especially as economies begin to pick up pace and carbon emissions are on a rebound.³³ If countries can seize this opportunity to pursue a green recovery, the world economy could cut the expected emissions in 2030 by a maximum of 25%. Thus, the possible low carbon recovery may boost the chance of keeping temperature rise to below 2 degrees Celsius up to 66%. In reality, the picture is mixed because both conventional economic policies and low carbon recovery policies have been applied. Below is a list of pandemic responses and recovery policies in the four nations.

³¹ BP Statistical Review of World Energy 2020.

³² S. Korea unveils 2 upgraded road maps for 2050 carbon neutrality goal, Korea Herald. Link: <http://www.koreaherald.com/view.php?ud=20211018000839>

³³ Emissions Gap Report 2020, UNEP. Link: <https://www.unep.org/emissions-gap-report-2020>

Table 1. Overview of climate-related policy responses or economic recovery packages to COVID-19³⁴

Country	Overall fiscal measures and amount	“Green” measures
China	An estimated USD 0.75 trillion (RMB 4.8 trillion) or 4.7% of GDP of discretionary fiscal measures announced, mostly with local special government bonds, with figures expected to reach up to USD 2.7 trillion by 2025 to support its New Infrastructure Plan targeted on industrial internet of things, data centers, artificial intelligence, 5G networks and high-speed rail.	<ul style="list-style-type: none"> ● Expanding China’s EV charging network by 50% in 2020 [1]; ● Extending financial support for EV until 2022 such as purchase tax exemption and direct subsidies; ● Increase in national railway development capital; ● Launching the National Green Development Fund focused on energy efficiency, green transportation, and clean energy.
Japan	Adopted two COVID-19 pandemic response packages in April and June 2020, amounting up to over USD 2.1 trillion (JPY 230 trillion) or over 40% of 2019 GDP.	<ul style="list-style-type: none"> ● USD 500 million (JPY 5 billion) support on the installation of self-consumption type solar power generation facilities that contribute to companies RE 100 etc. In light of bringing back the production bases to Japan [2].
South Korea	On 14 July 2020, South Korea’s President Moon Jae-In announced the “Korea New Deal” to invest USD 100 billion (114 trillion won) by 2025.	<ul style="list-style-type: none"> ● The Korea New Deal contains a USD 38 billion (42.7 trillion won) plan to boost renewable energy deployment and low-carbon infrastructure, adding 1.13 million EVs and 200,000 hydrogen vehicles by 2025 [3].
Mongolia	On 10 February 2020, the Mongolian Cabinet introduced a four-year plan worth USD 3.5 Billion (MNT 10 trillion) to improve economy and health.	<ul style="list-style-type: none"> ● As part of the plan, the cabinet will issue a total of USD 750 Million (MNT 2 trillion) soft loans with three years terms to support youth employment, develop new non-mining jobs [4].

Source:

[1] China is investing RMB 10 billion in EV charging infrastructure, Technode

[2] Emergency Economic Measures to Cope with the Novel Coronavirus (COVID-19), Ministry of the Environment, Japan

[3] South Korea to spend \$95 billion on green projects to boost economy, Reuters

[4] Mongolia to implement comprehensive plan against COVID-19, Xinhua Net

Although these four Asian countries issued climate-relevant policies to stimulate their economies, they also adopted “grey” measures that lead to a rebound and/or lock-in of fossil fuel consumption and related GHG emissions. For example, in February 2020, China relaxed restrictions on coal power expansion for a third year running, which opens the door for more regions to build coal power in 2021-

³⁴ Overview of recently adopted mitigation policies and climate relevant policy responses to COVID-19, New Climate Institute. Link: <https://newclimate.org/2020/09/29/overview-of-recently-adopted-policies-and-climate-relevant-policy-responses-to-covid-19-2020-update/>

2023.

2.3.2 Energy policy

Energy sector decarbonization is the most crucial aspect of economy-wide carbon reduction, where energy production accounts for majority of carbon emissions in most countries. Policies designed to adjust the energy mix would be prioritized to quickly lower the global reliance on fossil fuel-based power generation. A stable yet rapid energy transition towards a renewable heavy energy mix while maintaining economic development would be a challenging, but reachable goal for these four East Asian countries.

2.3.2.1 China

Energy mix: Coal still dominates

China is the only G20 country to have seen a significant increase in coal power generation in recent years. China's coal generation rose by 2% in 2020.³⁵ This is because the growth in electricity demand continues to outpace the rise of new clean electricity. From 2015 to 2020, China's electricity demand increased by 33%. Over these five years, China's non-fossil fuel power generation met only 54% of the growth in electricity demand, so the rest of the generation (46%) was met by fossil fuels, resulting in 19% higher coal-fired generation in 2020 than in 2015. China accounts for over half of global coal-fired power generation, up from 44% in 2015. In December 2021, coal generation continued to grow, reaching an all-time high of 384 million tonnes to meet the increasing power demand while the country continues to battle the impact caused by domestic power shortages.³⁶

Despite significant growth in wind and solar power, clean power generation could not fully meet the increased electricity demand. By 2018, China's total installed solar PV capacity was 174 GW.³⁷ Only a third of China's increased electricity demand was met from growth in wind and solar power, with the other third coming from increased hydro, nuclear and bioenergy, hence the government needs to increase coal-fired power generation to ensure grid stability.

Current energy policy

During the 13th Five-Year Plan period (2016-2020), China started to formulate policies related to energy development, such as "Energy Production and Consumption Revolution Strategy (2016-2030)", "Notice on the Establishment and Improvement of the Renewable Energy Electricity Consumption Guarantee Mechanism", and "Notice on the implementation of Renewable Energy

³⁵ Global Electricity Review 2021, Ember. Link: <https://ember-climate.org/project/global-electricity-review-2021/>

³⁶ China Briefing, 20 January 2022: 'Record-high' coal output; Winter Olympics 2022; Xi's new directives, The Financial Analyst. Link: <https://thefinancialanalyst.net/2022/01/20/china-briefing-20-january-2022-record-high-coal-output-winter-olympics-2022-xi-s-new-directives/#:~:text=In%202021%2C%20coal%20made%20up%2064%25%20of%20power,a%20more%20precise%20figure%20for%20December%3A%20384.67m%20tonnes.>

³⁷ End of the year wrap-up: five figures show China's renewable energy growth in 2019, Renewable Energy World. Link: <https://www.renewableenergyworld.com/wind-power/end-of-the-year-wrap-up-five-figures-show-chinas-renewable-energy-growth-in-2019/#gref>

Electricity Quota System (Draft for Comments)”. China has proposed several energy consumption and energy mix goals by 2030, for example, total energy consumption will be controlled to within 6 billion tons of coal equivalent, the average coal consumption of coal-fired power plants will be further reduced, and the proportion of natural gas reduction will be met by clean energy.

During the 14th Five-Year Plan period (2021-2025), where the Energy Bureau proposed to increase the national renewable portfolio to 40% of electricity consumption by 2030 (with nearly 26% from non-hydropower electricity consumption) in its consultation for setting targets for the Renewable Portfolio Standard in 2021 and as expectations for 2022-2030. In addition, energy-related policies in the 14th Five-Year Plan and the Long-Term Goals Framework to 2035 are as follows:

- increase the share of non-fossil energy in total energy consumption to around 20%; raise the scale of wind and photovoltaic power generation and promote nuclear power development;
- control fossil fuel sourced energy consumption, particularly the development of coal power, and promote the replacement of coal with electricity;
- adjust the industrial outlook, such as advancing development in hydrogen and energy storage technology.

On February 10, 2022, China’s National Development and Reform Commission (NRDC) and National Energy Agency (NEA) jointly issued the Opinions on Improving Institutional Mechanisms and Policy Measures for Green and Low-Carbon Energy Transition (hereafter referred to as the “Opinions”). The “Opinions” set out 10 general targets, such as developing new power systems, improving the clean and efficient use of fossil fuels, and establishing a mechanism to ensure supplies.³⁸ It is also one of the schemes to ensure the implementation of the “1+N” policy framework. The “1+N” is China’s major climate policy document, which includes suggestions of oil consumption peaking in the next five years, and a new target to increase the share of non-fossil energy to over 80% by 2060. “1” refers to the guiding opinions that sets out the general principles for all forthcoming policies designed to contribute to China’s carbon peaking and carbon neutrality goals. “N” will include a “carbon peaking action plan” which is a 10-point plan covering all major sectors (e.g., energy, industry, and transport), and other key policy areas for climate action (e.g., circular economy, carbon trading, nature-based solutions).³⁹

2.3.2.2 Japan

Energy mix: Relying on the imports of fossil fuels

Japan is one of the most developed economies in the world and its economic activities are largely

³⁸ Opinions on Improving Institutional Mechanisms and Policy Measures for Green and Low-Carbon Energy Transition, National Development and Reform Commission and National Energy Agency. Link: https://www.ndrc.gov.cn/xxgk/zcfb/tz/202202/t20220210_1314511.html?code=&state=123

³⁹ Zhenhua detailed the development of the 1+N policy system as a timeline and roadmap to achieve the dual carbon goal, China Climate Change Info-Net. Link: <https://www.ccchina.org.cn/Detail.aspx?newsId=73872&TId=57>

sustained by fossil fuels and nuclear energy. Japan relies heavily on imports of fossil fuels and its energy self-sufficiency rate was 12% in 2018. Non-renewable energy accounted for the largest share of Japan's total power generation at 77% in 2018, of which 38.3% from natural gas-fired generation and 31.6% from coal-fire power generation. Nuclear power generation produced 6.2% of the mix. Among renewable energy, hydropower and solar power accounted for 8% and 6% respectively.⁴⁰

The expansion of renewables, the gradual restart of nuclear power generation and improvements in energy efficiency have reduced the need for imported fossil fuels and contributed to the continued decline in GHG emissions. The Japanese GHG emissions reached a historic peak in 2013, as fossil fuels filled the gap left by the temporary shutdown of all nuclear power plants following the Fukushima accident. In 2018, GHG emissions were 12% lower than in 2013 and back to the same level in 2009. Despite all efforts, Japan remains heavily dependent on imported fossil fuels. In 2019, fossil fuels accounted for 88% of total primary energy supply, ranking sixth among IEA countries. At the same time, the carbon intensity of Japan's energy supply rose rapidly after 2011 and is only gradually declining since. Regarding the carbon intensity of power generation, Japan is the highest among the IEA member countries.

Current energy policy

Under the context of the revised Basic Energy Plan, the Japanese government announced two crucial policy changes related to coal-fired power plants: to phase out the vast majority of old and inefficient plants by 2030, and to limit overseas coal power financing only to those countries committed to long-term decarbonization. While the effectiveness of the announced policies is still under review, the former policy does not affect the construction and operation of efficient coal-fired power plants. The latter is however paradoxical, as any country with a decarbonization plan will not invest in new coal plants, which have an average lifetime of 46 years. Although there are potential loopholes and limitations affecting the effectiveness of these policies, but the plan to install 10 GW of offshore wind power deployment by 2030 may indicate a significant shift from coal to renewables in Japan's climate policy.

The "Green Growth Strategy", published in December 2020, identifies 14 sectors with high growth potential to achieve the 2050 target. The government is counting on an ambitious expansion of renewable energy, the revival of nuclear power and the deployment of new clean technologies, including low carbon hydrogen, safer advanced nuclear reactors and carbon recycling, to decarbonize the power sector. In addition, the strategy assumes that renewables will account for 50-60% of electricity demand by 2050, with nuclear power plants and thermal power plants with carbon capture,

⁴⁰ Energy White Paper 2020, Japanese Ministry of Economy, Trade and Industry. Link: <https://www.enecho.meti.go.jp/about/whitepaper/2020html/2-1-1.html>

utilization and storage (CCUS) for 30-40%, and hydrogen and ammonia generation for 10%.

2.3.2.3 South Korea

Energy mix

Most of South Korea's primary energy resources are mainly imported from outside the East Asian region⁴¹, and securing cost-competitive energy resources has been a policy priority for South Korea. Those energy resources come mostly from the Middle East, but the Russian Federation is also a significant partner, providing nearly 20% of total coal imports and substantial amounts of oil and gas in 2018. The emphasis on non-renewable resources in South Korea's energy production has led to a strong reliance on fossil fuels and consequently concerns on energy security.

The energy sector in South Korea is characterized by the dominance of fossil fuels, which accounted for 85% of total primary energy supply (TPES) in 2018, a strong dependence on energy imports represented 84% of TPES, and industrial energy use accounted for 55% of total final energy consumption, the highest share among IEA member countries.⁴² Regarding the energy use in electricity sector, 88% of electricity generation capacity is based on non-renewable energy resources, with the largest part coming from natural gas (32%) and coal (31%).

Current energy policy

The Renewable Portfolio Standard (RPS), the main policy instrument for promoting renewable energy, replaced the previous feed-in tariff scheme and has been in place since 2012. The RPS scheme requires major power utilities to increase the share of renewables and new energy in their electricity mix to 10% by 2023.⁴³

In the Third Energy Master Plan, the South Korean's government has confirmed its intention to gradually phase out nuclear power generation, which is expected to be completed in the last quarter of the century.⁴⁴ In addition, South Korea is also committed to phasing out coal-fired power generation. Overall, this amplifies the need to ensure power system reliability and constant adequate energy supply as the share of variable renewables increases. In order to facilitate greater deployment of renewable electricity, there is a need to interact more closely with local communities through the establishment of a more active consumer engagement framework.

2.3.2.4 Mongolia

In Mongolia, the total primary energy supply remains dominated by coal, with electricity generation

⁴¹ South Korea Analysis: Energy Sector Highlights, EIA. Link: <https://www.eia.gov/international/overview/country/KOR>

⁴² Korea 2020: Energy Policy Brief, IEA. Link: <https://www.iea.org/reports/korea-2020>

⁴³ S. Korea to raise renewable energy quota, Korea Herald. Link: <http://www.koreaherald.com/view.php?ud=20210419000811>

⁴⁴ Third Energy Master Plan, Ministry of Trade, Industry and Energy of ROK, 2020, p12. Link: http://10.129.8.44:83/2Q2WCE0AFA6831C5414253393617FECC6EA64A416BD6_unknown_FF6D8541C4569B68C75E6EDEB677786DBC9C557B_1_10.129.8.44_83/www.etrans.or.kr/ebook/05/files/assets/common/downloads/Third%20Energy%20Master%20Plan.pdf

mainly provided by coal-fired power plants, particularly combined heat and power plants. In 2018, 93% of total electricity was generated by thermal power and 98% of all district heating was provided by coal-fired systems.

Renewable energy resources in Mongolia, such as wind, solar, geothermal and hydro, are estimated to be capable of providing 2,600 GW of clean power capacity, far exceeding Mongolia's energy demand in 2018, around 1.2 GW.⁴⁵ Particularly, the Gobi Desert has significant renewable energy potential and favorable climatic and weather conditions for the efficient use of wind and solar resources.⁴⁶ Although Mongolia has abundant resources to generate renewable power capacity, it currently lacks sufficient grid stability and transfer capacity to meet the electricity needs for its vast geography and thus imports electricity from Russia and China. Power is imported across the northern border to compensate for power shortages in the central northern area during peak winter months. At the same time, power is imported from China to meet the electricity demand of the Oyu Tolgoi copper mine in southern Mongolia. Therefore, Mongolia has been heavily dependent on electricity imports in recent years.

Current energy policy

To ensure the reliability and stability of the energy sector, priority has been given to investment in thermal power plants, district heating plants and transmission and distribution networks that are currently in operation. The energy sector is gradually undergoing capacity expansion to be technically modified and upgraded. At the same time, renewable energy sources with limited capacity for domestic use are being developed, and the share of renewable energy generation is slowly increasing from year to year. In addition, local air pollution from power and heating plants located in urban areas and from the direct use of coal for households heating is an important issue to be addressed through energy policy.

The Mongolian government has set targets to increase the share of electricity generation from renewable sources to 20% by 2023 and 30% by 2030, and to establish export-oriented power plants.⁴⁷ The goal of these targets is to position Mongolia as an energy exporter in the future, using its abundant renewable energy resources and employing efficient and environmentally friendly technologies, while establishing mutually beneficial cooperation with neighboring and regional countries.

⁴⁵ Asia Development Bank, 2 June 2020, Unlocking Mongolia's Rich Renewable Energy Potential Unlocking Mongolia's Rich Renewable Energy Potential. Link: <https://www.adb.org/news/features/unlocking-mongolias-rich-renewable-energy-potential>

⁴⁶ IRENA and KEEI (2021), Renewable energy and electricity interconnections for a sustainable Northeast Asia, International Renewable Energy Agency. Page 26.

⁴⁷ Government of Mongoli, Dec. 2015, SCALING-UP RENEWABLE ENERGY PROGRAMME (SREP) Investment Plan for Mongolia. Link: https://www.climateinvestmentfunds.org/sites/cif_enc/files/srep_ip_mongolia_final_14_dec_2015-latest.pdf

2.3.3 Pathways to carbon neutrality for China, Japan and South Korea

The Paris Agreement recommends that all parties strive to formulate and communicate long-term low greenhouse gas emission development strategies (LT-LEDS) by 2020 as part of the long-term response to climate change. In December 2020, the Japanese and South Korean governments officially released the “Green Growth Strategy Through Achieving Carbon Neutrality in 2050” and “2050 Carbon Neutrality Strategy of the Republic of Korea”, respectively. Both of them presented key strategies that will guide policymaking, social transformation and technological innovations for their green transition. Currently, the Chinese government has not issued long-term strategies for 2060 carbon neutrality, so the research conducted by Institute of Climate Change and Sustainable Development (ICCSA) and another multi-model study on achieving the 1.5 °C global warming limit led by domestic and foreign climate experts will serve as the main references for China’s pathways to carbon neutrality by 2060. Mongolia lacks behind the three countries, yet to come up with its own carbon neutral strategy. **Table 2** presents the long-term strategies to achieve carbon neutrality in different sectors in the three East Asian countries.

Table 2. Overview of long-term carbon neutral strategies by sectors in three East Asia Countries

	China	Japan	South Korea
Power	<ul style="list-style-type: none"> ● The share of primary energy used for power generation exceed 50% in 2030, and reach about 75% in 2050; ● The share of electricity generated by non-fossil sources in total electricity generation increase from the current level of 32% to about 90% in 2050; ● By 2050, the total installed capacity of non-fossil energy will reach 5.3 billion kW; ● Auctions scheme to ensure competition in wind and solar power 	<ul style="list-style-type: none"> ● Establish attractive domestic market through encouraging domestic and foreign investment and systematically promoting the establishment of power grids, ports and harbors; ● Enhance hydrogen use in transport (road and shipping); ● Develop small module nuclear reactors and high-temperature gas-cooled reactors. 	<ul style="list-style-type: none"> ● Enhance predictability of the power output; ● Build a reliable and flexible power backup system and enabling environment for renewables; ● Move from centralized, one-way system into a decentralized, participatory and multi-way grid system; ● Promote the new business model using Distributed Energy Resources; ● Deployment of smart grids to secure demand flexibility.

	China	Japan	South Korea
	projects; <ul style="list-style-type: none"> ● Market and grid reforms to support flexible power and market-based pricing. 		
Industry	<ul style="list-style-type: none"> ● Improve energy and resource utilization efficiency; ● Develop high-tech industries and advanced manufacturing industries. 	<ul style="list-style-type: none"> ● Pushing for efficient energy demand management and CO₂ emission reductions through digitalization; ● Energy saving and greening of the digital equipment industry. 	<ul style="list-style-type: none"> ● Low-carbon transition and industry streamlining; ● Commercial development of technology (e.g., CCUS and low-carbon fuels); ● Tighten energy efficiency standards for boilers and other major equipment.
Transport	<ul style="list-style-type: none"> ● Promote the intensive and efficient use of resources; ● Optimize the transportation structure; ● Increase the share of green transportation; ● Promote use of electrification, hydrogen fuel and biofuel. 	<ul style="list-style-type: none"> ● Promote vehicle electrification by developing carbon-neutral fuel and cutting battery cost via scale-up manufacturing; ● Convert to carbon-free alternative fuels in shipping and aviation sectors; ● Improve energy efficiency of LNG-fueled ships; ● Electrifying equipment and propulsion system of aircrafts; ● Promote the development of hydrogen-powered aircrafts. 	<ul style="list-style-type: none"> ● Subsidize eco-friendly vehicles purchase and set minimum sales requirements of eco-friendly vehicles for carmakers; ● Tighten emissions regulation on medium- and heavy-duty vehicles in the coming years; ● Construct electric- and hydrogen-fueling infrastructure.
Building	<ul style="list-style-type: none"> ● Strengthen building energy efficiency standards; ● Develop distributed smart renewable energy networks for 	<ul style="list-style-type: none"> ● Life cycle carbon minus (LCCM) houses and buildings, net-zero energy houses and building, and improve energy efficiency performance of houses; 	<ul style="list-style-type: none"> ● Finance retrofitting of buildings and expanding tax cuts; ● Provide funding for vulnerable populations to affordable energy supply.

	China	Japan	South Korea
	thermoelectric synergy; ● Promote nationwide energy-saving renovation of existing buildings.	● Expend the spread of high-performance building materials.	

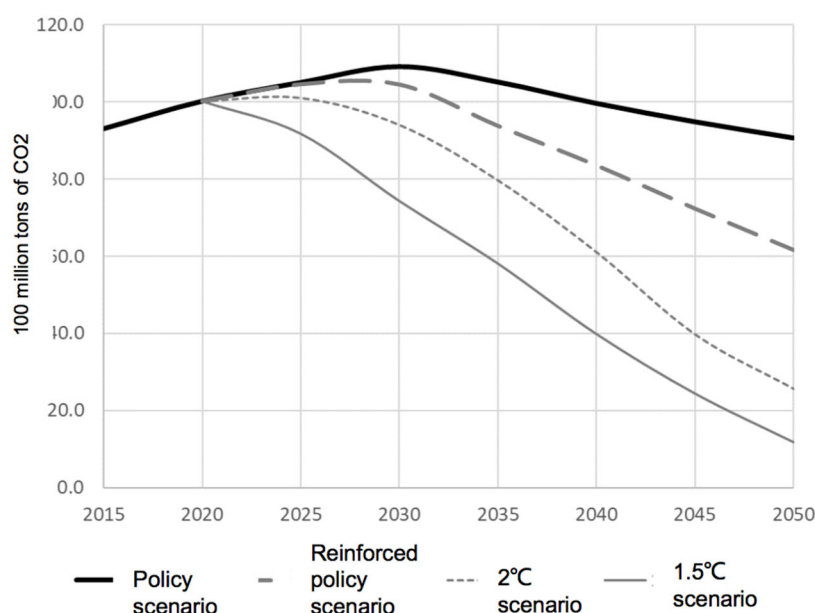
2.3.3.1 China

Together with more than a dozen major domestic research organizations, ICCSD at Tsinghua University launched a research project on China's Long-term Low-carbon Development Strategy and Pathway. This project drafts four research scenarios:

- **Policy scenario**, implementing and carrying on with the 2030 NDC targets;
- **Reinforced policy scenario**, strengthening the prior-2030 NDC scenario from bottom up and stepping up the emission reduction efforts;
- **2 °C scenario**, achieving an emission reduction case aligned with the global 2°C target by 2050, with per capita CO₂ emission no higher than 1.5 metric tons;
- **1.5 °C scenario**, achieving net-zero CO₂ emissions by 2050.

Due to the control and reduction of total energy consumption, especially the acceleration of low-carbon energy structure, CO₂ emissions will show a rapid downward trend in the next decades. The carbon dioxide emissions trends under different scenarios are shown in Figure 1. Under the policy scenario, the achievement of the NDC target, peaking CO₂ emissions by 2030, can be guaranteed. The CO₂ emissions in the reinforced policy scenario can peak before 2030, while the 2 °C scenario needs peak before 2025. In the 1.5 °C scenario, the peak needs to be reached around 2020 (Note: This study is working on China's carbon neutrality by 2050).

Figure 1. CO₂ emissions from 2015 to 2050 under four scenarios⁴⁸



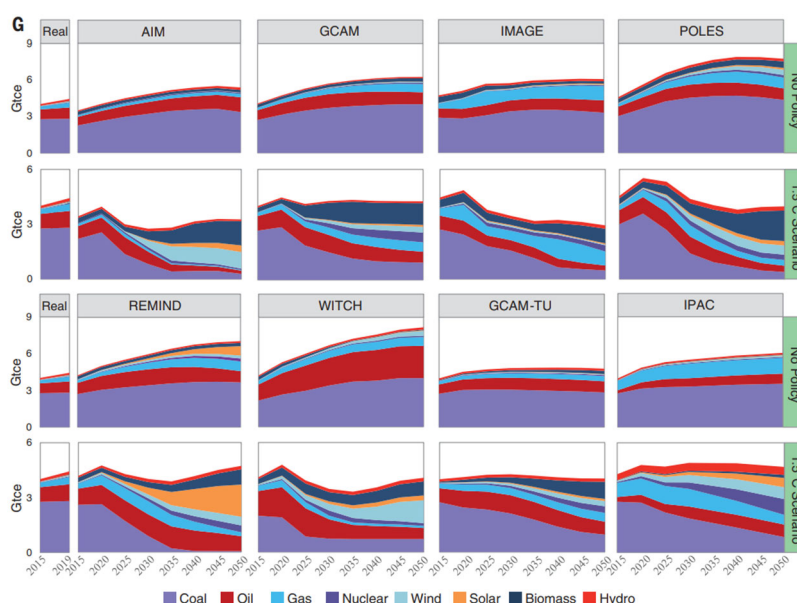
Source: Institute of Climate Change and Sustainable Development, Tsinghua University

According to a multi-model analysis paper in exploring the consequences for China in doing its part to achieve the 1.5 °C target under the Paris Agreement, the existing scenarios from various models globally shows that China's 2060 carbon neutrality target is largely consistent with the 1.5 °C warming limit⁴⁹. Compared to the “no policy” case (without additional climate mitigation policies), the 1.5 °C target scenario is associated with emission reductions exceeding 90% of China's total CO₂ emissions and an average decline of 70.6% and 52.2% in CH₄ and N₂O emissions, respectively. In addition, China's fossil fuels and total primary energy consumption would need to be dramatically reduced by more than 73% and 39%, respectively, to reach the 1.5 °C warming limit target, while most models predict the power sector is required to achieve full decarbonization by 2050. The attainment of the 1.5 °C warming limit calls for large-scale emission reductions based on the accelerated deployment of renewables and their substantial replacement of carbon-based fuels (Figure 2).

⁴⁸ Launch of the Outcome of the Research on China's Long-term Low-carbon Development Strategy and Pathway, Institute of Climate Change and Sustainable Development, Tsinghua University. Link: <https://www.efchina.org/Attachments/Program-Update-Attachments/programupdate-iceg-20201015/Public-Launch-of-Outcomes-China-s-Low-carbon-Development-Strategies-and-Transition-Pathways-ICCSD.pdf>

⁴⁹ Assessing China's efforts to pursue the 1.5 °C warming limit, Duan et al., Science 372, 378–385 (2021). Link: <https://science.sciencemag.org/content/372/6540/378.full>

Figure 2. Energy restructuring across the target models for China



Source: Assessing China's efforts to pursue the 1.5 °C warming limit (Duan et al., 2021)

Achieving the 1.5 °C target largely depends on substantial replacement of fossil fuels with renewables. The model comparison demonstrates different possible energy transitions consistent with the 1.5 °C warming limit (Figure 2). Fossil fuels consistently play a dominant role in the power sector in the no policy scenario, while except the REMIND model, other 1.5 °C target modes are not optimistic about the deployment of solar power to ensure power sufficiency.

2.3.3.2 Japan

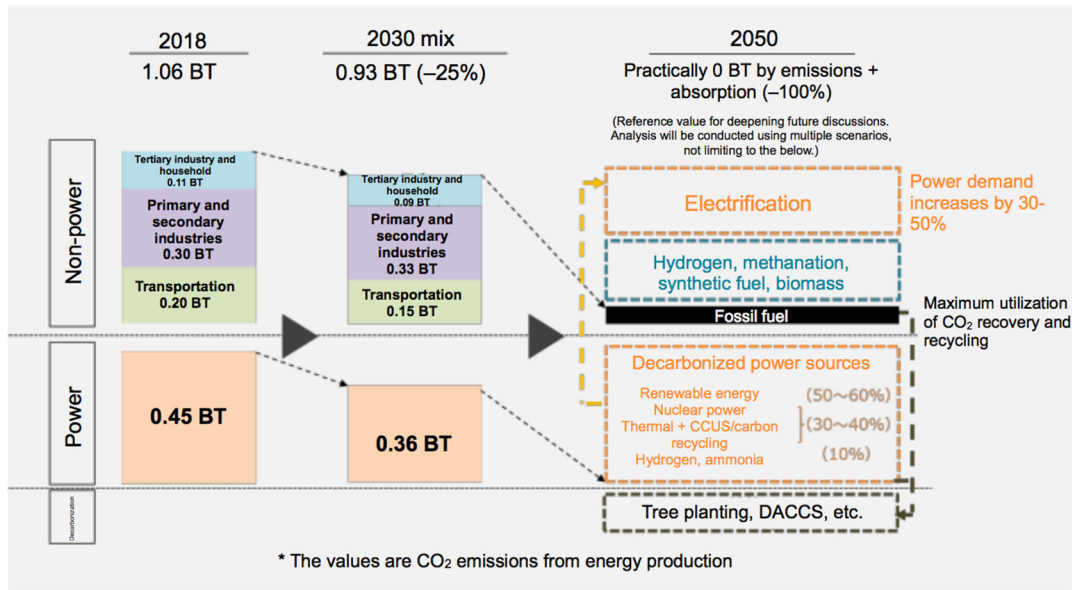
One estimate says the Japanese power demand in 2050 will increase by 30-50% due to electrification in the industrial, transportation and building sectors.⁵⁰ For the heat demands, decarbonized fuels such as hydrogen as well as recycled CO₂ and recovery of CO₂ from fossil fuels will also be utilized. According to the Figure 3, CCUS may play a part in decarbonizing the coal power sector. The development of CCUS⁵¹ in the past two years and its role in the global decarbonization of power and industry sectors suggest that CCUS may be scaled up commercially after 2030.⁵²

⁵⁰ Green Growth Strategy Through Achieving Carbon Neutrality in 2050, Ministry of Economy, Trade and Industry, the Government of Japan. Link: https://www.meti.go.jp/english/press/2020/1225_001.html

⁵¹ Global Status of CCS Report 2020. Global CCS Institute, 2021. Link: <https://www.globalccsinstitute.com/resources/global-status-report/>

⁵² Net Zero by 2050. International Energy Agency (IEA), 2021. Link: <https://www.iea.org/reports/net-zero-by-2050>

Figure 3. Proposed process of transition to Japan's carbon neutrality



Source: Green Growth Strategy Through Achieving Carbon Neutrality in 2050

Japan's speedy transition to renewable energy system faces challenges such as transmission capacity and social restrictions. Japanese government is pessimistic about its ability to cover all electricity demands by renewable energy alone by 2050 even if all stated policies are effectively implemented. In the current reference of 2050 carbon neutral goals, approximately 50-60% of electric power generation comes from renewable energy including solar, wind, hydro, geothermal, and biomass.

Relevant technologies in the development and demonstration phase include thermal power presupposing CO₂ recovery and recycling, as well as hydrogen and ammonia power generation. Their applications will depend on the acceleration of scaled-up technological deployment across different industries. Assuming smooth social implementation according to the Green Growth Strategy, the reference values for deepening discussions are set to about 10% for hydrogen and ammonia power generation and about 30-40% for nuclear power and thermal power presupposing CO₂ recovery. While working towards a revised Strategic Energy Plan, the government is predicted to explore outside of its traditional technologies, deepening creative discussions using multiple scenarios. Long term factors such as domestic economic growth and population change could create uncertain obstacles in Japan's carbon neutral roadmap.

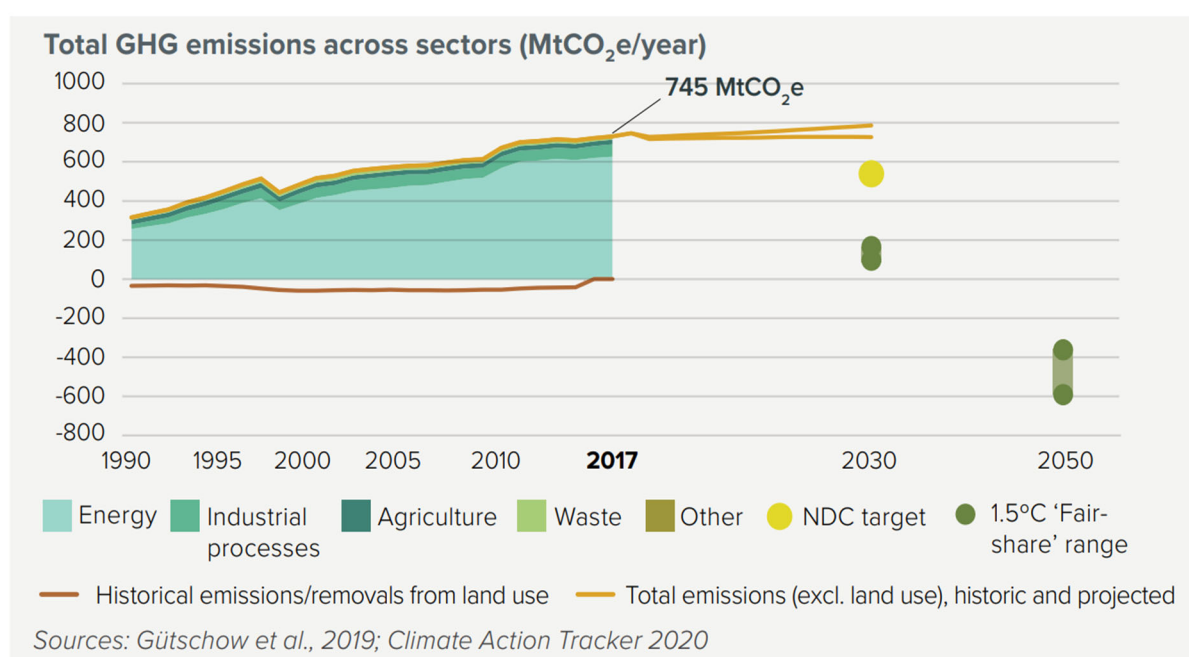
Japan is utilizing the challenge of 2050 carbon neutrality as a long-term growth strategy to transform its industrial and economic structures. It is seen as an opportunity to expedite growth in the next three decades in the booming markets, such as energy, transportation and manufacturing. As a result, developmental stages from R&D to expansion are accelerated. Considering characteristics of

respective fields, Japan intends to incorporate concrete measures to strengthen Japan's international competitiveness.

2.3.3.3 South Korea

South Korea's carbon emissions (excluding land use) have more than doubled from 1990 to 2017, largely because of the increase in energy-related emissions. The most recent emissions projections show that under current policies, emissions will continue to increase until 2030. South Korea has challenges in meeting its updated NDC target. The greater emissions reduction target is necessary to become 1.5°C 'fair-share' compatible (Figure 4).

Figure 4. GHG emissions across sectors of South Korea and CAT 1.5 °C 'fair share' range⁵³



To accelerate climate actions, South Korea decided to develop its LEDS and set up the 2050 Low-carbon Vision Forum to consult with various experts from private sector, academia, industry, and civil society. This team of specialists closely examined and reviewed a broad spectrum of options for South Korea's vision of reducing GHG emissions by 2050. The Forum drafted a proposal that initialized inter-ministerial discussions and national consultations to collect opinions from diverse stakeholders in order to establish the "Carbon Neutrality Strategy".

South Korea's 2050 Vision or LEDS includes the following key points:

- South Korea moves towards the goal of carbon neutrality by 2050;
- The Korean New Deal will serve as a stepping-stone to achieve carbon neutrality by 2050,

⁵³ Climate Transparency Report 2020, Climate Transparency. Link: <https://www.climate-transparency.org/wp-content/uploads/2020/11/South-Korea-CT-2020-WEB2.pdf>

harnessing green innovations and digital technologies to create synergies between the Green New Deal and the Digital New Deal, the two pillars of the Korean New Deal.

In 2017, the energy sector accounted for 36% of the total emissions. Therefore, producing low carbon or carbon free electricity and using such green power in greater scope is the most essential mitigation strategy to achieve Korea's 2050 Vision. Korea plans to phase out coal power plants, by converting them into liquefied natural gas (LNG) power plants. In addition, Carbon Capture, Utilization and Storage (CCUS) technology will be applied to coal-fired power plants to minimize GHG emissions. The industry sector (comprised of sub-sectors of mining, manufacturing, and construction) accounted for 37% of Korea's total GHG emissions in 2017. The government plans to strengthen industry competitiveness by considering the global mitigation trends as well as the characteristics of each industry. The building sector contributed to 7% of the total GHG emissions in 2017. Minimizing infrastructure energy use, while maximizing the energy efficiency and supplying low-carbon energy, is the most cost-effective mitigation option that can reduce the energy cost and GHG emissions at the same time.

The transportation sector accounted for 14% of total GHG emissions in 2017. It will seek a decarbonization pathway by developing electric vehicles and hydrogen fuel-cell vehicles in the next 10 years.

2.3.4 Energy transition in the power sector

2.3.4.1 China

The report titled "Pathways and Policy for Peaking CO₂ Emissions in China's Power Sector", published by North China Electric Power University and the Institute of Energy Research of Peking University in December 2021, designs three scenarios to simulate typical carbon peaking pathways for a representative mix of generation technologies and different development scenarios for coal-fired generation: a coal-driven accelerated electrification scenario (CHS), a multi-source synergistic accelerated electrification scenario (MHS), and a new energy-led electrification scenario (NBS). This report recommends a multi-source accelerated electrification pathway as the policy pathway, with carbon emissions peaking at a manageable time and within a manageable peak.⁵⁴

MHS ensures the demand for electricity for accelerated electrification by optimizing the installed technology mix of coal power, tapping deeper into the potential for energy saving and emission reduction, and developing synergistically with clean energy sources such as wind and solar power and large controllable power sources, while increasing the level of renewable energy consumption.

⁵⁴ Pathways and Policy for Peaking CO₂ Emissions in China's Power Sector, North China Electric Power University and Institute of Energy, Peking University

MHS achieves the non-fossil energy planning targets (over 1.2 billion kW of wind and light installed and over 50% of non-fossil energy generation), with non-fossil energy generation accounting for 40.9%, 50.5% and 61.4% in 2025, 2030 and 2035 respectively. This scenario results in a peak of 5.2 trillion kWh of coal power generation in 2025, with new energy generation gradually replacing coal stock after 2025. Coal power is actively transformed into a peaking function, providing flexibility and reliability to the power system along with large controllable sources, and supporting the transformation of wind, solar and other unstable renewables into major sources of electricity. In 2030 and 2035, coal power utilization hours per year fall below 4,400 hours, in line with flexible and functional power sources. Under this scenario, carbon emissions from electricity generation would peak around 2025, with peak carbon emissions controlled at 4.64 billion tons, and the emissions plateau would end in 2030, followed by an accelerated reduction phase. The power sector, including heating, also peaks at 5.05 billion tons in 2025.

According to the report, the three typical scenarios shows that no additional coal power is needed to meet the lower conventional electrification demand. To meet the higher accelerated electrification demand, wind and solar power alone is not sufficient and the potential of large controllable power sources needs to be explored in depth. To achieve the peak carbon target, coal power needs to be contained at 1.15-1.2 billion kilowatts, ensuring reasonable utilization of coal power, keeping coal power generation to 5.3 trillion kilowatt hours and keeping the power sector's peak carbon emissions to 5.2 billion tons.

2.3.4.2 Japan

Under the basic energy program determined by the Japanese government in 2018, the energy mix for fiscal 2030 consists of 22-24% renewable energy, 20-22% nuclear power, and 56% thermal power.⁵⁵ However, achieving the energy mix put forth by the government is difficult, and it needs to develop more active policies as soon as possible. Renewable Energy Institute (REI), a Japanese non-profit think tank, conducted a scenario analysis on a sustainable energy mix projection that Japan should adopt (Table 3).

⁵⁵ Japan weighs raising share of low-carbon power sources to 60%, Japan Times. Link: <https://www.japantimes.co.jp/news/2021/05/14/national/japan-energy-renewables/>

Table 3. Overview of FY2030 Renewable Energy Projections

	Source	Actual	FY2030		
			Gov't	Current	Transition
Installed capacity (GW)	Solar PV	56	64	102	145
	Wind	4	10	23	29
	Geothermal	1	1-2	1	2
	Bioenergy	5	6-7	8	8
	Hydro	21	49	23	24
Installed capacity (GW)	Solar PV	63	75	123	173
	Wind	7	18	65	82
	Geothermal	3	10-11	4	7
	Bioenergy	24	39-49	51	52
	Hydro	81	94-98	82	84
	Total	177	237-252	324	398

Source: Renewable Energy Institute

REI has proposed two scenarios, including the Current Policy Scenario and the Transition Promotion Scenario, to estimate electricity generated from renewables by 2030⁵⁶ (Figure 5). Details are as follows:

- **Current Policy Scenario:** the cost of solar PV will continue to fall and the deployment of solar PV systems for private residential and industrial applications will continue to make progress. Wind power will also steadily come online as projects complete the current environmental assessment processes. At the same time, the planned introduction of a base generation charge in the future will reduce the cost competitiveness of renewable energy. As a result, it estimates the amount of electricity generated from renewable energy sources in fiscal year 2030 to be approximately 324 Twh, approximately twice the level of renewable electricity output in fiscal year 2018.
- **Transition Promotion Scenario:** this scenario sets ambitious medium- and long-term assumptions for bidding under the Renewable Energy Special Measures Act and foresees a stable bidding system lasting until the market is self-sufficient. Also, it assumes the operational improvements and necessary enhancements to important transmission lines that are necessary for the further development of wind energy and to enable a faster grid connection. Furthermore, it assumes that the introduction of carbon pricing will place an appropriate cost burden on fossil fuels and that other necessary measures will be taken

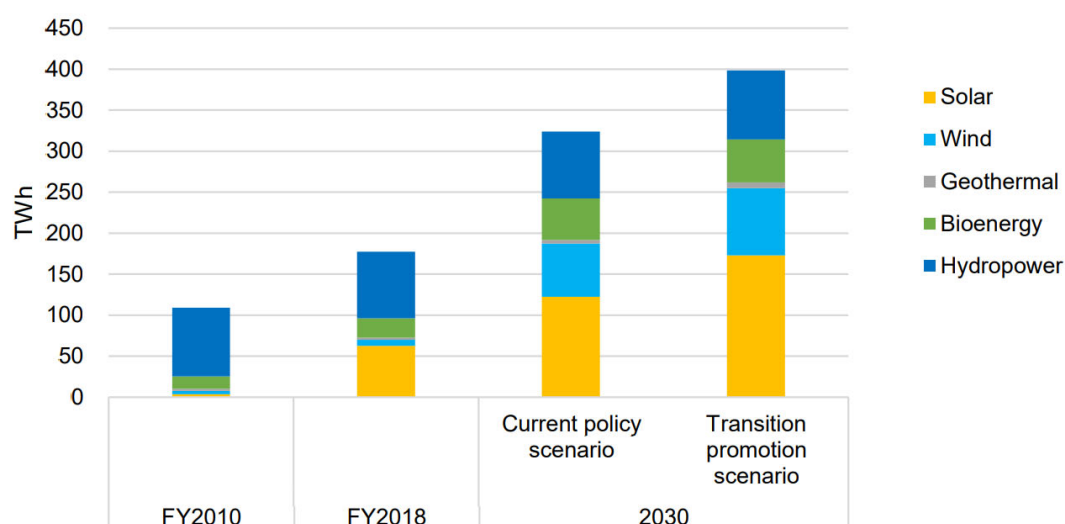
⁵⁶ Proposal for 2030 Energy Mix in Japan (First Edition), Renewable Energy Institute. Link: https://www.renewable-ei.org/pdfdownload/activities/REI_Summary_2030Proposal_EN.pdf

to accelerate the deployment of renewable energy.

As a result of these measures and the falling costs of solar PV and wind power, a pathway is emerging for autonomous growth in the electricity sales sector that is not dependent on financial assistance. This will not only be economically beneficial for private consumption patterns, but in this case the installation of new homes and buildings will be mandatory, which will lead to a steady annual increase in new deployments.

Given the above, it forecasted around 398 Twh of renewable energy generation by 2030. In this scenario, the renewable energy market will be competitive even when compared to existing fossil fuels and is likely to continue to grow beyond 2030.

Figure 5. Electricity generated from renewable energy



Source: Renewable Energy Institute with actual figures from the Ministry of Economy, Trade and Industry

2.3.4.3 South Korea

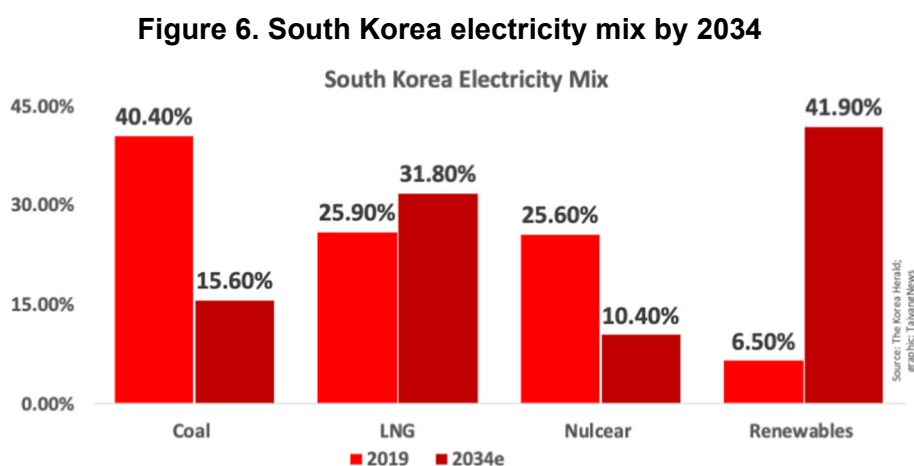
“The 9th Basic Plan for Electricity Supply & Demand 2020-2034”, unveiled by the Government of South Korea in 2020, calls for an increase in the share of renewable energy in its electricity generation from the 15.1% in 2020 to 40% by 2034 (Figure 6).⁵⁷ While this is an improvement on the 22% target set in the 8th Basic Plan in 2017, it falls short of the outlook for a 38% share of capacity by 2030. Under the latest “Plan”, solar and wind will drive the increase in renewable energy capacity. Solar power capacity is expected to more than double, from 14 GW today to 34 GW by 2030, while wind capacity will grow rapidly from 2 GW to 18 GW. Around 16.1 GW of solar and wind capacity is already in the immediate pipeline, equivalent to the current combined solar and wind capacity operating in

⁵⁷ Korea to quadruple renewable power by 2034, downsize nuclear, coal, Korea Herald. Link: <http://www.koreaherald.com/view.php?ud=20201215000856>

Korea.

South Korea imports all of its natural gas through liquid natural gas (LNG). The 9th Basic Plan continues to support new gas construction, with the gas capacity growing from 41 GW today to 55 GW by 2030. Approximately 12.7 GW of new gas-fired projects will come from coal-to-gas projects. Natural gas will be used as the main balancing fuel to support variable renewable energy sources.

South Korea is not yet ready to let go of coal and nuclear power as it enters the final stages of construction of both technologies. Combined, coal and nuclear power have provided nearly two-thirds of South Korea's electricity supply in the past decade. The new "Plan" confirms South Korea's coal power expansion in the short term, with total coal capacity increasing from 36 GW today to 40.6 GW by 2024. In the long term, coal capacity will fall to 29 GW by 2034, as all coal-fired power plants that have reached their 30-year lifetime will be retired. Similarly, nuclear capacity will fall in the long term from 23 GW today to 19 GW planned for 2034 but peaking at 25.9 GW in 2024.



Source: The Korea Herald

In February 2022, collaborating with Agora Energiewende, the three leading South Korea climate and energy think tanks – the Green Energy Strategy Institute, Institute for Green Transformation, and NEXT Group – jointly released a detailed and ambitious carbon neutrality roadmap for South Korea, a report titled “2050 Climate Neutrality Roadmap for Korea (K-Map Scenario)”, which highlights that one of the keys for South Korea to achieve carbon neutrality by 2050 is to significantly increase the deployment of renewables. Under the K-Map scenario, by 2030, renewable power will supply 53% of Korea's energy; by 2050, the figure will increase to 84%. Coal-fired power will be phased out by 2035 (a reduction of 37 GW against current levels); gas power plants by 2045, and nuclear power will be slowly reduced over three decades according to the government plan, from 22GW in 2018 and down

to 11 GW in 2050.⁵⁸

2.3.4.4 Mongolia

With Mongolia's dependence on its energy sector, the Government of Mongolia's "State Policy on Energy (2015-2030)" demonstrates a strong commitment to the development of renewable energy, setting an ambitious target of increasing renewable power generation to 30% of installed capacity by 2030.

- In the 1st stage (2015-2023): to develop energy security resources and back-up capacity, to lay the foundations for the development of renewable energy and to launch large power stations and DC line projects in cooperation with neighboring countries. The installed power capacity will be doubled and the use of key technologies with high parameters will begin. Hydropower will account for at least 10% of the total installed capacity and increase back-up capacity to 10%, creating the basis for intensive development of the renewable energy sector.
- In the 2nd stage (2024-2030): to export secondary energy and sustainable development of the renewable energy sector. An integrated and smart energy system will be created by connecting the regions with high-capacity transmission lines. The state-owned electricity companies will become a public company. Distribution and supply services will be privatized, and the energy sector will operate as a competitive sector under regulation. Secondary energy will be exported to other East Asian countries through high-capacity DC line connections.

Table 4. Indicators of Mongolia's energy sector policy⁵⁹

Indicators	2014 base	1 st stage by 2023	2 nd stage by 2030
Reserve electrical installed capacity	-10%	10% ≤	20% ≤
Reserve heat installed capacity for big cities	3%	10% ≤	15% ≤
Profit margin for electrical tariff for Central energy system	-16.22%	0%	5%
Internal use of thermal power plants	14.40%	11.2%	9.14%
Electrical transmission & distribution loss (excluding Oyutolgoi import)	13.70%	10.80%	7.80%
Share of renewables on total installed capacity for domestic supply	7.62%	20%	30%

⁵⁸ 2050 Climate Neutrality Roadmap for Korea (K-Map Scenario), Green Energy Strategy Institute, Institute for Green Transformation, NEXT Group and Agora Energiewende, Link: <https://www.agora-energiewende.de/en/publications/2050-climate-neutrality-roadmap-for-korea-k-map-scenario/>

⁵⁹ STATE POLICY ON ENERGY (2015-2030), The Government of Mongolia. Link: http://www.jcm-mongolia.com/wp-content/uploads/2020/12/STATE-POLICY-ON-ENERGY2015-2030_Unofficial-translation.pdf

Indicators	2014 base	1 st stage by 2023	2 nd stage by 2030
Greenhouse gas emissions per 1 Gkal energy production	0.52 tons CO ₂ equivalent	0.49 tons CO ₂ equivalent	0.47 tons CO ₂ equivalent
Reduction of building heat loss	0%	20%	40%
New technologies in energy sector	High pressure	Sub critical pressure technology, coal bed methane, battery energy storage, pumped storage	Super critical, ultra-super critical pressure technology, hydrogen, concentrated solar plant

2.3.5 Prospects and opportunities for the electrification of road transport

2.3.5.1 China

Since 2015, China has been the world's largest market for low-emission vehicle sales and is expected to continue to maintain this leading position in the coming years. In 2019, the road transportation accounts for 8% of total national carbon emissions, sitting at 800 million tones CO₂e.⁶⁰ In 2020, China's low emission vehicle sales was 1.3 million, accounting for 5.4% of the vehicle market. By the end of 2020, the number of electric vehicles in China reached 4.92 million, accounting for 1.75% of the total number of vehicles, which was on par with the goal of China's "Development Plan for Energy Reduction and Low-emission Vehicle Industry (2012-2020)" of total 5 million electric vehicles.

Road transportation electrification is key to ensure China stays on track its double carbon goals of carbon peaking before 2030 and carbon neutral before 2060. According to China's "Renewable Energy Vehicle Industry Development Plan" (2021 - 2035), China plans to increase its electric vehicle sales to 20% of total sales and reach 6 million electric vehicles by 2025.⁶¹ In October 2021, the State Council issued a "Carbon Peak Action Plan by 2030", which put forward an ambitious development goal for electric vehicles proportions to reach 40% by 2030.⁶²

To reach those targets, China is using strategies like limiting the registration of new gasoline powered car plates, tax incentives for individual buyers and electric vehicle companies, building extensive charging structure networks and improving battery technology to increase the charging capacity.

⁶⁰ CHINA AUTOMOBILE LOW CARBON ACTION PLAN (CALCP) RESEARCH REPORT 2021: MARCHING TOWARDS NET ZERO OVER WHOLE LIFE CYCLE, CALCP. Link: <http://www.auto-caca.com/a/chengguofabunaron/ziliaoxiazai/zhongguoqichedit/2021/1206/416.html>

⁶¹ Notice on printing and issuing the development plan for the new energy vehicle industry (2021-2035), The General Office of the State Council. Link: http://www.gov.cn/zhengce/content/2020-11/02/content_5556716.htm

⁶² Action Plan for Carbon Dioxide Peaking Before 2030, The State Council, 2021.10.26. Link: http://www.gov.cn/zhengce/content/2021-10/26/content_5644984.htm

National incentives for car buyers, though reduced annually, provide 13 thousand RMB in subsidies for electric vehicles with driving range between 300-400km, and 18 thousand RMB for those above 400km. All electric vehicles are exempt from purchase tax, which is 10% of pre-tax price.⁶³

China's rapid transportation electrification can also contribute to its uniquely large ride-sharing fleet that has taken advantage of the lower life cycle cost of electric vehicles comparing to gasoline vehicles. Didi, China's largest ride-sharing app, has registered nearly 1 million electric vehicles by the end of 2019, and nearly 1.2 million by the end of 2020, making up 30% of overall electric vehicles nationwide. In 2019, electric vehicle's mileage on Didi accounted for 20.6% of the national total electric vehicle mileage.⁶⁴

Looking ahead, China will need to quadruple its low emission vehicles in the next 3 years, with different metropolitans implementing various strategies to grow its electric vehicle proportions. China's capital, Beijing, plans to reach 1 million low-emission vehicles by 2025, accounting for 30% of all vehicles. Shenzhen, fast growth metropolis in Guangdong province, aims to achieve an ambitious 60% low-emission vehicle proportions. Hainan, China's southern island, is the only province in China that has put forward a commitment to ban gasoline powered vehicle sales by 2030.

2.3.5.2 Japan

As the only Asian G7 country, Japan has been a leader in transport electrification in the past three decades. Japan was the first country to design and produce hybrid vehicles, with the introduction of the Toyota Prius in 1997 and then the Nissan Leaf in 2010, both took the car industry by storm by quickly becoming the best-selling cars worldwide. In 2019, Japan's transportation sector emitted 18% of its national carbon emissions, which was down 1.6% and 2.1% comparing to its 1990 and 2018 emission levels respectively.⁶⁵

Along with Japan's NDC carbon neutrality goals by 2050, Japan's METI (Ministry of Economy, Trade and Industry) announced in its "Green Growth Strategy Through Achieving Carbon Neutrality in 2050" that Japan would reach 100% of its new car sales clean energy vehicles by 2035, and all vehicles manufactured in Japan after 2050 will be clean energy vehicles.⁶⁶

Due to historical reasons, majority of Japan's low-emission vehicles sold is still hybrid vehicles. In 2020, electric vehicles accounted for 36.2% of total vehicle sales, and out of those 1.4 million electric

⁶³ Administrative Measures of Beijing Municipality for Promotion and Application of New Energy Vehicles, Beijing Municipal Science and Technology Commission and other five departments. Link: <http://open.beijing.gov.cn/html/gjjcyzc/2020/2/1580893636170.html>

⁶⁴ Digital mobility helps achieve carbon neutrality, Center for Environmental Education and Communications of Ministry of Ecology and Environment. Link: http://www.chinaeol.net/ceecst/202107/t20210702_844043.shtml

⁶⁵ National GHG Inventory Report of Japan 2021. pg.50. retrieved Oct 2021. Link: <https://www.cger.nies.go.jp/publications/report/i154/en/>

⁶⁶ "Green Growth Strategy Through Achieving Carbon Neutrality in 2050" Formulated, METI, pg. 33, retrieved Oct 2021. Link: https://www.meti.go.jp/english/press/2020/pdf/1225_001b.pdf

vehicles, 97.8% of them were hybrid vehicles.⁶⁷ To speed up the pace of transportation electrification and increase the sales of battery electric vehicles, Japan's Environment Ministry has temporarily increased its subsidies for purchasing battery electric vehicles in December of 2020. Under the new policy, individuals or companies could receive double the previous subsidy amount, as high as 800 thousand yen (or approximately USD 7200) when purchasing battery electric vehicle (BEV), plug-in hybrid electric vehicle (PHEV) and fuel cell electric vehicles (FCEV), excluding hybrid electric vehicles (HEV).⁶⁸

Aside from passenger vehicles, Japan have been a leader in the electrification of its public transportation system. Offering one of the world's best public transportation, Japan's electric railway (JR) and buses provide affordable, comfortable, reliable, secure, and extremely punctual travel option, which have reduced the need for private vehicles.⁶⁹

2.3.5.3 South Korea

South Korea's carbon emission from road transportation is still on a rise, accounting for 16% of its national total emissions. The Climate Transparency report points out South Korea should have 100% zero emission vehicles in new car sales by 2035, but up until 2018, electric vehicles only accounted for 2.2% of new car sales.⁷⁰ Though South Korea's electric vehicle sales has been growing exponentially in the past 5 years, with the lack of regulatory limits on gasoline vehicle purchases, the incentives for purchasing electric vehicles can be accounted to vehicle performance (including battery technology and charging infrastructure) and government subsidies. To increase the price competitiveness of eco-friendly vehicles, South Korea has been providing subsidies for eco-friendly vehicle purchase, implementing policies for minimum purchase requirement for public sector and minimum manufacturing requirements for car makers. For individual buyers, the government has already provided 1.5 trillion Korean Won (approximately USD 1.2 billion) in subsidies 2015 - 2019.⁷¹

In line with South Korea's "2050 Carbon Neutral Strategy", it's committed to reducing greenhouse gas emissions by 40% from 2018 levels by 2030. To reduce transportation emissions, it plans to double its electric and hydrogen fueled vehicles on the road in 2022, in an announcement made on December 21, 2021, by South Korea's Minister of Economy and Finance Hong Nam-ki. The government will increase the number of electric and hydrogen vehicles to approximately 500,000 in 2022, from the

⁶⁷ U.S. International Trade Administration. Market Intelligence: Japan Transition to Electric Vehicles. retrieved Oct 2021. Link: www.trade.gov/market-intelligence/japan-transition-electric-vehicles

⁶⁸ Japan to Boost Subsidy for Electric Vehicle Purchases, Dec. 15, 2020. Retrieved Oct. 2021. Link: <https://www.nippon.com/en/news/yjj2020121500966/>

⁶⁹ Transportation System in Japan: A Literature Study. July 2017. Link: https://www.researchgate.net/publication/318555942_TRANSPORTATION_SYSTEM_IN_JAPAN_A_LITERATURE_STUDY

⁷⁰ Climate transparency report comparing G20 climate action and responses to the covid-19 crisis, South Korea: Link: <https://www.climate-transparency.org/wp-content/uploads/2020/11/South-Korea-CT-2020-WEB2.pdf>

⁷¹ 2050 Carbon Neutral Strategy of the Republic of Korea: Towards a Sustainable and Green Society, The Government of the Republic of Korea. Link: https://unfccc.int/sites/default/files/resource/LTS1_RKorea.pdf

current level of 248,000 cars. Under the plans, there will be an additional 200,000 electric vehicles and 35,000 hydrogen vehicles, respectively.

Aside from subsidies, rapid development of charging infrastructure would also aid the sales of eco-friendly vehicles. The government is expanding its investment, expecting to increase from the current 5936 EV fast charging stations and 34 hydrogen charging stations in 2019 to 160,000 electric charging stations and 310 hydrogen charging stations by 2022.

The implementation plans for 2022 also include a 1.93 trillion Korean won (USD \$1.62 billion) budget to finance research and development on the subject of zero emissions technology, such as the plan to introduce 58 eco-friendly state vessels to have a total of 528 zero-emission ships by 2030.⁷²

2.3.5.4 Mongolia

Mongolia installed its first electric vehicle charging station in May of 2020, under the Peace Bridge in central Ulaanbaatar by the Petrovis Group in cooperation with ABB. Back in 2018, UN trade data showed 60% of imported vehicles into Mongolia were hybrids, dominated by secondhand Toyota Prius, which was selling for as little as USD \$2,000. They were popular in Mongolia for its affordability, fuel efficiency and compatibility with the cold. In 2017, Japan exported 30,000 hybrid vehicles to Mongolia.⁷³ In mid-2020, Mongolia has 300 electric vehicles with green plates on the road, mostly are imported Japanese vehicle Nissan Leaf.⁷⁴

2.3.6 Carbon pricing development: Emission trading schemes or carbon tax

The utilization of carbon market and carbon tax is an effective approach to encourage the emission reductions of various industries and its associated upstream supply chain. In particular, the EU, South Korea and Canada already have mature carbon market systems. In 2021, EU advanced its CBAM policies as an effort to control the carbon leakage from its international supply chain as a result of its own stringent carbon market. When European CBAM is approved and implemented in the near future, we may see an active global carbon market development and an overall increase of carbon prices.

2.3.6.1 China

The first compliance cycle of the Chinese national carbon market was announced in February 2021. The proposed market covers only the power sector, including more than 2,200 power plants nationwide.⁷⁵ In July 2021, the Chinese national carbon market commenced trading on the trading platform operated by the Shanghai Environment and Energy Exchange (SEEE). The next natural step

⁷² S. Korea to double electric, hydrogen cars in 2022 in net zero emission drive. December 28, 2021. Link: <http://www.koreaherald.com/view.php?ud=20211228000680>

⁷³ Everyone in Mongolia drives a Prius. Dec. 2018. Link: <https://www.economist.com/asia/2018/12/22/everyone-in-mongolia-drives-a-prius>

⁷⁴ Mongolia's first electric vehicle charging station installed. May 21, 2020. Link: <https://news.mn/en/792544/>

⁷⁵ Update on China's Carbon Market and the EU Carbon Border Adjustment Mechanism (in Chinese). REEI website, 2021 March. Link: <http://www.reei.org.cn/blog/829>

is to manage auction allowances instead of free allocation and the timely progression to cover other sectors.

From the legislation side, Chinese Ministry of Ecology and Environment (MEE) released the draft on “Interim Regulations on the Management of Carbon Emissions Trading” for public opinions. With the carbon peaking and carbon neutrality commitments, carbon market development is expected to accelerate. The regulations and rules are relatively weak since they are still at the ministry level, a Climate Change Law or Carbon Neutrality Law will be needed to enforce the actions on climate change with a more robust legal framework.

The role of carbon market and carbon tax in the carbon neutrality roadmap has been in constant discussion by researchers in China. Some argue that big carbon emitters should be controlled under the carbon market, while the scattered and mobile ones under the carbon tax scheme. The carbon neutrality goal will speed up China’s policy options on carbon pricing in the mid- to long-term.

2.3.6.2 Japan

The current carbon pricing scheme in Japan is an existing 2012 carbon tax levied on fossil fuels usage, along with the two established and inter-linked carbon markets in Tokyo (since 2010) and Saitama (since 2011), mainly covering commercial and industrial sectors.⁷⁶ There is no national carbon market at the moment. The future carbon pricing options are still being discussed, based on the ‘Long-term Low-Carbon Vision’ released in 2017, which considers carbon pricing as an essential tool for a decarbonizing society.⁷⁷

2.3.6.3 South Korea

Among the three East Asian countries, South Korea has a more advanced carbon market. The K-ETS currently covers all of the country’s largest emitters, accounting for more than 70% of national GHG emissions. The K-ETS started Phase 1 in 2015, and after a successful Phase 2 (2018-2020), it is now going through Phase 3 (2021-2025). In Phase 3, a stricter capacity, updated allocation provisions, and expanding shares of allowance auction ratio are implemented to meet with the 2030 national GHG reduction target (Table. 5). Under South Korea’s 2050 net-zero emissions target, there should be updates on carbon pricing and the climate policy framework in the coming years.

⁷⁶ Japan - Tokyo Cap-and-Trade Program. ICAP 2021 April. Link:

https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems%5B%5D=51

⁷⁷ Emissions Trading Worldwide: ICAP Status Report 2021. Link: <https://icapcarbonaction.com/en/icap-status-report-2021>

Table. 5: Work plan of Phase 3 K-ETS towards to 2030

	Actions
Allocation	<ul style="list-style-type: none"> ● Set the total emissions target in accordance with the 2030 national GHG emissions target in the NDC; ● Increase the share of auctioning to 10% and raise the number of business types subject to benchmarking method from 7 to 12; ● Change the unit of allowance calculation from “installations” to “business sites”.
Market	<ul style="list-style-type: none"> ● Allow other participants - financial institutions - to trade on the market; ● Maintain market liquidity by supplying or retrieving liquidity reserve; ● Introduce derivatives and allow futures trading on the Exchange.
Support for Industry	<ul style="list-style-type: none"> ● Use revenues from auctioning of allowances to invest in companies’ eco-friendly practices; ● Survey mitigation technologies from major businesses and share the ones with proven mitigation effects.
International Market Mechanism	<ul style="list-style-type: none"> ● Use overseas carbon offsets to earn carbon credits in compliance with the Paris Agreement.

Source: 2050 Carbon Neutral Strategy of the Republic of Korea: Towards a Sustainable and Green Society

Main Challenges toward Carbon Neutrality

The future development models of the four East Asian countries' energy systems under their long-term carbon neutrality goal are being shaped, with massive number of opportunities arising in the energy transition; challenges are also obvious, such as financing, coal phase-out processes, Just Transition, and cross-border arrangement on carbon pricing.

3.1 Financing energy transition under the carbon neutrality goal

At the 2021 National People's Congress Meeting, for the first time, President Xi painted the picture of China's future energy system. This ignited the discussion on how to build a power network based on new energy, and a recognition that there are improvements to be made in policies on fiscal taxation, prices, finance, land and government procurement for this transition.⁷⁸

Looking back, energy transition in China has been mostly policy driven. The backbone of change are the financial incentives given to renewable energy development, in the forms of the feed-in-tariff (FiT). This subsidy has incentivized rapid installations of renewable power plants, lowering the cost of renewables onto similar levels as coal power energy. However, China is switching from a heavily subsidized era to a time of grid-parity. Although renewable power becomes competitive in levelized cost of electricity (LCOE)⁷⁹ compared to coal power, the high cost of connection to the grid and the related infrastructure investment has trailed behind.

Approaching 2060 carbon neutrality, China's key challenge in energy transition is raising sufficient investments in the decades to come. To meet the global 1.5 °C scenario, China's total primary energy consumption will be under 5 billion tce (ton of coal equivalent) by 2050, with non-fossil fuels accounting for 85% and coal less than 5%. In this scenario, the accumulated investment in energy system from 2020 to 2050 is RMB 138 trillion (approx. USD 21 trillion)⁸⁰, and around USD 700 billion of investment annually. Apart from decarbonization of the power sector, the electrification of energy use in building, manufacturing and transportation sectors is also crucial in the pathway to successful energy transition. Future energy investments will largely focus on the power sector, including more distributed renewable power and more extensive smart power grid. Funding will depend not only on national fiscal policies, but also on shifting costs to the consumer end, either through a decentralized renewable energy approach or through higher tariff on electricity consumption.

⁷⁸ Xi stresses healthy growth of platform economy, efforts for carbon peak and neutrality. March 16. Link: <http://en.people.cn/n3/2021/0316/c90000-9829063.html>

⁷⁹ Bloomberg New Energy Finance, 1H 2020 LCOE Update, 2020.

⁸⁰ Jiankun Liu, 2020. *Comprehensive Report on Low Carbon Development Strategy and Transition Pathways*. Link: <https://www.efchina.org/Attachments/Program-Update-Attachments/programupdate-lcecg-20201015>

Japan's recent pledge at the Climate Summit in April 2021 of a 46% carbon emissions reduction by 2030 against 2013 level, nearly doubled its current 26% reduction target, which will require further investment into renewable energy while reducing its dependence on fossil fuels. Japan's Basic Energy Plan is to be revised if new commitment is much ambitious than before, and one of the pressing issues is to increase the investments into renewable energy and energy efficiency while quickly phasing out coal power in the coming decade.

South Korea announced its plan for the Korean New Deal as a strategy to overcome the COVID-19 pandemic. The Green New Deal is part of the effort to address climate and ecological crisis, with aims to mobilize KRW 73.4 trillion (approx. USD 65 billion) by 2025, including a boost in renewable energy investments. However, the Deal does not mention the government's previous promise on the introduction of a carbon tax, and the phasing out of financing for domestic and overseas coal projects by public institutions.⁸¹ South Korea needs a clearer roadmap before 2030, especially for a well-rounded economic strategy to speed up its energy transition from coal to renewables. Overseas coal project investments, especially those from public funds could cause greater pressure not only from domestic environmental groups and communities, but also international climate organizations. During 2030-2050, the financing of South Korea's energy transition still remains unclear, the way to a net zero emission society depends on coal phase out and the role of state-owned corporations' involvement in the decarbonizing process.

The total investment required to finance Mongolia's National Green Development Policy and its NDC is estimated to total USD \$690 million to \$1.03 billion annually. As a result, Mongolia depends heavily on private sector and international investments for its energy transition. Mongolia promotes its green development through its Mongolian Sustainable Finance (MSF) Initiative, integrating environmental and social aspects into investment projects. In 2018, Mongolia introduced its National Sustainable Finance Roadmap to 2030, to include sustainable finance into banking, insurance, capital markets and institutional investors. To further ensure green investment, Mongolia introduced a Green Taxonomy Committee, to provide clarity on activities eligible for green investments.⁸²

3.2 Coal phase-out: The path to carbon neutrality, but how soon?

China's energy system is still heavily dependent on coal. In 2019, coal contributed to about 58% of China's total energy consumption, down from around 70% in 2000. This reduction attributes to China's efforts to diversify its energy supplies in recent years, the trend shows a clear pattern of lower coal dependency with higher shares of renewable energy. Under the current 2060 carbon neutrality goal,

⁸¹ Korean 'Green New Deal': Is it really green? (In Chinese) Link: <http://www.reei.org.cn/blog/795>

⁸² Mongolian Green Taxonomy, Mongolia Sustainable Finance Association. Link: <https://www.ifc.org/wps/wcm/connect/0c296cd3-be1e-4e2f-a6cb-f507ad7bdf9/Mongolia+Green+Taxonomy+ENG+PDF+for+publishing.pdf?MOD=AJPERES&CVID=nikyh1h>

the diversification of China's energy system has been accelerated. China's dominant strategy will be growing renewable and nuclear energy's contribution ratio and gradually shrinking coal's share in the energy mix. But the process of moving away from coal could be long and painful, considering the current over-capacity status and several newly built alleged super-low emission coal-fired power plants. In later parts of 2021, coal was once again the focus of power generation with the power shortage problem that plagued most of China. Coal consumption control policies in the coming decade would, to a large extent, resemble the ones under the '*13th Five-Year Energy Development Plan*' (2016-2020)⁸³, China would continue to implement the two binding targets of total coal consumption in primary energy consumption and coal consumption per unit of coal power output.

According to the METI, Japan had about 48 GW of more than 150 units of coal-fired generating capacity in July 2020, with the major power utilities owning about 39 GW of over 70 units.⁸⁴ At COP26 in 2021, Japan, the world's fourth largest coal-fired power producers, did not join the commitment to phase out coal. Japan is the only G7 country still building coal-fired power plants: over the next decade, new coal power plants are expected to be connected to Japan's power grid, replacing dozens of aging coal-fired plants that are due to retire.⁸⁵ Since the Fukushima nuclear disaster a decade ago sparked public opposition to nuclear power, Japan has turned to fossil fuels to keep its economy moving. Coal-fired power now supplies nearly 30% of Japan's electricity. For the resource-poor Japan, coal is simply too good to give up, as it is abundant, inexpensive and vital to maintaining a steady power supply.

South Korean President Moon Jae-in recently announced that 10 existing coal-fired power plants will be closed by the end of 2022, and another 20 coal-fired power plants will be closed by 2034. However, ironically, as of 2020, South Korea has seven on-going new coal power projects. Although South Korea's "Green New Deal" has not yet reached true greenness, the South Korean government may make follow-up measures in the future to increase South Korea's ambitions for climate action. The road to transition is thought to be bumpy, not only from political point of view and the big corporations' impacts, but also from the fact that the current energy mix is heavily dependent on coal. The pathway to decrease the share of coal-fired power generation from around 40% in 2019⁸⁶ and quickly increase the share of renewable energy from merely 6.5% to a higher level remains unclear.

With abundant fossil fuel resources, Mongolia's economy is heavily dependent on its coal production. Coal accounts for 43.7% of Mongolia's total export and 81% domestic power generation.⁸⁷ However,

⁸³ China: 13th Five-Year Plan for Energy Development. Link: <https://policy.asiapacificenergy.org/node/2918>

⁸⁴ Japan's coal power share to drop to 26% by 2030-31 on regulatory push: METI, S&P Global. Link: <https://www.spglobal.com/commodity-insights/en/market-insights/latest-news/electric-power/040921-japans-coal-power-share-to-drop-to-26-by-2030-31-on-regulatory-push-meti>

⁸⁵ Welcoming J-POWER and Ube Industries' decision to cancel coal power station in Yamaguchi, Japan: Other coal-fired power projects must stop, too, KIKO Network. Link: https://www.kikonet.org/press-release-en/2021-04-16/nishiokinoyama_cancelled

⁸⁶ The substance of a Korean Green New Deal is still being defined. China Dialogue, 2020.07.01. Link: <https://chinadialogue.net/en/climate/the-substance-of-a-korean-green-new-deal-is-still-being-defined/>

⁸⁷ Trade summary for Mongolia 2019. Link: <https://wits.worldbank.org/countrysnapshot/en/MNG>

despite its dependency, Mongolian government's "State Policy on Energy 2015-2030" showcases a strong commitment to developing renewable energy, setting an ambitious target of increasing renewable electricity generation to 30% of installed capacity by 2030. This could be achievable through developing the vast potential of the Gobi Desert for both solar and wind energy, where it has 300 sunny days per year combined with low temperatures and high wind.⁸⁸

3.3 Public investment from East Asia on overseas energy infrastructure

Energy infrastructures include many components, from generation and transmission to the distribution of electricity. The three East Asian countries' investment in the domestic coal power sector is showing a similar trend with the mid-century carbon neutral goals, namely, to stop investing in new coal power plants for Japan and South Korea, and to get stricter approval requirements for new ones in China. However, the overseas energy infrastructure investment, temporarily crippled by the coronavirus pandemic, is showing a rebound. Post COVID-19, many countries have enacted low interest rates and cheap financing structures for economic stimulation. Although climate change is creating vast demand for renewable energy development⁸⁹, it also pushes forward the construction of fossil fuels exploration and thermal power generation to meet immediate power demands.

China's involvement in coal power is mainly through its 'Belt and Road Initiative', with state-owned power groups and state-owned banks as the dominant investors. However, during COP26 in November of 2021, China announced for the first time that it would halt all overseas coal investments. South Korea and Japan are the only two OECD countries that are still investing in overseas coal projects using public funds. South Korean financiers, public and private ones combined, have invested USD 50 billion in coal projects over the past decades, and more than 90% of those are overseas projects.⁹⁰ However, halting investment in domestic and overseas coal-fired power projects is not mentioned in its "Green New Deal". Despite the 2050 net zero emissions goal, the South Korean government still provided a USD 3 billion emergency loan to the domestic coal-fired power company Doosan Heavy Industries, a major coal-fired power plant manufacturer.⁹¹ Majority of South Korea's coal power investments are located in Southeast Asian countries, such as Vietnam and Indonesia. Yet, these two countries have received protests from local environmental organizations for its coal power projects and are avidly developing renewable energy.

Apart from coal, the oil and gas exploration projects involving Chinese and Korean, and some

⁸⁸ IRENA electricity interconnections Northeast Asia 2021.

⁸⁹ How to get infrastructure right? The Economist. 2021.01.02 ed. Link: <https://www.economist.com/leaders/2021/01/02/how-to-get-infrastructure-right>

⁹⁰ Is South Korea on the right path to carbon neutrality? China Dialogue, Dec 02, 2020. Link: <https://chinadialogue.net/en/climate/south-korea-path-to-carbon-neutrality/>

Korean 'Green New Deal': Is it really green? (In Chinese) Link: <http://www.reei.org.cn/blog/795>

⁹¹ China: 13th Five-Year Plan for Energy Development. Link: <https://policy.asiapacificenergy.org/node/2918>

Japanese entities are widely seen in countries such as the Philippines, Myanmar, Nigeria, Iran, Canada, Qatar, and Mexico. Sometimes the exploration will connect to the mainland by the crude oil pipeline and natural gas pipelines, others will be processed at local liquefied natural gas (LNG) facilities.

These overseas power plant investments in Southeast Asia, South Asia, and Africa show the increasing demand for electricity resulting from rapid economic growth in recipient developing countries. But this investment does not consider the associated environmental sustainability and longer-term climate risks. The assessment for project selection should consider the factors such as carbon emissions and air pollution costs. Nevertheless, the right to power access, or energy justice, is also considered through stakeholders' consultation.

3.4 Just transition: A topic China and Mongolia should not ignore

"Just Transition" is defined as a system of fair shift to a low carbon economy, focusing on developing more clean energy in the energy systems while also ensuring the economic stability and employment of the coal industry. In the Chinese context, it is necessary to adapt its own energy system in order to fulfill its long-term climate commitments while maintaining social stability. China has already started closing some outdated, small, and inefficient coal mines since 2016⁹², a comprehensive employment diversion plan was in place for the affected coal workers included financial aid, entrepreneur funds, and re-training programs. However, China's energy transition is very different to that of western developed countries, attributing to 1) the Chinese coal industry is largely dominated by state-owned groups; 2) the successful "Just Transition" cases tend to be on a smaller scale in developed nations.⁹³ Looking into the 'Just Transition' happening in other parts of the world, China would need more preparations to achieve a dynamic, effective, inclusive energy transition. However, it will be a challenging task for China to achieve an open and fair energy transition over a relatively short period of time, while ensuring multidimensional stakeholder engagement.

The positive side of the story is that the majority of the coal mining and power centers are also the base of China's renewable energy development. For those skilled technicians and professionals in the coal power sector, it will be relatively easy to transition to jobs in renewable energy industries. However, it will be more challenging for the low-skilled displaced workforce, the situation of finding new jobs is more challenging. The outcome depends on whether local governments are well-prepared for the incoming challenges and get workers trained early on through the skill-promotion centers. Some fast-moving and open-minded local governments have attracted new investments of renewable energy industry as well as provided attractive policies for other non-energy related businesses such

⁹² China Statistical Yearbook 2015. National Bureau of Statistics of China. Link: <http://www.stats.gov.cn/tjsj/ndsj/2015/indexeh.htm>

⁹³ REEI Energy Review 2016. Rock Environment and Energy Institute, 2017. Link: <http://en.reei.org.cn/publication/740>

as tourism.⁹⁴

There are also regional differences to consider in the implementation of the resettlement policies in China. For example, the transition would be simpler in some coal production bases in the eastern coastal areas with small production scales. These area's local economy is relatively developed, with a high proportion of tertiary industries, making it easier for those coal sector related workers to find alternatives. However, for some resource-based mining cities in North, Northwest, and Northeast of China, due to the less diverse industrial and economic structure, it is difficult for workers to find alternative options.⁹⁵

Some domestic coal groups have been keen in re-investing within the coal industry, such as upgrading coal technology to make it cleaner in hopes to revitalize the coal economy, rather than diversifying itself or preparing its employees for employment in other fields. This re-investment model will face challenges considering China's carbon emission peaking target before 2030 and carbon neutrality commitments before 2060. Instead, the funds from these 'sunset' industries should be used to transition their workforce to sustainable careers. Retraining, healthcare, retirement, infrastructure, and other community costs all must be considered and covered as coal regions transition to a more diverse economy.

Though Mongolia's economy is heavily dependent on its mining industry, the industry only accounts for about 4.4% of its employment. Majority of employment is in agriculture and hunting, while many also work in manufacturing and wholesale. As Mongolia aims to move away from coal and significantly increase its renewable energy development, successfully transitioning its most skilled workers from mining industry into clean technology would be the key. Mongolia's new COVID-19 recovery plan includes key fund to support the training and development of youth employment in non-mining industries, utilizing its demographic with the highest potential.⁹⁶

⁹⁴ Lin, J., Momoi, T., Lee, J., Zhao, A., Evdabe-dan, I. & Schinzel, J. (2018). Coal power sector in China, Japan, and South Korea: Current status and the way forward for a cleaner energy system. Beijing: China Association for NGO Cooperation, East Asia Climate Network & China Civil Climate Action Network.

⁹⁵ Research on the employment impact of the "cut overcapacity" policy on the coal industry. NRDC 2017. Link: <http://coalcap.nrdc.cn/datum/info?id=53&type=1>

⁹⁶ Mongolia's Transition To a Green Economy: A Stocktaking Report, Partnership for Action on Green Economy. Link: https://www.un-page.org/files/public/mongolia_green_economy_eg_full_nov16_web.pdf

Conclusion

China, Japan and South Korea all announced carbon neutral strategies in late 2020, providing a new round of national commitments to support a global target of 1.5 °C scenario. Though Mongolia lacks carbon neutral goals, its updated NDC and green economy measures show their commitment to reducing its emissions by the middle of this century. By comparing the backgrounds, policy measurements, and impacts of carbon neutral strategies, this policy brief demonstrates the three points.

First, there are huge potential for the East Asian nations to cooperate in various areas related to technological exchanges, trading opportunities, and financial support. The cooperation may help these countries to achieve their climate neutral targets more cost-effectively; Second, the four neighbors may have different approaches to seek the targets due to their disparities in political system, policy capacities, economic situations, and energy profiles. Therefore, it is worthy to closely observe and analyze how each country pursue their climate targets. The whole process presents a valuable opportunity for think tanks and climate advocacy groups from each individual country to learn and offer more relevant policy recommendations on achieving carbon neutral goals in the long run; Third, a potential new era of global climate governance may accelerate the climate actions and shorten the period of achieving carbon neutrality for the three nations. European Union's pioneering commitment to 2050 carbon neutral target in 2019 and the updated climate commitments by some large economies including the U.S. at the Leaders' Summit on Climate in April 2021 may imply a coming age of climate competition. At the COP26, we also saw major international movements, from the US-China partnership to India's updated NDCs, to the global methane pledge and international coal phase-out pledge.

These advancements showcase a proactive global climate environment in tackling the challenge of reaching 1.5 degrees Celsius scenario. Under this new era of climate cooperation and competition which may be facilitated by bilateral and multilateral trading policy and schemes, the peer pressure in the Asian neighboring countries and the built-up pressure from the international community towards the major East Asian economies, particularly China, will play an important role in their future climate actions.



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