

Korea's 10th Electricity Basic Plan is not aligned with the global 1.5°C limit :

*Delayed coal to renewable transition jeopardizes
consistency with common global goal*



SCHOOL OF
PUBLIC POLICY
CENTER FOR GLOBAL
SUSTAINABILITY

SFO°C
Solutions for Our Climate

Korea's 10th Electricity Basic Plan is not aligned with the global 1.5°C limit :

*Delayed coal to renewable transition jeopardizes consistency
with common global goal*

In 2023, the Republic of Korea announced two essential national planning documents for the next decade: a National Carbon Neutrality Green Growth Basic Plan (Carbon Neutrality Plan), which updates several Nationally Determined Contribution (NDC) targets; and its 10th Electricity Basic Plan of Long-Term Electricity Supply and Demand (Electricity Basic Plan). While the Republic of Korea has previously advanced a strong national target, or nationally determined contribution (NDC), under the Paris Agreement, its recently released implementation strategies fall short of what will be needed to achieve its target for a global 1.5°C trajectory.

This analysis examines Korea's proposed energy targets and compares them to emissions pathways and electricity generation projections developed using an integrated assessment model, the Global Change Analysis Model (GCAM-CGS).¹ The modeling results suggest that the 10th Electricity Basic Plan is not in line with the global 1.5°C target. To avoid high overshoot, Korea can accelerate the coal to renewable energy transition, increase total installed renewable capacity to at least 100 GW by 2030, and phase out all conventional coal power generation by 2035.

Our research shows that rapid decarbonization of the power sector is key to achieving the 1.5°C low-overshoot pathway (See Figure 2 for scenario analysis). To achieve this, the 1.5°C consistent pathways highlight the need for a rapid phaseout of conventional coal power generation. The analysis shows an 80% decrease in coal generation by 2030, less than 1% of total electricity coming from residual coal (about one 600 MW plant) by 2035, and a complete phaseout of coal power post-2035 (Figure 1). However, under the 10th Electricity Basic Plan, coal without carbon capture and storage remains a significant share of the country's electricity mix—19.7% and 14.4% of total generation in 2030 and 2036, respectively.² According to the Plan, coal is projected to be the Republic of Korea's third largest source of electricity in 2030.³

As of August 2023, there are 30 coal-fired power plants (85 units, a total of 40.2 GW) in operation, and two new units (2.1 GW) under construction in Samcheok City.⁴ Following the announced retirements and a 30-year lifetime for the remaining plants, 51 units (28.7 GW) remain operating by 2035, and a complete coal phaseout does not occur until 2050 (Figure 1). Therefore, accelerated coal retirement is needed to close the gap.

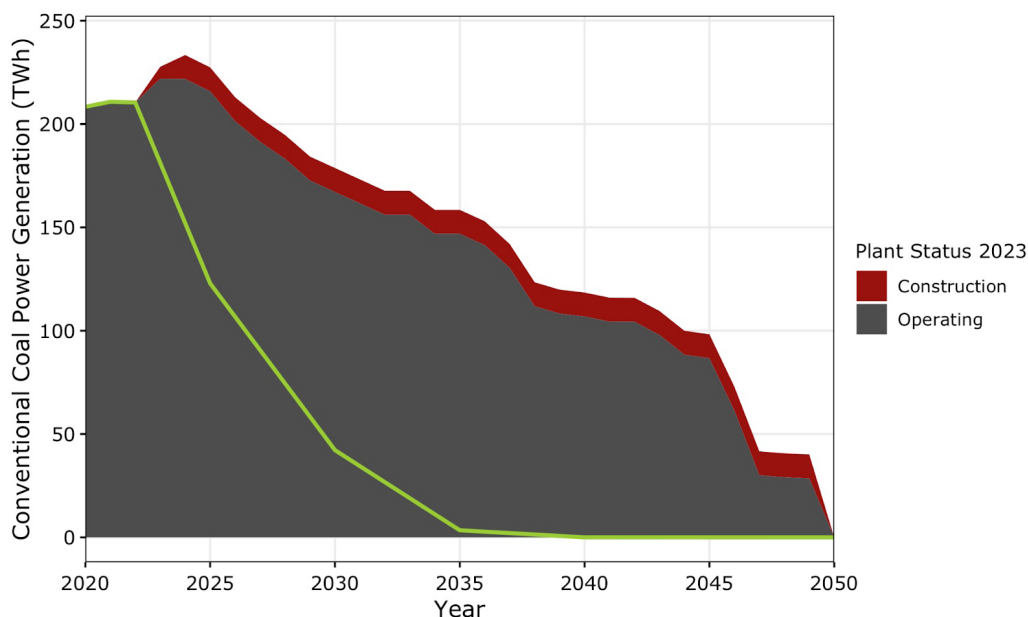


Figure 1. South Korea conventional coal power generation under Korea's current plan (area) and the 1.5°C low-overshoot pathway (line).

Solid colors show power generation trajectory for operating and under construction coal plants as of August 2023, assuming constant utilization level as of 2022, and based on the planned retirements or a 30-year lifetime, and a 2050 phaseout according to the government's carbon neutrality scenario.⁵

As coal is phased out, renewables with their rapidly reducing costs⁶ provide alternative sources of electricity, yet the current Electricity Basic Plan's carbon-free and renewable energy targets are incompatible with a global 1.5°C limit, and thus the economy-wide NDC emissions target. Prior commitments included a target of 30.2% total generation from renewable sources,⁷ but the current Electricity Basic Plan reduced this target to just 21.6%. Our analysis suggests that by 2030, 45% of total electricity generation that is provided by renewable sources of energy, mostly solar and wind generation, can exceed both the prior target and the current 10th Electricity Basic Plan.³ To achieve this level of generation, over 100 GW of renewable capacity needs to be installed by 2030, which requires adding 10–12 GW new capacity per year between today and 2030.

The next decade is critical for global action to limit warming below 1.5°C. Our results suggest that the newly released Electricity Basic Plan is not aligned with a global 1.5°C limit. Rapid power sector decarbonization by 2030 is a key component for Korea to achieve economy-wide emissions reductions that in aggregate achieve the NDC across all sectors and gases. Increasing renewable energy targets in the Electricity Basic Plan can help to ensure that the NDC target is met, and that essential emissions reduction in the power sector is achieved.

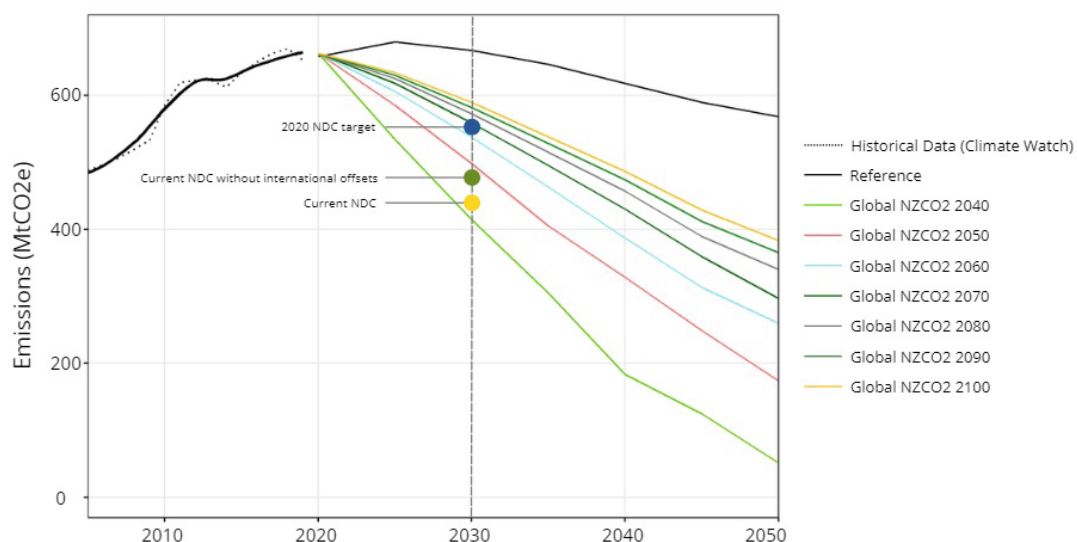


Figure 2. Korea's GHG emissions across scenarios for achieving global net zero in different years. To evaluate the ambition of Korea's 2030 NDC and 10th Electricity Basic Plan, we compare country-level targets with global 1.5°C emissions pathways (Figure 2). We constrained global emissions to net-zero in 10-year increments to assess temperature aligned emissions pathways. We assess both projected temperature changes and global cumulative CO₂ to identify 1.5°C and below-2°C scenarios. These curves show reductions in emissions needed to achieve 1.5°C-compatible scenarios. Korea's current NDC (yellow dot in 2030) is roughly in line with a 1.5°C trajectory with low-overshoot (Global NZCO₂ 2040). Korea's NDC, accounting for international offsets (green dot in 2030), is consistent with a high-overshoot pathway (Global NZCO₂ 2050). Dotted line represents actual history, solid line is an averaged representation of history. Our analysis, consistent with other research findings,⁸ demonstrates that aggregate global CO₂ emissions need to reach net-zero before 2050 to limit warming below 1.5°C by the end of the century, and by 2040 with low-overshoot. Our analysis shows that while Korea's previously committed NDC target level is consistent with global 1.5°C pathways, the increasing reliance on international offsets in Korea's Carbon Neutrality Plan to achieve the 2030 NDC target is not aligned with a 1.5C target (with low-overshoot).²

1. GCAM is a global integrated assessment model that examines long-term changes in the coupled socioeconomic, energy, agriculture/land-use, and climate systems with technology-rich representations of energy production, transformation, and consumption. GCAM covers economy-wide emissions and all GHGs. Scenarios are generated using GCAM 5.4. Detailed documentation can be accessed at <http://jgcri.github.io/gcam-doc/>.
2. N. Hultman, J. Behrendt, R. Cui, M. Zwerling and B. Phelps. (April 2023). "Korea's National Carbon Neutrality Plan and 10th Electricity Basic Plan are not aligned with the global 1.5°C limit; accelerated deployment of renewable energy is crucial to meet the common global goal." Center for Global Sustainability, College Park.
3. Korea Ministry of Trade, Industry and Energy (MOTIE). (2023). The 1st 10th Basic Plan for Long-Term Electricity Supply and Demand.
4. Global Energy Monitor, Global Coal Plant Tracker, July 2023, with authors' adjustments
5. Korea Joint ministries. (2023). National Carbon Neutrality, Green Growth and First National Basic Plan. <https://www.2050cnc.go.kr/base/board/read?boardManagementNo=2&board-No=1469&searchCategory=&page=2&searchType=&searchWord=&menuLevel=2&menuNo=16>
6. Park, W., Abhyankar, N., Paliwal, U., Kim, J., Khanna, N., Shiraishi, K., Lin, J., Phadke, A., Song, Y., Moon, H., Kim, E., Hong, S., & Kim, S. (2023). A Clean Energy Korea by 2035. Lawrence Berkeley National Laboratory. <https://doi.org/10.2172/1970341>
7. Korea Joint ministries. (2021). 2030 National Greenhouse Gas Reduction Target (NDC) Upgrade Plan. Available at: <https://www.korea.kr/common/download.do?fileId=196125969&tblKey=GMN>
8. IPCC. (2022). Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In Global Warming of 1.5°C: IPCC Special Report on Impacts of Global Warming of 1.5°C above Pre-industrial Levels in Context of Strengthening Response to Climate Change, Sustainable Development, and Efforts to Eradicate Poverty (pp. 93–174). Cambridge University Press. <https://doi.org/10.1017/9781009157940.004>

Suggested citation: N. Hultman, J. Behrendt, R. Cui, M. Zwerling and B. Phelps. (September 2023). "Korea's 10th Electricity Basic Plan is not aligned with the global 1.5°C limit; delayed coal to renewable transition jeopardizes consistency with common global goal." Center for Global Sustainability, University of Maryland, College Park, MD.

September 2023

Nate Hultman, Jenna Behrendt, Ryna Cui, Matt Zwerling and Bradley Phelps
(Center for Global Sustainability, University of Maryland)

