SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

PATHWAY DERIVATION: POWER SECTOR PATHWAYS

Version 1.0 Second Consultation Draft

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sciencebasedtargets.org /science-based-targets @sciencetargets info@sciencebasedtargets.org

ABOUT SBTi

The Science Based Targets initiative (SBTi) is a corporate climate action organization that enables companies and financial institutions worldwide to play their part in combating the climate crisis.

We develop standards, tools and guidance which allow companies to set greenhouse gas (GHG) emissions reductions targets in line with what is needed to keep global heating below catastrophic levels and reach net-zero by 2050 at latest.

The SBTi is incorporated as a UK charity, with a subsidiary SBTi Services Limited, which hosts our target validation services. Partner organizations who facilitated SBTi's growth and development are CDP, the United Nations Global Compact, the We Mean Business Coalition, the World Resources Institute (WRI), and the World Wide Fund for Nature (WWF).

DISCLAIMER

VERSION HISTORY

Version	Change/update description	Release date
Version 1.0	● Draft to accompany the Power Standard second public consultation draft	July, 2026

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1. INTRODUCTION

1.1 Background

In 2023, global energy-related CO_2 emissions reached 37.4 Gt, with the power sector accounting for 39.4% (IEA, 2024a). Emissions from electricity generation grew by 1% to an all-time high of 14.8 Gt with coal-fired power remaining the largest single global source of electricity (Ember, 2025). While renewable generation growth is far outpacing fossil generation growth, total electricity demand still rose by 2.2%, underscoring the importance of not only adding renewable capacity but also retiring fossil fuel assets (Ember, 2025; Fofrich Navarro et al., 2020). Demand is expected to climb a further 3.4% in 2026, largely driven by increasing electrification in Emerging Economies (IEA, 2025). These trends emphasize the need for new power sector pathways sensitive to recent developments in energy decarbonization and climate science.

Since the SBTi first published its Power Sector pathway and target-setting methods in 2020 (SBTi, 2020), the scientific community has continued to advance the available frameworks for pathway derivation and target setting. Beyond reflecting more recent emissions data, the SBTi recognizes the need to refocus corporate climate target-setting from ambition to action, requiring more flexible asset- and activity-level pathways that move beyond simple emissions quantification while preserving the credibility and ambition of earlier work. These insights are reflected in the ongoing revisions to the SBTi's Corporate and Power Sector Net-Zero standards, and the development of the new modular metrics, methods, and pathways (MMPs) framework.

1.2 Purpose and Scope

This Pathway Derivation document is developed in line with the SBTi's Standard Operating Procedures[1] (SOP) and sets out how the updated Power Sector pathways are derived, providing the scientific basis behind the values reflected in the second public consultation draft of the SBTi Power Sector Net Zero Standard.

1.3 Key Research Questions

- What are the eligible scenarios in the latest scientific literature required to drive 1.5°C-aligned emissions, asset-, and activity-level pathways in the power sector?
- What are the most appropriate approaches to derive regional power sector pathways for science-based target setting?
- What role do non-CO_2 greenhouse gases have in power sector decarbonization?
- What role do biogenic emissions and removals have in power sector decarbonization?
- What emissions, activity, and asset transition benchmarks will drive power sector emissions reductions consistent with achieving net-zero by 2050?

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[1] Synthesis reports or pathway derivation documents developed as part of the SBTi standard development process are informative documents that summarize research and analysis findings informing a new or updated standard. The inclusion of findings related to technical foundations including metrics, methods, and/or pathways in a normative standard is subject to the discretion of the standard development project team and the SBTi Technical Department. As such, some content in this document may not be present in the final published version of a new or updated standard.

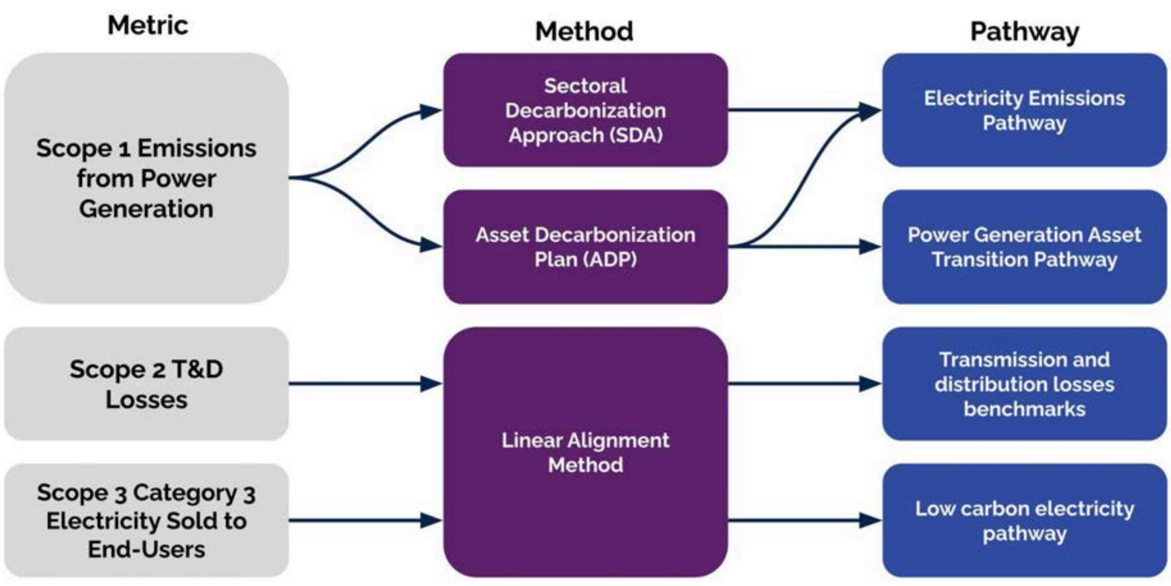
2. OUTPUT REQUIREMENTS

The required outputs of this work are all power sector pathways and benchmarks required to operationalize target setting under the second public consultation draft of the SBTi Power Sector Net-Zero Standard. Four output pathways were required, each with a binary regional differentiation, and mapped to the relevant metric and target-setting method:

- Gross emissions intensity pathways to set targets on Scope 1 emissions from power generation using the Sectoral Decarbonization Approach (SDA) and Asset Decarbonization Plan (ADP) carbon-budget approach.
- Transition milestones specifying the retirement year for unabated baseload power generation of a given fuel type, for use with the ADP milestones approach.
- Low-carbon electricity pathways to set targets on the share of low-carbon electricity generated and sold to end users (Scope 3 cat. 3) using the Linear Alignment method
- Transmission, distribution, and storage loss net-zero benchmark values and target years to set targets on the share of electricity lost, using the Linear Alignment method.

Unless otherwise stated, all pathways are derived on a gross basis, span the 2020 to 2050 horizon, and are differentiated regionally following the IEA's Advanced and Emerging Economy classification.

Figure 1. Diagram of the modular metrics, methods, and pathways framework used in target-setting for the second public consultation draft of the power-sector net zero standard. Please note transmission and distribution losses benchmarks do not have an associated pathway specification sheet at this time.



3. PATHWAY SOURCE AND DATA AVAILABILITY

Two bodies of scenario evidence were considered to derive the pathways described in Section 2: the C1 category of scenarios described in the IPCC's Sixth Assessment Report (AR6) and the International Energy Agency's (IEA) 2024 Net Zero Emissions by 2050 (NZE) scenario. These scenarios limit warming to 1.5°C by the end of the century with low overshoot, corresponding to the most ambitious goal of the Paris Agreement. Within this suite, scenario selection follows the six guiding principles that underpin the SBTi's scientific foundations, namely that pathways be ambitious, responsible, rigorous, actionable, robust, and transparent.

Scenarios were filtered against a set of quantitative sustainability filtering criteria derived from the SBTi's guiding principles for technical development. These filters constrain reliance on bioenergy, bioenergy with carbon capture and storage (BECCS), afforestation, geological carbon storage, novel carbon dioxide removal, and fossil fuel rebound. Scenarios were also assessed for output granularity, including regional reporting and the reporting of the benchmarks required to derive each transition indicator needed for power pathway development. Seven scenarios passed all sustainability filtering criteria. For the full list of scenario selection criteria, see the SBTi Cross-Sector Pathway Synthesis Report. The following sub-sections set out which of these scenarios could supply the necessary data to derive each required output.

3.1 Emissions intensity and alignment

Deriving the SBTi's electricity emissions intensity and low-carbon power generation pathways requires two principal inputs. The first is the gross emissions intensity of power generation, obtained by adding CO_2 removals associated with BECCS power generation back to net power generation emissions and dividing by power generation activity. The second is the share of power generated by low-carbon sources, obtained by dividing the combined generation of renewables, nuclear, biomass, and gas with CCS by total generation across all technologies.[2] Each input variable must be resolved by the scenario over the 2020 to 2050 period and at a geographic resolution that can be assembled into an Advanced and Emerging Economies split. All seven scenarios provide the variables needed to derive the emissions intensity and low-carbon share pathways for both economy groupings.

3.2 Asset transition milestones

Deriving asset transition milestones for the power sector requires a more granular set of model outputs. While all 7 eligible scenarios report installed capacity and generation activity by technology type, the IPCC AR6 scenarios do not provide sufficient detail to derive explicit per-fuel retirement benchmarks for the power sector (Byers et al., 2022).

[2] Low-carbon power generation, as defined in CNZS V2.0, refers to electricity produced by an individual generator that is characterized by direct GHG emissions less than or equal to 0.048 $kgCO_2$ /kWh. This threshold changes to 0.024 $kgCO_2$/kWh in 2035. These thresholds correspond to gas generation with a 90% or 95% CO_2 capture rate. Accordingly, gas with CCS is used in the selection of variables that define the pathway, while all other fossil fuel power generation is excluded.

The IEA NZE 2024 scenario does provide the granularity necessary to derive per-fuel asset transition milestones. To maintain consistency in climate outcomes across the power generation target-setting options, a single common scenario source must be used to derive every power pathway. The IEA NZE 2024 scenario is therefore selected as the single source for all power generation pathways, as it satisfies all the sustainability filtering criteria and provides all the model outputs necessary to derive emissions intensity, alignment, and asset transition pathways.

3.3 Transmission, distribution and storage losses

Transmission, distribution, and storage loss benchmarks follow a best-practice approach based on real-world loss data. Lack of standardized definitions and variability in the publicly available data make these benchmarks challenging to derive, particularly in separating technical losses, which are addressable through grid improvements, from non-technical losses such as theft and metering error, which fall outside the scope of SBTi pathways due to the low level of control over these by the network operators.

Two options are proposed for consultation. Option A derives separate technical loss benchmarks for the transmission and distribution networks directly from the average CEER survey values (CEER, 2025), applied evenly across Advanced and Emerging Economies but with differentiated benchmark years. Option B instead fixes the net-zero benchmark year at 2050 but derives regionally differentiated values based on a ratio approximation; IEA grid loss data shows combined technical losses roughly twice as high in non-OECD as in OECD economies while MEDREG informs the ratio between distribution and transmission losses (IEA, 2023; MEDREG, 2023). For storage, where reducing losses is particularly challenging, a recommendation rather than a benchmark is proposed.

4. PATHWAY BOUNDARY AND SCOPE

4.1 Greenhouse gas coverage

A literature review on the role of direct non-CO_2 GHG emissions in power generation found that non-CO_2 emissions from stationary combustion normally represent less than 1% of direct GHG emissions (US EPA, 2024). The review further found that non-CO_2 GHG emissions are mitigated proportionally to CO_2 by the primary sectoral decarbonization lever, as phasing out fossil fuel combustion reduces all resulting GHGs. Accordingly, the electricity emissions pathway is expressed in terms of CO_2. Direct CO_2e emissions from power generation, including CH_4 and N_2O, are captured separately under Metric-PS.2, which is used for disclosure, applicability, and target setting.

4.2 Biogenic CO2 and removals

The pathways aim to align with the Greenhouse Gas Protocol Land Sector and Removal Standard (LSRS) for biogenic CO_2, subject to one principal limitation: the LSRS excludes forestry, a key biomass source for power generation (GHGP, 2026). The IEA NZE 2024 scenario treats biomass power production as carbon-neutral at the point of combustion (IEA, 2024a). To reflect this, biogenic combustion CO_2 sits outside the electricity emission pathway boundary. Similarly, the electricity emission pathway is presented on a gross basis rather than net of removals to preserve visibility on the roles of emissions reductions vs. carbon dioxide removals. Consistent with the gross basis, negative-emission generation such as BECCS and the associated biomass combustion emissions are excluded from the electricity emissions pathway.

4.3 Activity and Asset Boundary

The Power Sector pathways cover power generation emissions, activities, and assets whose primary purpose is electricity generation and combined heat and power (CHP) generation. Because the IEA NZE includes stand-alone heat generation within its Power Sector boundary, the SBTi is consulting on expanding the scope of the Power Standard and its associated pathways to include stand-alone heat generation.

The emissions boundary covers direct combustion emissions only; upstream fuel-cycle emissions from extraction, processing, and supply fall outside the Power Standard. This draft also introduces a more granular activity boundary that disaggregates the transmission and distribution sub-sectors, as consultation feedback emphasised their different operational and mitigation profiles.

4.4 Regionality

The first public consultation draft of the Power Sector standard used a global pathway for emissions and low-carbon activity, and a binary regional split (OECD vs. non-OECD) for the asset transition milestones. The second consultation draft expands the regionally differentiated options across all power pathways, following the IEA convention of Advanced Economies and Emerging Economies. The regional emissions, activity, and asset transition pathways are derived directly from the IEA NZE as it is the single source for power generation pathways, and the disaggregated regional transmission and distribution benchmarks (see section 3.3) are modified from their original OECD vs. non-OECD split to match the IEA classification. While these regions provide differentiated benchmarks that reflect regional energy system conditions, they do not include any explicit equity consideration.

5. RESULTS

The four pathways are derived from a single common source, the IEA NZE 2024 scenario, with historical values for 2020 to 2023 from Ember (2025). Each is presented at the regional level for Advanced Economies (AE) and Emerging Market and Developing Economies (EE), with full values given in the corresponding specification sheets and Annex B.3 of the second public consultation draft of the Power Sector Standard.

5.1 Electricity emissions pathway

The electricity emissions pathway presents the gross CO_2 intensity of generation in gCO2/kWh, calculated by dividing gross emissions from power and heat generation by total generation activity, for use with the SDA. Gross intensity falls from 367 gCO_2/kWh in 2020 to 90 gCO_2/kWh by 2030 and to 1 gCO_2/kWh by 2050 in Advanced Economies, and from 997 to 510 gCO_2/kWh and then 1 gCO_2/kWh over the same period in Emerging Economies, with the slower near-term decline reflecting rising demand and electrification.

5.2 Low-carbon electricity pathway

The low-carbon electricity pathway gives the share of electricity from low-carbon sources, calculated as the sum of generation from renewables, nuclear, hydrogen, biomass, and abated gas divided by total generation, for use with the Linear Alignment method. The share rises from 75% in 2025 to 99% by 2035 and 100% by 2040 in Advanced Economies, and from 50% in 2025 to 87% by 2035 and 100% by 2045 in Emerging Economies. The differentiated net-zero benchmark year between the regions will result in differentiated targets for companies with the same starting point in different regions.

5.3 Power generation asset transition pathway

The power generation asset transition pathway reports two per-fuel milestones: the year beyond which no new unabated capacity is added, and the year of unabated generation phased out. In Advanced Economies, unabated coal, oil, and gas reach no new unabated capacity by 2025, with phase-out of unabated generation by 2030, 2035, and 2040 respectively. In Emerging Economies the same no-new-capacity years apply, with phase-out extending to 2040 for coal and oil and 2045 for gas, reflecting the slower transition pace.

5.4 Transmission and distribution benchmarks

The loss benchmarks are best-practice empirical values rather than scenario-derived pathways, applied with the Linear Alignment method. Two options are put forward for consultation: Option A applies common technical loss values of 2% for transmission and 7% for distribution, with differentiated benchmark years of 2035 for Advanced Economies and 2050 for Emerging Market and Developing Economies; Option B applies regionally differentiated values, 2% transmission and 5% distribution for OECD and 4% and 10% for non-OECD, both aligned to a net-zero benchmark year of 2050.

6. LIMITATIONS

The pathways are derived from a single scenario source, the IEA NZE 2024, to maintain consistency across all four pathways and to reflect the latest trends in the global energy system. While the IEA NZE 2024 scenario meets all of the sustainability and feasibility criteria applied, the exclusion of a multi-model ensemble of Integrated Assessment Model (IAM) derived scenarios from the AR6 suite remains a major limitation. This consultation draft extends pathway regionality to all target-setting options, but regional resolution is limited to a binary Advanced and Emerging Economy split, so variation in regional, national, and sub-national energy system conditions is not captured. The loss benchmarks carry a separate limitation, as the underlying best-practice data are drawn from real-world observations and are subject to issues of data quality, completeness and consistency. Finally, the pathways make no explicit equity consideration, beyond providing two differentiated regions, and so do not fully reflect any climate equity principle.

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