Scenarios of Coal Production in Indonesia

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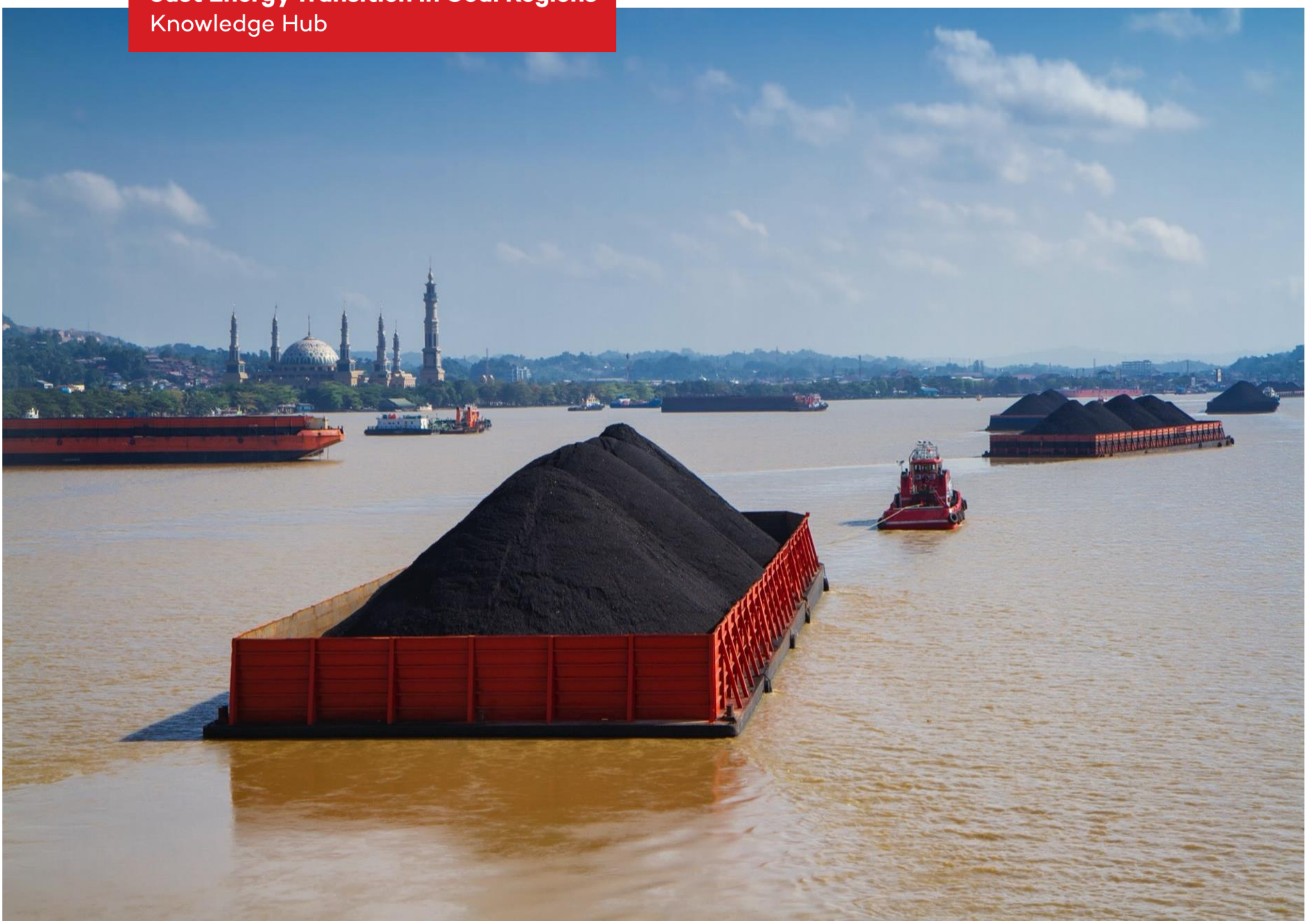
Just Energy Transition in Coal Regions
Knowledge Hub



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Executive Summary

This publication analyses **the future development of coal production in Indonesia** in order to support decision makers in Indonesian coal regions in their long-term transition process.

Coal plays a pivotal role in Indonesia's economy and energy system, as the country is one of the world's largest coal producers and the leading thermal coal exporter. Historical data indicates a massive increase in both exports and domestic consumption. Both rose by around tenfold between 2000 and 2024. However, this growth trajectory is unlikely to continue in the long term. Global energy scenarios suggest that worldwide coal use will plateau and decline by 2030 at the latest, due to the growing competitiveness of renewables and climate mitigation policies. **The central question for Indonesia is therefore no longer if, but when coal production will peak and begin to decline.**

We have witnessed that stakeholders and decision makers in Indonesia's coal region are becoming increasingly aware of this development and are trying to actively shape the future of their regions, e.g. by diversifying the local economy thus becoming less dependent on coal for jobs and public revenues. However, we have also witnessed a great insecurity and very different expectations on when and how quickly coal mining will decline. This report tries to narrow down the existing uncertainties and sketch a corridor of developments which we consider to be most likely.

Analysis of Demand Drivers

We assess future coal production by evaluating four key demand drivers:

1. Exports: Approximately two-thirds of Indonesia's coal production is exported, primarily to China and India. Weaker global demand and rising domestic production in key markets pose an emerging risk to this export-driven model. Data from the first half of 2025 already suggests a turning point, showing a 6% decline in exports compared to the same period in 2024.

2. Grid-based power generation: Coal currently is the dominant fuel, accounting for over 60% of electricity generation. Although Indonesia pursues long-term climate neutrality by 2060, current planning documents (RUPTL and RUKN) include additional coal capacity until at least the early 2030s.

3. Captive power for industrial use: Demand from industrial, off-grid coal-fired power plants has increased sharply in recent years, rising sixfold between 2014 and 2024. The majority of all new coal power projects currently under construction is designated for industrial captive use.

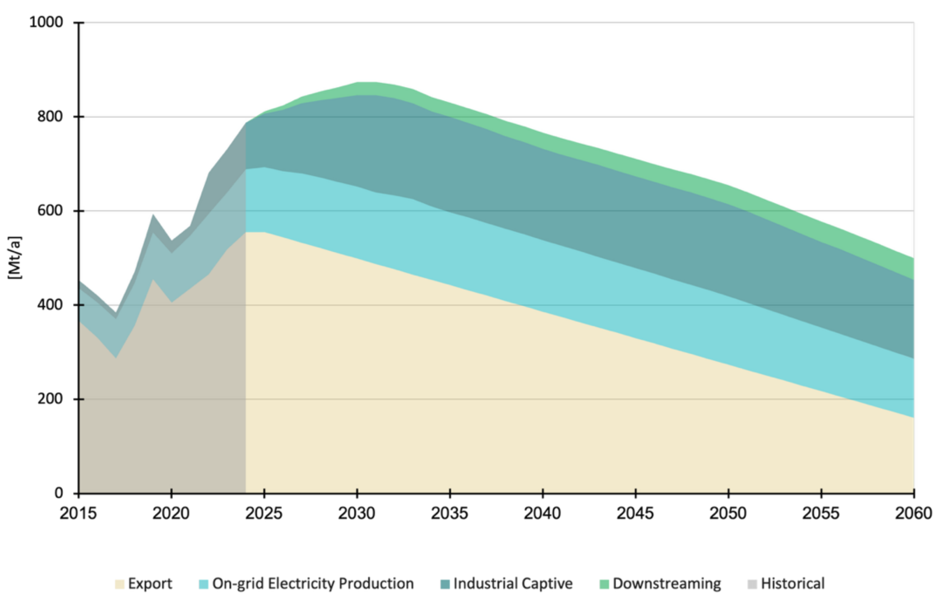
4. Coal downstreaming and value-added use: Government efforts aim to convert coal into higher-value products like Dimethyl Ether (DME). However, due to high costs and lack of competitiveness, this driver is considered unlikely to become a key source of overall coal demand.

For each sector we develop a **WI** (= Wuppertal Institute) **High Scenario** and a **WI Low Scenario**, based on Indonesian national plans combined with additional (international) assessments like the International Energy Agency's (IEA) projections energy scenarios. Assuming that total coal demand equals production, we add up all sector contributions to a consolidated High Scenario and a consolidated Low Scenario. These scenarios can be understood as the anticipated upper and lower limits of coal production in Indonesia, thus defining **a corridor of likely future developments.**

Consolidated Scenarios and Policy Implications

The **WI High Scenario** assumes a gradual decline in exports following the IEA Stated Policies Scenario (STEPS) that assumes only existing energy and climate policy as well as technology development. Domestic demand follows RUPTL and RUKN projections, with high reliance on CCS in the long term for both on-grid and captive power. Captive demand increases sharply until 2031 (16.6 GW capacity increase). Coal downstreaming achieves MEMR targets. In this scenario, coal production would peak in 2031 and subsequently decline moderately to 500 Mt in 2060.

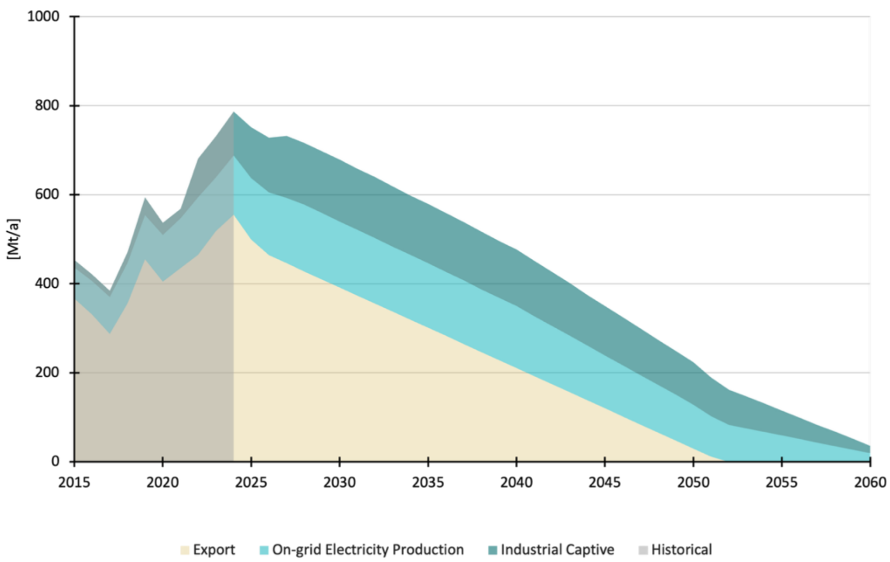
Figure S1. Consolidated WI High Scenarios for coal demand for industrial captive, on-grid electricity production and export



Source: Author's own calculations

The **WI Low Scenario** describes a more immediate contraction, assuming global climate policies align with the Paris Agreement (IEA NZE). Exports decline immediately and steeply, reaching near zero shortly after 2050. Domestic demand peaks much earlier (captive peak 2027, on-grid peak 2028) as CCUS is deemed uncompetitive against renewables. Coal downstreaming is negligible. Under these assumptions, coal demand peaks in 2024 and is expected to gradually decrease to 36 Mt annually by 2060.

Figure S2: Consolidated WI Low Scenarios for coal demand for industrial captive, domestic power production and export

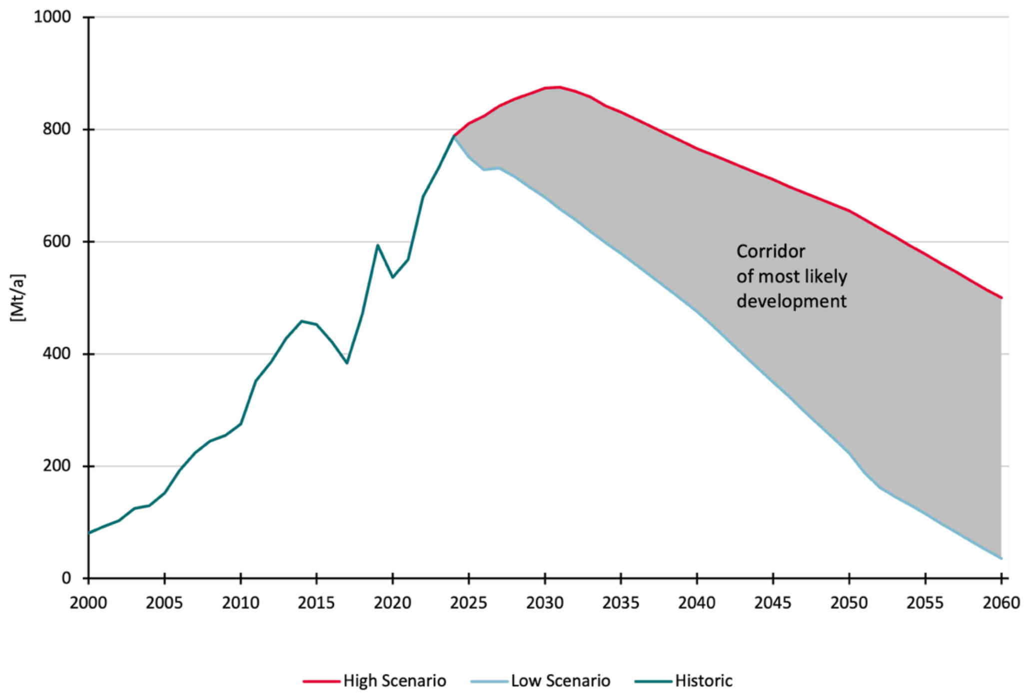


Source: Author's own calculations

The overarching conclusion is that for the short-term perspective (the next five years) a plateau or a slow rise/decline is most likely. Growth or decline rates are expected to be lower than the fluctuations experienced in the past (e.g. driven by market forces or the COVID pandemic). However**, in the long-term** horizon (2040 and beyond), **coal mining will decline**. Thus decision-makers in regions that are economically highly dependent on the coal sector, such as East Kalimantan and South Sumatra, must plan for long-term economic shifts.

Uncertainties exist concerning both the speed of decline and the level coal mining will reach in 2060. In 35 years from now, coal mining could be down to (almost) zero or still be at a level comparable to 2020. This will strongly depend on global climate ambition, the viability and cost-competitiveness of CCS and renewables, and Indonesia's GDP growth.

Figure S3: Consolidated WI High and Low Scenarios for coal production in Indonesia with resulting corridor of most likely development



Source: Author's own calculations

Strategic Guidance

Even though high uncertainties exist concerning long-term developments, we expect with high certainty a trend-break in the dynamics of Indonesia's coal sector. The strong growth rates of the past will not be reached anymore, in contrast mining will decline with all the impacts on the local economy, local public revenues, direct and indirect jobs in the mining regions. We therefore strongly suggest to pro-actively manage this transition process:

1. Start Now: Economic diversification is a multi-decade process; regions should use their current position of strength (stable revenues) to steer the transition actively.

2. Develop a Long-Term Strategy: Regions need a 20- to 30-year vision addressing future infrastructure and education for a non-coal workforce.

3. Ensure Fairness: The transition must protect the most vulnerable groups, such as informal workers linked to the coal sector, who lack the capacity to find alternatives without support.

Further studies should break down the national perspective to a regional one in order to have a clearer picture how coal industry in the different Indonesian coal regions could develop.

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Abbreviations and Acronyms

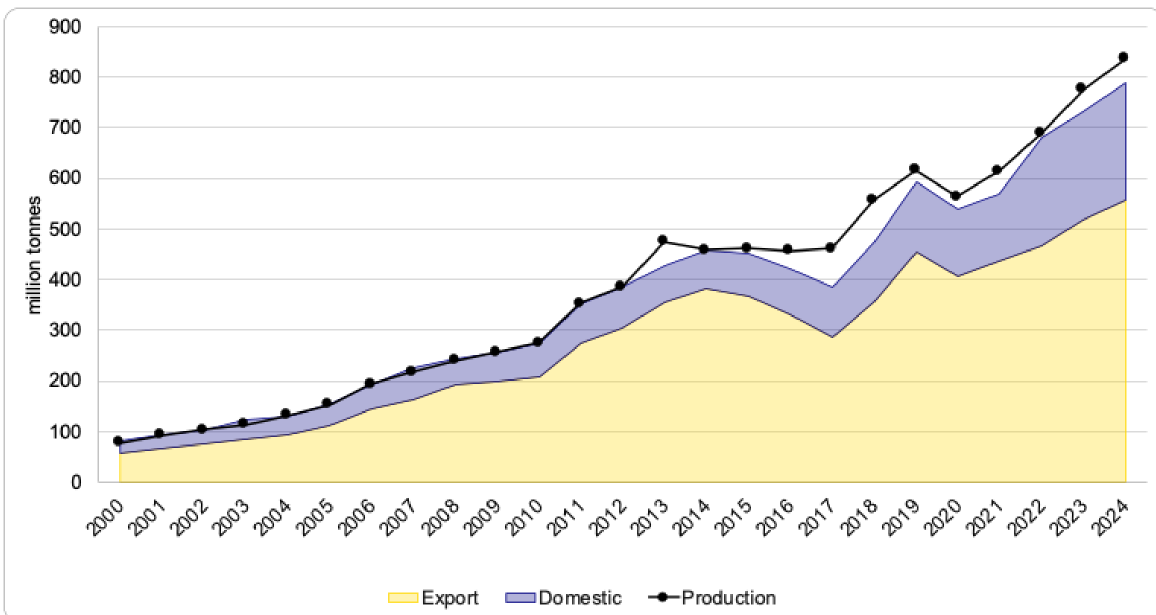
APS	Announced Pledges Scenario
CFPP	Coal Fired Power Plant
CCFP	Captive Coal-Fired Power Plant
CCS	Carbon Capture and Storage
CfBio	Cofiring Bio
DME	Dimethyl Ether
DMO	Domestic Market Obligation
GDP	Gross Domestic Product
GW	Gigawatt
HBA	Harga Batubara Acuan (Reference price for coal)
ICI	Indonesia Coal Index
IPP	Independent Power Producer
JETP	Just Energy Transition Partnership
IEA	International Energy Agency
MEMR	Ministry of Energy and Mineral Resources
Mt	Million tonnes
NZE	Net Zero Emissions by 2050 Scenario
PLN	Perusahaan Listrik Negara (State Electricity Company)
PPA	Power Purchase Agreement
RUKN	Rencana Umum Ketenagalistrikan Nasional (National Electricity Master Plan)
RUPTL	Rencana Usaha Penyediaan Tenaga Listrik (National Electricity Supply Business Plan)
STEPS	Stated Policies Scenario
TWh	Terawatt Hours
WEO	World Energy Outlook
WI	Wuppertal Institute for Climate, Environment, Energy

1. Introduction

Coal plays a pivotal role in Indonesia's economy and energy system. As one of the world's largest coal producers and the leading thermal coal exporter, the country has long relied on coal to drive economic growth, generate state and regional revenue, and provide affordable energy for domestic use. Coal contributes significantly to the country's GDP, supports millions of jobs, and underpins energy security by leveraging abundant domestic reserves.

Looking at historical data, the only way for coal was up - both exports and domestic use have been increasing massively with only temporary dips e.g. during the COVID pandemic (see **Figure 1** below). While in the past, export has grown more quickly than domestic demand, this has changed in the last decade with a notable surge in domestic demand particularly from the power and industrial sectors.

Figure 1. Historical development of Indonesia's coal market



Source: Author's own diagram with data taken from Handbook of Energy & Economic Statistics of Indonesia (HEESI) (MEMR Indonesia, 2025a)

However, with a long-term perspective, this trajectory is unlikely to continue. Global energy scenarios such as (IEA, 2025a) suggest a decline in coal use due to the growing competitiveness of renewables and climate mitigation policies. The key question for Indonesia is no longer **if,** but **when**: **When will coal production plateau and when will it begin to decline?**

While the future is inherently uncertain, decision makers particularly in coal regions in Indonesia such as East Kalimantan and South Sumatra must plan ahead and make decisions that will shape local economies for decades. If coal production is going to "decline eventually," then this poses a massive challenge to the regional economy. It is necessary to make decisions today on what infrastructure to build or which kind of education to support. Should today's young people in East Kalimantan and South Sumatra learn to become miners or renewable experts, or something else entirely? For these difficult decisions, it is important to estimate likely future developments as closely as possible. This is a highly complex task, as the future of the coal industry does not only depend on decisions taken by the Indonesian government, the Indonesian electricity provider PLN or Indonesian industry - it largely depends on factors beyond the reach of any Indonesian decision maker, e.g. decisions on climate policy and coal imports in China and India. The goal of this report is to address this complexity, narrow it down to essentials and provide strategic guidance to those planning the future of Indonesia's coal regions.

Against this background, this report compiles independent projections on short-term trends and long-term scenarios, combining and comparing them with the projections and targets of the Indonesian government. To do so **we assess coal production trends in Indonesia as a result of coal demand along four key drivers**:

- **Exports**: Approximately two-thirds of Indonesia's coal production is exported, primarily to major markets such as China, India, and countries in Southeast Asia (MEMR Indonesia, 2025a). Historically, export revenues have been a critical source of foreign exchange and public income. However, shifts in global energy policy and slowing demand growth in key markets are posing an emerging risk to the long-term stability of this export-driven model.

- **Grid-based power generation:** Coal remains the dominant fuel in Indonesia's power sector, accounting for over 60% of electricity generation (MEMR Indonesia, 2025b). This is supported by PLN's Electricity Supply Business Plan (RUPTL), which includes additional coal capacity until at least the early 2030s (PLN Indonesia, 2025). However, Indonesia has a long-term climate neutrality target (2060) and plans to reduce coal-based electricity production.

- **Captive power for industrial use:** The rapid growth of off-grid coal-fired plants supplying energy-intensive industries, particularly nickel and aluminium smelters, has emerged as a key source of demand. Captive coal capacity has tripled in the past five years and is expected to increase further (Ember, 2025a).

- **Coal downstreaming and value-added use**: Although, today's contribution is marginal, there is an ongoing discussion on government-backed efforts to promote coal gasification and other downstream projects, such as the production of dimethyl ether (DME), aim to enhance domestic energy value and reduce import dependency. However, due to its cost intensity and lack of competitiveness coal downstreaming is unlikely to become a key driver of coal demand.

These drivers will first be analysed separately (with respect to historic trends and future scenarios) in Chapter 2 for export and Chapter 3 for domestic use. For each sector a **WI** (=Wuppertal Institute for Climate, Environment, Energy) **High Scenario** and a **WI Low Scenario** will be presented which reflect the highest and the lowest conceivable development and which we, based on the evaluated literature, consider to be likely. For the export scenarios, we combined short term and long-term projections from IEA with most recent data on coal exports. To guide this assumption, we provided a subchapter on IEA scenarios in chapter 2. The scenarios for the domestic sectors are mainly based on the National Electricity Master Plan (RUKN) - which is presented accordingly in chapter three - with several additional assumptions. Finally, in Chapter 4, we combine the sector perspectives into overall scenarios and thus derive a corridor of a likely future development.

Data Inconsistencies

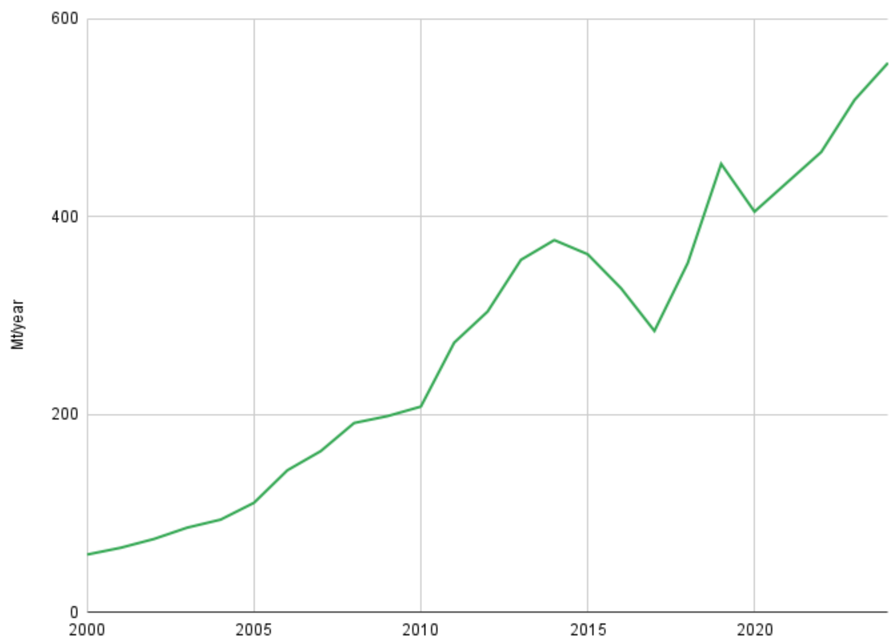
Inconsistent data remains a persistent challenge in analysing Indonesia's coal sector. Key national datasets such as those from Statistics Indonesia (BPS) and the Ministry of Energy and Mineral Resources (MEMR) often report strikingly different figures for coal production and exports in the same year, which complicates analytical reliability and scenario building. For example, in 2024, BPS recorded Indonesia's coal exports at 405.76 million tons (Badan Pusat Statistik Indonesia, 2025), whereas the widely cited MEMR Handbook of Energy and Economic Statistics gave a much higher figure of 555.35 million tons for the same period (MEMR Indonesia, 2025a, p. 20). Discrepancies of over 100 million tons can substantially alter projections and, consequently, affect the credibility of policy recommendations based on these figures. BPS coal export data originates from customs documentation, specifically export (PEB) and import (PIB) declaration forms, which are maintained by the Directorate General of Customs and Excise. Therefore, every number published by the BPS reflects aggregated customs reporting rather than direct surveys from mining companies or port authorities. It is important to acknowledge this when comparing BPS with MEMR, whose figures typically draw on self-reported company data, mining permits and licensing records. These different reporting systems are a primary cause of inconsistencies across national datasets. To address this issue, each scenario in our study clearly specifies the dataset that serves as its baseline. Furthermore, there is a gap between coal production and coal sales, which in our view cannot easily be explained (see page 30 for more details).

2. Export

2.1. Historic and Status Quo

Since the 1990s, coal exports have played a vital role in the country's economic development strategy, generating substantial state revenue and foreign exchange earnings. Over the past three decades, the country has emerged as the world's largest exporter of thermal coal, supplying over 30% of global seaborne thermal coal in 2023 (IEA, 2024b).

Figure 2. Coal export in Indonesia from 2000-2024



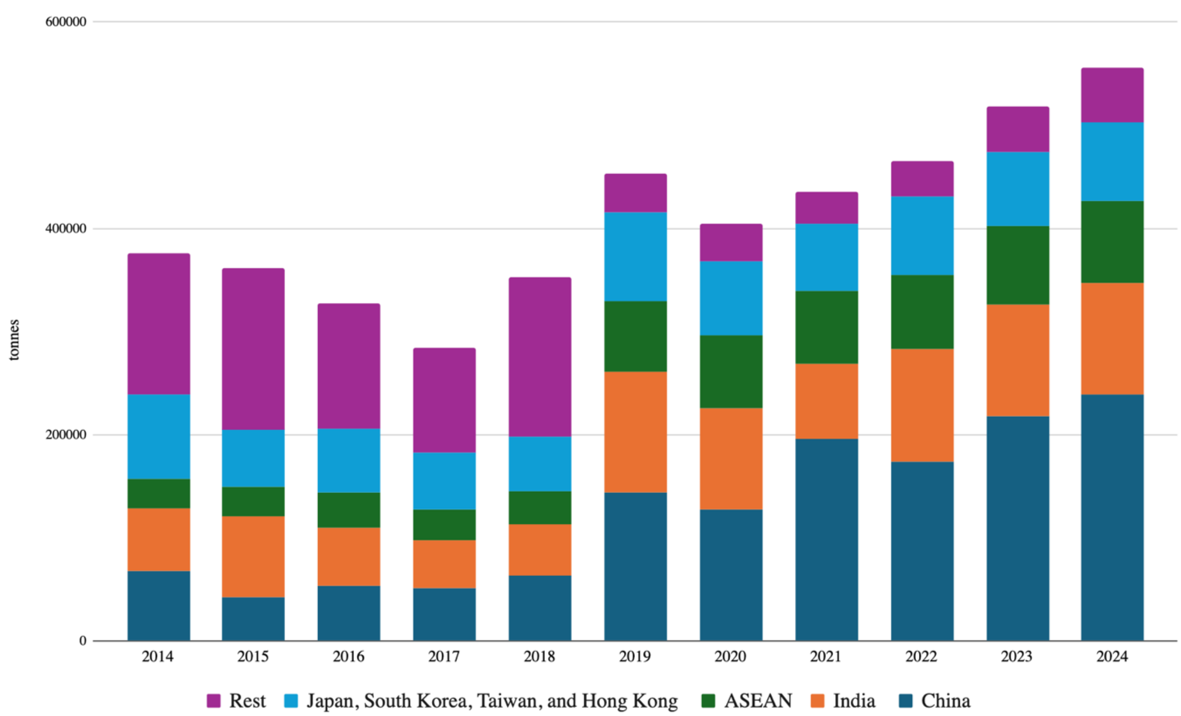
Source: Author's own diagram with data collected from Handbook of Energy & Economic Statistics of Indonesia (HEESI) 2014-2024 (MEMR Indonesia)

From the early 2000s, coal exports expanded steadily, driven by growing energy demand. However, between 2016-2017, exports experienced a notable dip after years of sustained growth. This downturn resulted from weaker global coal prices, production cuts to manage oversupply, and slowing demand from importers like China and India (CNN Indonesia, 2016). Following this, exports rebounded strongly after 2018 as energy demand in Asia and global commodity markets stabilize. Then, in 2020, the COVID-19 pandemic caused a sharp but short-lived decline in coal. Exports rebounded strongly in 2022 and 2023, reaching record highs (see **Figure 2**).

By 2024, export volumes had climbed to around 555 Mt (MEMR Indonesia, 2025a) marking a 7% increase on the previous year. This increase was driven by robust domestic production and rising demand from Asian markets (IEA, 2024a). In the first nine months of 2024 alone, coal exports grew by 30 Mt year-on-year, with China, India, and ASEAN nations accounting for 11 Mt, 9 Mt, and 4 Mt of the increase, respectively (IEA, 2024a), fortifying China's and India's position as key importers of Indonesian coal (see **Figure 3**).

However, data from the first half of 2025 suggests a turning point, with coal exports reaching 186 Mt. This represents a 6% decline compared to the same period in 2024, when exports were recorded at 198 Mt (CNBC Indonesia, 2025).

Figure 3. Coal export by destination from 2014-2024



Source: Author's own diagram with data taken from Handbook of Energy & Economic Statistics of Indonesia 2024 (HEESI) (MEMR Indonesia, 2025a)

2.2. Future Outlook

The outlook for Indonesian coal exports is becoming increasingly uncertain, largely due to structural changes in its two largest markets, China and India. Together, they accounted for 63% of Indonesia's coal exports in 2024 (see more in **Figure 3**) (MEMR Indonesia, 2025a).

China, the dominant player in the global coal market, recorded total coal imports of 548 Mt in 2024, with Indonesia as its largest supplier. However, imports are expected to decline significantly, with a predicted drop of approximately 76 Mt in 2025 and a further decrease of around 14 Mt in 2026 (IEA, 2025b). This decline is due to sluggish demand, record-high stockpiles and strong domestic production (IEA, 2025b). This structural shift is reinforced by China's rapid expansion of renewable energy, with solar and wind deployment already exceeding electricity demand growth (Ember, 2025d). As additional renewable capacity meets future demand growth, the need for new coal capacity will continue to diminish. China's commitment to peaking emissions before 2030 exerts further downward pressure, with the IEA's Net Zero Roadmap indicating that coal imports will decline faster than domestic production due to policies, energy security and economic priorities (IEA, 2023c). A detailed analysis of why the decline in Indonesian coal imports to China in 2025 is not due to cyclical fluctuations and market volatility, but rather to structural changes that will continue to reduce China's long-term demand for Indonesian coal imports is provided by (Ilango, 2025).

In contrast, India has emerged as a major contributor to the growth in global coal demand. In 2024, its coal consumption increased by 45 Mt (4%). Looking ahead, demand is expected to continue rising, but at a more moderate pace. It is projected to grow by 1.3% to reach 1.31 Bt in 2025, and by a further 2.5% to around 1.35 Bt in 2026 (IEA, 2025b). Despite this robust growth, India's import requirements are being constrained by strong domestic output. The government's strategy to boost self-sufficiency in coal production is already reshaping trade flows and reducing reliance on overseas suppliers. Thermal coal imports are expected to decline to just over 150 Mt in 2025, driven by rising domestic output and weaker electricity demand, which reduces reliance on overseas supply. In 2026, however, imports are projected to rebound to around 219 Mt, as stronger electricity demand pushes overall coal consumption higher, despite continued growth in domestic production. This trend reflects India's explicit policy shift towards increasing domestic coal production and use as part of its energy security strategy. India's dual-track approach of rapidly deploying renewable energy while continuing to grow its demand for coal has mixed implications for Indonesia. While India's growing coal consumption helps to sustain near-term export opportunities, the long-term trend of higher domestic production coupled with declining import dependence signals a shrinking market for Indonesian coal.

As India and China reduce their reliance on imported coal, Indonesia may face significant pressure on its export volumes. Indonesian thermal coal exports are projected to decline by at least 10% in 2025 compared to 2024 levels, and by a further

35 Mt in 2026 relative to 2025 (IEA, 2025b). Although demand in secondary markets like Vietnam, the Philippines, and Bangladesh is growing, it remains insufficient to offset steep declines from China and India. The IEA forecasts that despite strong domestic demand, Indonesian coal production could decline over the medium term due to weakening global demand and falling prices for thermal coal (IEA, 2025b). These dynamics underscore the vulnerability of Indonesia's coal sector to shifts in a highly concentrated and increasingly volatile export market.

2.2.1. National Strategy

Indonesia's coal export outlook is increasingly being shaped by a strategic policy shift towards prioritising domestic use. Although coal exports are expected to remain a key source of revenue in the short term, the government has demonstrated a deliberate shift in focus: utilising coal as a national asset to ensure an energy supply, promote industrial growth and stabilise domestic pricing. This strategy reflects broader national development goals and is expected to significantly impact the long-term balance between domestic consumption and international trade.

A key instrument in this shift is the Domestic Market Obligation (DMO), which requires at least 25% of total coal production to be supplied to the domestic market. This obligation guarantees domestic availability and reinforces the government's intention to reduce reliance on volatile export markets. Furthermore, the government has reinforced its role in setting prices through Ministerial Decree No. 72.K/MB.01/MEM.B/2025, which establishes the Coal Reference Price (Harga Batubara Acuan, HBA) as the mandatory minimum price for all coal transactions, both domestic and export-oriented, effective March 2025. This move is geared towards securing national interests by stabilising prices and asserting greater control over the valuation of mineral resources (MEMR Indonesia, 2025b).

These regulatory interventions are not just reactive; they reflect a forward-looking strategy. As the HBA is usually higher than commercial indices such as the Indonesia Coal Index (ICI), and now adjusts twice monthly, exporters face greater pricing rigidity and reduced flexibility in long-term contracts. Although there have been no major cancellations, early signs of buyer hesitation, particularly from China, suggest emerging pressure. This is emphasised by recent data showing that coal exports declined by 12% year-on-year in the first four months of 2025, due to softening demand and increased domestic production in major import markets such as China and India (Reuters, 2025).

In summary, there is, to our knowledge, no established target or pathway for coal exports (unlike the existing plans for domestic use, see below). Coal exports are driven by global markets, but also affected by the above noted strategic intervention of the

Indonesian government. So even though coal exports contribute highly to Indonesia's export economy, the government aims at prioritising domestic use.

2.2.2. IEA Scenarios and Outlook

We have analysed a great number of global energy and climate scenarios and the respective role of coal in those scenarios (for a full description of the scenarios see Annex). There are many differences in detail in those scenarios, but there are two key similarities in all of the scenarios we have analysed:

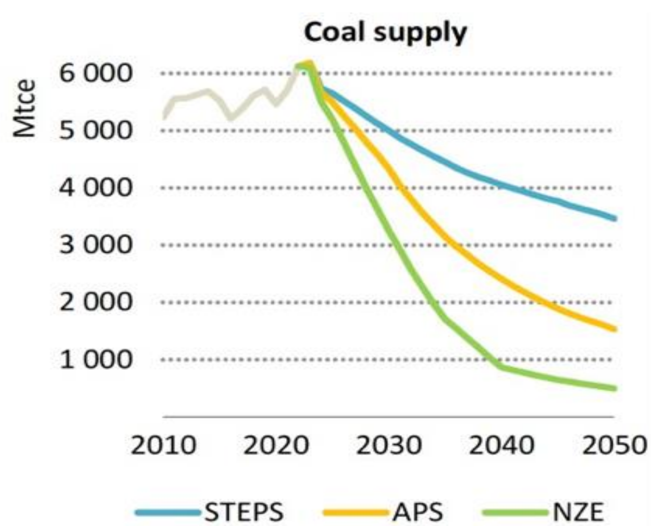
- Even though global coal demand has been rising over the last years and decades - it is expected that it will plateau and decline by latest 2030.
- In the long-term coal demand will decline dramatically. Differences in scenarios depend on the level of climate policy ambition and the role of specific technologies (e.g. expected costs for renewables or CCS), but generally, global coal use in 2050 is expected to be much lower compared to 2020.

In this section we will highlight the scenarios of the International Energy Agency (IEA), because they are a trusted and globally acknowledged source and they do provide specific information on coal use and export for Indonesia.

IEA Long-Term Scenarios

The International Energy Agency provides a series of scenarios which outline possible pathways for the energy future of countries and on a global scale (see box below for a description of those scenarios). When looking at coal use it is most striking that global coal use will decline in all three scenarios - starting in the next few years (see **Figure 4**). Thus, the message is that even without further new climate policies, just based on existing policies and technological development, coal use will go down in the short term.

Figure 4. Global coal supply by scenario



Source: (IEA, 2023c, p. 142)

In the long-term, coal will continue to decline, but it depends on the ambition of the climate policies globally whether coal use will drop to almost zero or only go down to roughly 2/3 of today's level (IEA, 2022, 2023c).

The IEA Energy Scenarios

The International Energy Agency (IEA) regularly publishes a range of scenarios in the World Energy Outlook (WEO). While these scenarios do not predict how the world will look in the future, each one is based on a set of assumptions. In order to use them correctly, it is important to understand the assumptions behind the IEA scenario family. This is why they are briefly explained here.

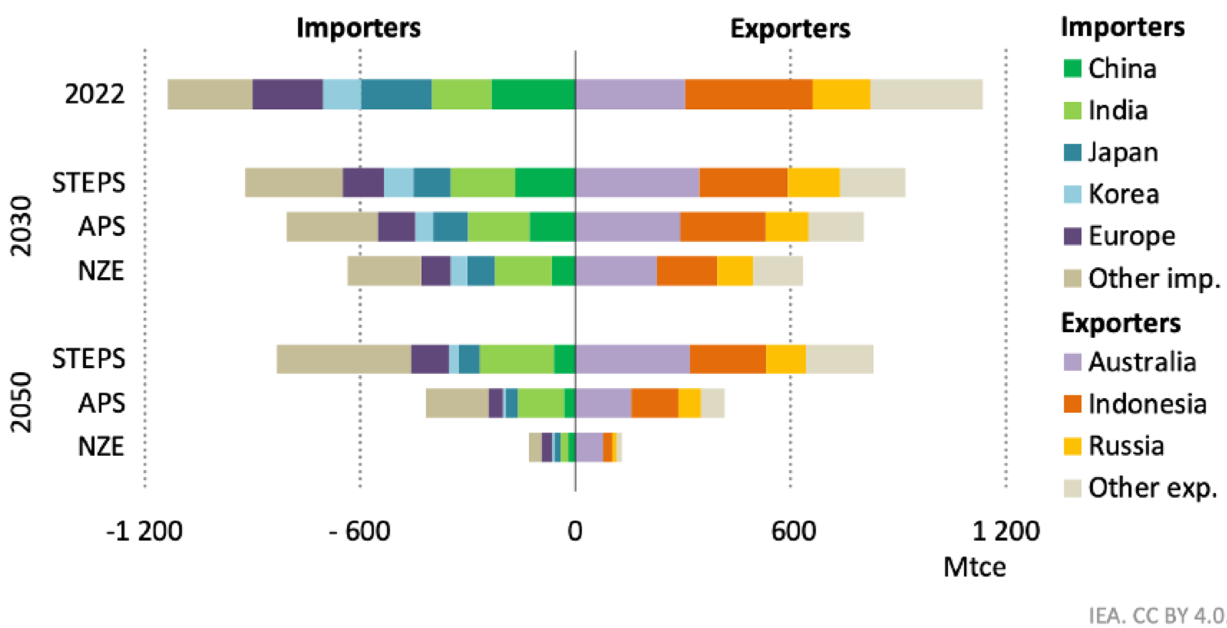
The **STEPS - Stated Policies Scenario** reflects the impact of existing policy frameworks and current policy intentions as well as expected technological development. The scenario takes into account the effects of energy policies that have already been implemented or are clearly scheduled for implementation, but does not assume that announced climate targets beyond these policies will be fully achieved. (For Indonesia this would include all national energy policies and the country's commitment in its Nationally Determined Contribution (NDC), which still foresees a massive growth of the country's CO_2 emissions until 2030 (*Climate Pledges Explorer – Data Tools*, n.d.)). In consequence global CO_2 emissions in 2050 remain almost as high as in 2020, leading to a projected global temperature increase of 2.6°C by 2100 compared to pre-industrial levels. It is important to note that energy systems would still strongly change due to technological development, e.g. renewable energy becoming more and more cost-competitive.

The **APS - Announced Pledges Scenario** assumes that governments worldwide fully implement their announced climate targets and pledges, even if these have not yet been translated into concrete policies. For Indonesia this is represented by the country's pledge to become climate neutral in 2060. Compared with STEPS, which only reflects policies that are already in place or clearly scheduled for implementation, APS represents a more ambitious pathway aligned with governments stated intentions.

The **Net Zero Emissions by 2050 Scenario (NZE)** is not driven by what countries are planning nationally, but by what would be necessary to reach the Paris climate target. It specifically outlines a pathway which is consistent with limiting global warming to 1.5°C (with a 50% chance). To become a reality, countries around the world would need to increase the ambition of their respective national climate targets.

The IEA also projects global coal trade. In **Figure 5**, the development of coal amounts for main importing and exporting countries are displayed over time and for the three scenarios. Here again the message is that coal exports from Indonesia will decline in the future. For all three scenarios there is a significant decrease until 2030 with a subsequent moderate decline in the STEPS Scenario and a decline to almost zero in the NZE Scenario. In reality however, the degree of decline will depend on how ambitious the climate targets of importing countries will be implemented and on how quickly renewable energies will be applied worldwide.

Figure 5. Top coal importers and exporters by scenario, 2022, 2030 and 2050



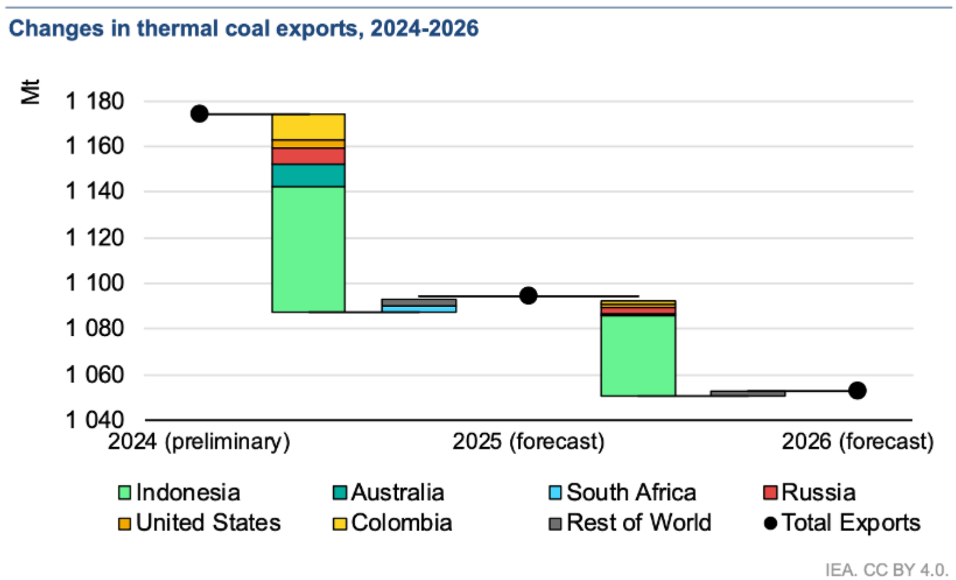
Source: (IEA, 2023c, p. 143)

IEA Short-Term Outlooks

While the long-term scenarios are good at indicating long-term trends and pathways, they are not made to assess short term developments. Individual events like the COVID pandemic, the war in Ukraine or short-term economic developments have a large impact and lead to "ups and downs" over the long-term trend.

The IEA provides a short term (two to three years) outlook specifically for coal. In the 2024 Coal Report (IEA, 2024a) and its 2025 mid-term update (IEA, 2025b) the agency projects that Indonesian coal exports will decline in 2025 compared to 2024, driven by weak international demand and low global prices. This downward trend is expected to continue into 2026, although domestic coal demand is projected to grow, supported by increased power generation and industrial use, including the expansion of the smelting sector.

Figure 6. Changes in thermal coal exports, 2024-2026



Source: (IEA, 2025b, p. 19)

2.3. WI Export Scenarios

We developed a **WI** (= Wuppertal Institute for Climate, Environment, Energy) **High Scenario** and a **WI Low Scenario** for the future development of Indonesian coal exports. The High Scenario marks what we consider to be a realistic upper limit for coal exports, while the Low Scenario can be seen as the lower limit. Historical data is taken from (MEMR Indonesia, 2016, 2025a).

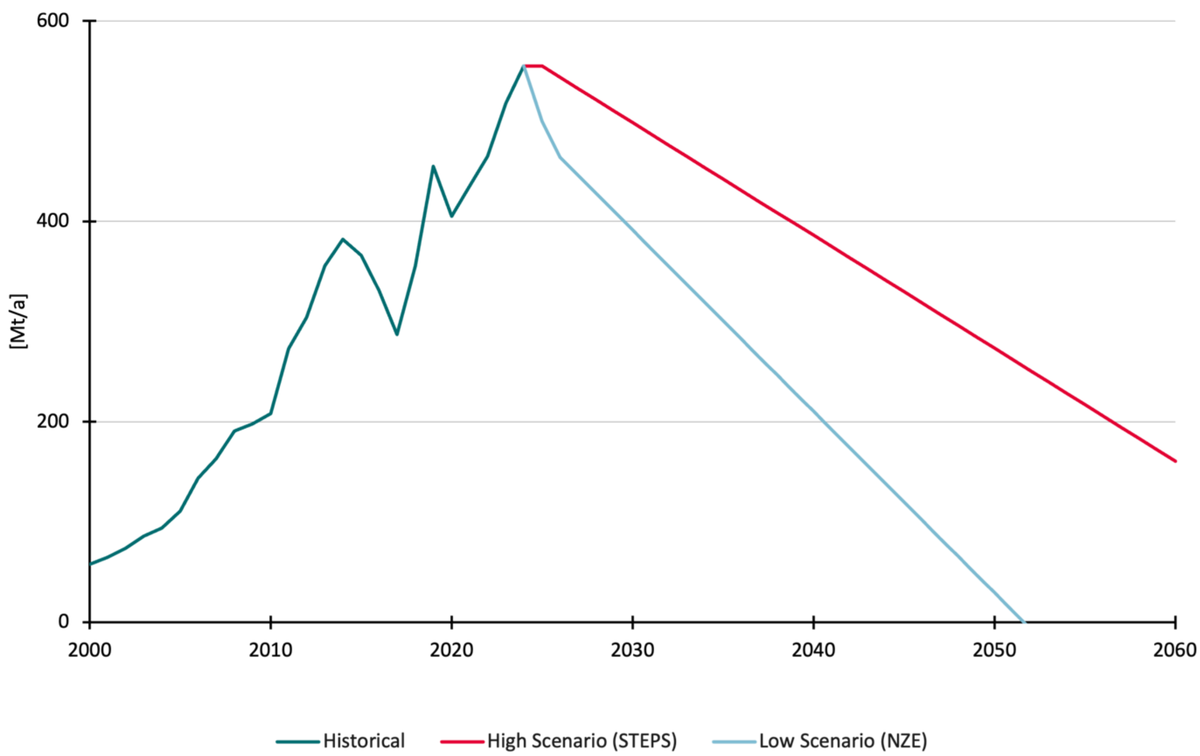
After the all-time high of 555 Mt in 2024 (MEMR Indonesia, 2025a) various sources expect a decline in coal export in 2025 (IEA, 2025b) (Ember, 2025b). We find it plausible that the current global economic situation will not lead to an unexpected growth of coal due to no major growth in the economy or energy demand in key importing countries. The current tariff policies of the USA are one of many factors, which could dampen coal demand in China.

Consequently, for our short-term assessment in the WI Low Scenario we assume that export values will steeply decline down to 464 Mt in 2026 in line with IEA's short-term coal outlook (IEA, 2025b). For our WI High Scenario, we assume a plateau with export in 2025 equal to 2024 level.

Our long-term (2050) projection for Indonesian coal exports is premised on the IEA's World Energy Outlook 2023 (IEA, 2023b). This version contains explicit values for coal export for Indonesia. We have cross checked with the newer WEO 2024 and found very consistent overall coal trends (but not specific data for Indonesia). Our 2050 scenario values are based on the IEA STEPS Scenario for our WI High and IEA NZE Scenario for our WI Low Scenario. As the IEA publication uses "Mt coal equivalent" while "Mt" are used throughout our report, we used the percentage decrease of the 2050 value compared to 2022.

With this long-term trend as a background, we estimate that the short-term 2025/2026 decline is not a single dip with recovery afterwards, but a fundamental trend-break to Indonesia's coal export growth in the past. For simplicity we assume a linear decline between the short-term and long-term estimates up to 2050 with the WI High Scenario declining to 274 Mt (in line with IEA STEPS) and the WI Low Scenario reaching 29 Mt (in line with IEA NZE). Beyond the year 2050, values are extrapolated linearly to 2060 (see **Figure 7**).

Figure 7. WI High and Low Scenarios for Indonesian coal export



Source: Author's own calculations

3. National Coal Demand

Indonesia is not only one of the world's largest producers of coal, but also one of its largest consumers. Domestic coal demand is driven primarily by two key sectors: grid-connected electricity generation and the rapid expansion of captive coal power plants for industrial use. In the future the development of downstream coal industries, such as gasification and liquefaction might also become a factor. Despite national and international climate commitments, including the goal of phasing out coal by 2050 (Sekretariat Kabinet Republik Indonesia, 2024), energy policies still support coal infrastructure through exemptions and strategic projects. Understanding these factors is crucial for estimating Indonesia's future coal demand. As we build our scenarios largely on the official governmental energy plans, we first give an overview of key documents - and after that go into the three specific demand sectors (on-grid, captive and coal downstreaming).

3.1. National Policy Framework and National Electricity Plan (RUKN)

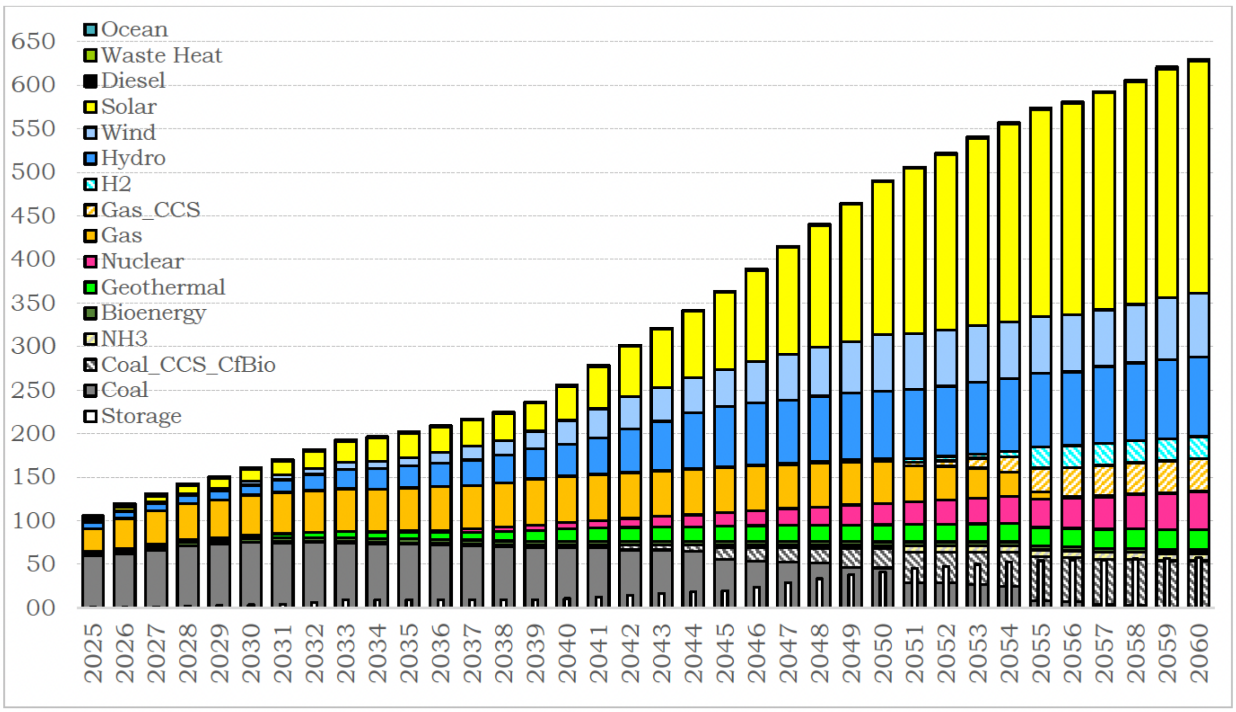
The National Electricity General Plan (RUKN 2025–2060) published by the Ministry of Energy and Mineral Resources (MEMR) is the government's key long-term planning document for the electricity sector, presenting official projections for installed capacity, generation mix, and energy use until 2060. It offers the most comprehensive and policy-aligned outlook on coal demand in Indonesia's power sector, covering both grid-connected and off-grid systems.

Although the RUKN provides a unified national projection, it does not explicitly distinguish between on-grid generation and captive power operated by industrial users. Both are aggregated under total coal-fired capacity and generation. To develop our scenarios, we disaggregate the RUKN projections into on-grid and captive components, using additional data sources and consistency checks.

The RUKN also reflects Indonesia's current policy priorities, including targets to expand renewable energy, gradually retire coal-fired power plants, and implement carbon capture, utilisation, and storage (CCUS) as well as biomass co-firing (CfBio). Anchoring the analysis on the RUKN ensures alignment with the government's officially endorsed assumptions and long-term energy transition pathway.

To complement the RUKN's long-term perspective, the Electricity Supply Business Plan (RUPTL 2025–2034) outlines short- to medium-term developments in the electricity system operated by state-owned utility Perusahaan Listrik Negara (PLN) and Independent Power Producers (IPPs). While the RUPTL also includes off-grid electricity generation, it does not cover captive generation. The RUPTL provides detailed information on near-term project pipelines, capacity additions, and technology composition within the national grid. By using RUKN's long term national projections and cross-checking with RUPTL's short-term data, the study ensures a consistent and integrated analysis. Captive capacity and related coal demand are calculated separately using official sources, such as the MEMR Energy Handbook, alongside complementary data from the Centre for Research on Energy and Clean Air (CREA) and the Global Energy Monitor (GEM). These estimates are cross-verified with RUKN and RUPTL data to maintain coherence between aggregated national totals and disaggregated sectoral estimates.

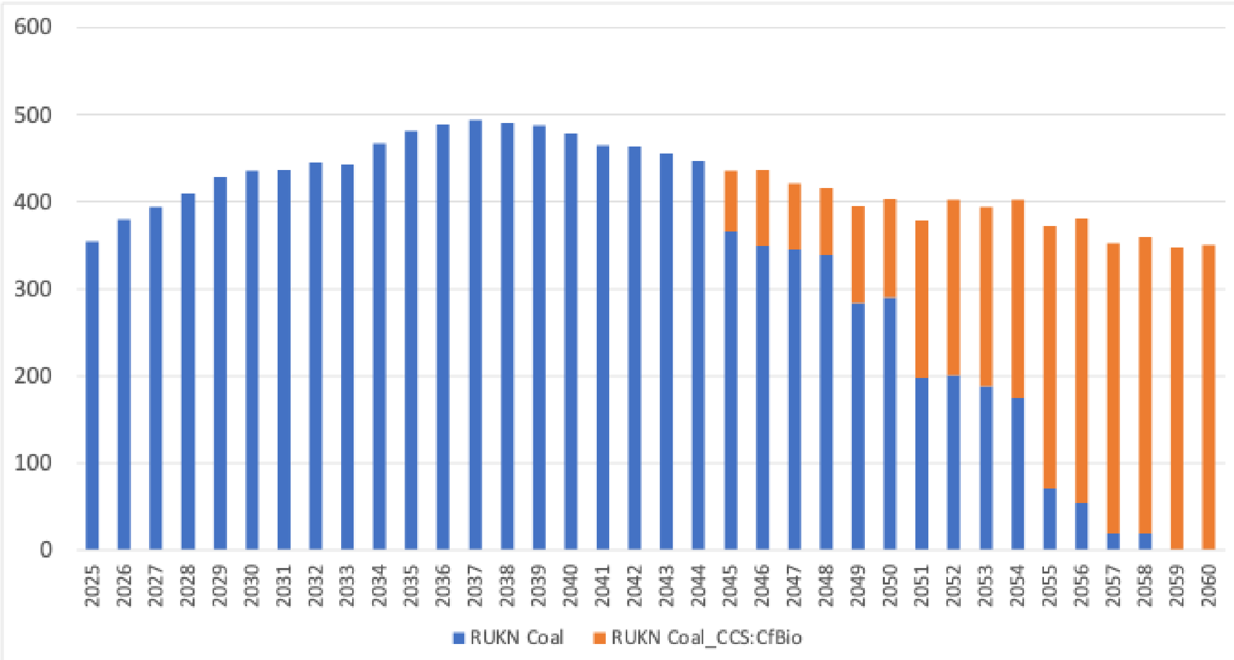
Figure 8. Projected power plant capacity in RUKN 2025-2060 (in GW)



Source: (MEMR Indonesia, 2025c)

Projections from the RUKN (National Electricity General Plan) 2025-2060 indicate that electricity generation from coal will peak before 2040, followed by gradual decline (see more in **Figure 8**). This decline is expected to be partially offset by the deployment of lower-emission technologies such as coal with carbon capture and storage (CCS) and biomass co-firing (CfBio), starting in the mid-2040s. This projection suggests that while traditional coal generation will taper off, CCS will prolong coal's relevance into the 2050s, despite a declining share of the energy mix.

Figure 9. Projected electricity generation from coal in RUKN 2025-2060 (in TWh)



Source: (MEMR Indonesia, 2025c)

In summary, Indonesia's official energy planning documents reflect how coal will remain central to the electricity system in the near and medium term, driven by concerns over affordability, reliability, and the pace at which renewable energy infrastructure will be scaled up.

Contrary to these plans, President Prabowo Subianto has committed politically to phase out all coal and fossil fuel power plants by 2040 and to achieve net-zero emissions by 2050 (IEEFA, 2025b). Although the National Energy Policy 2025 (Kebijakan Energi Nasional 2025, Government Regulation No. 40/2025) aims to achieve net-zero emissions not before 2060, these targets expose a fundamental tension between Indonesia's climate and clean energy ambitions, and its ongoing investment in coal (and gas) infrastructure. The latter will make it extremely challenging for the country to meet its obligations under the Paris Agreement. This raises critical questions about the coherence and practical feasibility of the country's energy transition strategy.

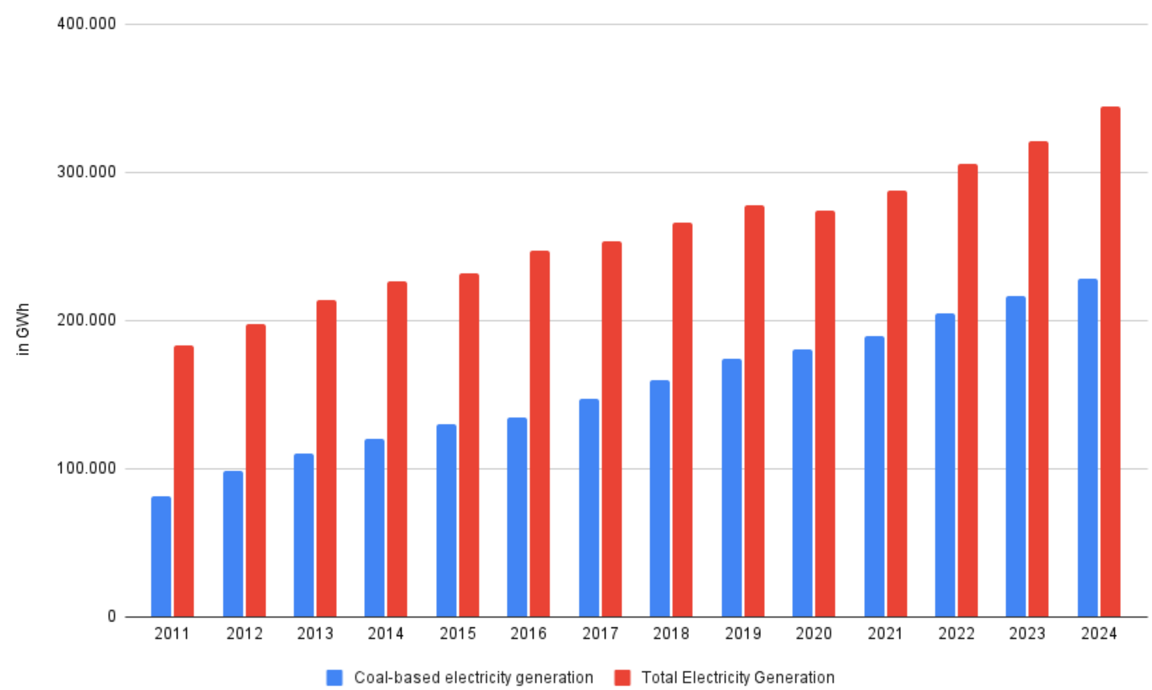
Moreover, Indonesia's long-term energy policy is gradually supporting renewables. The National Energy Policy 2025 foresees achieving a 19-23% renewable energy share by 2030. National commitments under the Just Energy Transition Partnership (JETP) even target 44% renewables by 2030 (IESR et al., 2024, p. 10). This indicates a shift in the composition of the domestic power supply in the long-term (see also chapter 3.2.2.).

3.2. On-Grid Electricity Generation

3.2.1. Historic and Status Quo

Coal has long been the backbone of Indonesia's electricity generation, powering both the national grid and industrial operations for a number of interconnected reasons. Due to the country's abundant domestic reserves, coal is considered a relatively cheap and secure energy source. Historically, coal has enabled Indonesia to rapidly expand access to electricity through large-scale baseload generation.

Figure 10. Historical development of electricity generation in Indonesia



Source: Author' s own illustrations with data taken from Handbook of Energy and Economic Statistics of Indonesia 2012 and 2024 (MEMR Indonesia, 2012, 2025a)

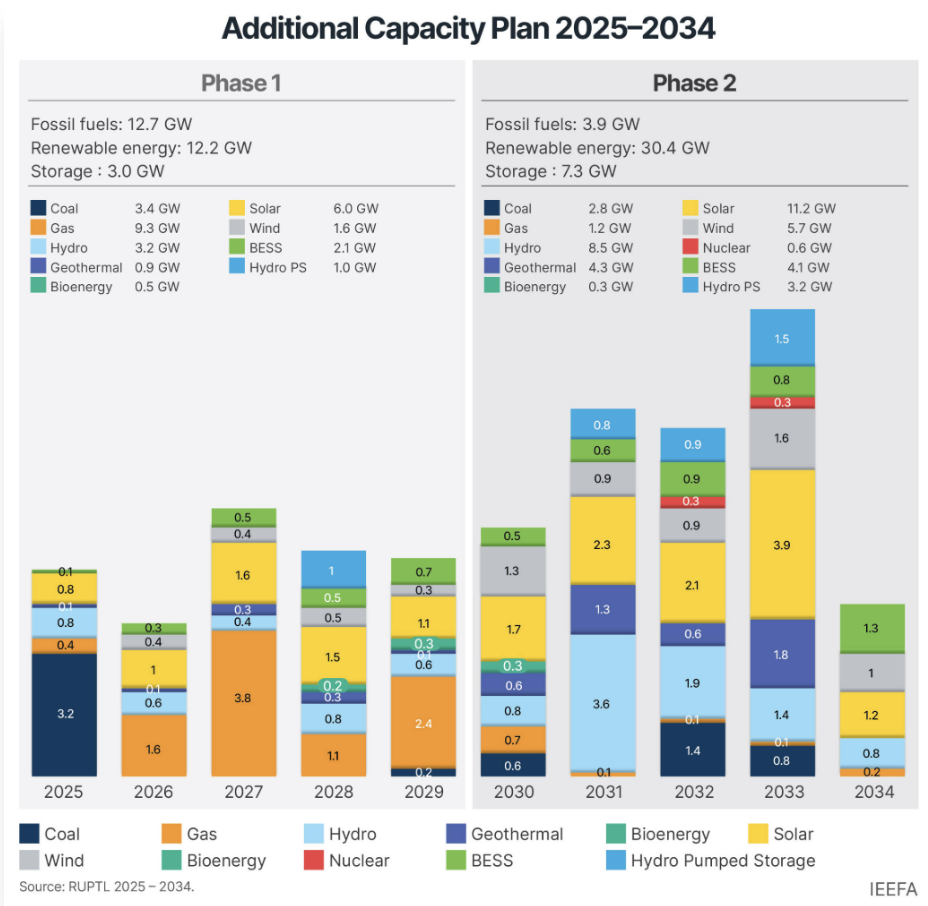
Figure 10 above illustrates the historical development of coal-based and total electricity generation in Indonesia between 2011 and 2024. The chart shows a consistent upward trend in both total generation and coal-based generation. Coal output nearly tripled over the period, increasing from less than 90 TWh in 2011 to more than 230 TWh in 2024, while total electricity generation rose from about 180 TWh to almost 340 TWh. The data clearly indicate coal's persistent dominance in the national power mix, accounting for around 66% of total electricity generation, equivalent to 228 TWh in 2024 (MEMR Indonesia, 2025a). There are currently around 254 coal-fired power plants in operation, over 80% of which were commissioned after 2005 (MEMR Indonesia, 2025b). This means that the country's coal fleet is relatively young and has a long way to go before reaching the end of its technical lifespan.

3.2.2. Future Outlook

Despite climate commitments under the Paris Agreement and the Just Energy Transition Partnership (JETP), national planning documents such as the recently published RUPTL 2025-2034 for state-owned utility Perusahaan Listrik Negara (PLN) show a continued reliance on coal until at least 2034 (PLN Indonesia, 2025).

While the government has set ambitious renewable energy targets, such as reaching 35% renewables in the energy mix by 2034 and deploying 75 GW of renewable power capacity by 2040 (IEEFA, 2025b), the RUPTL also commits to an additional 16.6 GW of fossil-based power. This consists of 6.2 GW of coal and 10.5 GW of gas (PLN Indonesia, 2025). More than half of the additional coal capacity (3.5 GW) is already in the final stages of construction.

Figure 11. Additional capacity plans in RUPTL 2025-2034 (in GW)



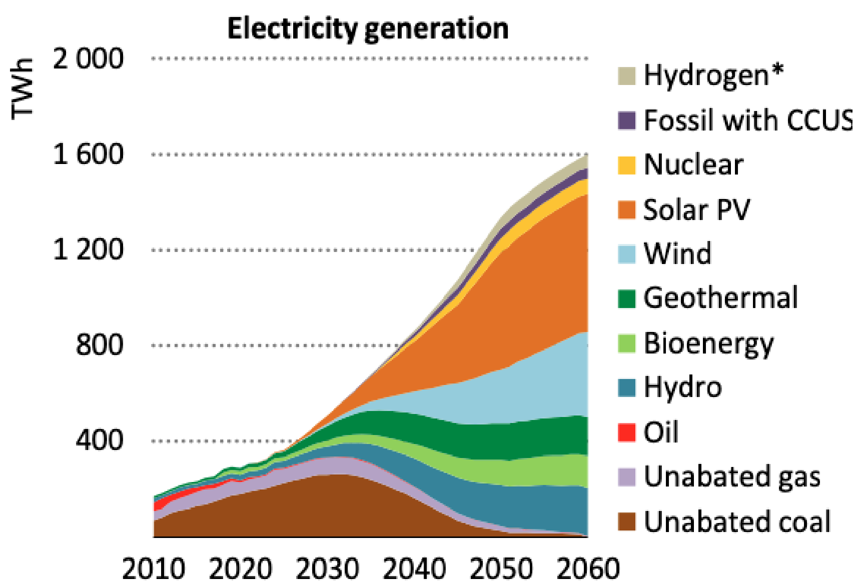
Source: (IEEFA, 2025b)

Given the planned addition of new coal-fired capacity and continued growth in electricity demand, coal consumption in the power sector is expected to remain high, and even to increase over the next five to ten years. As shown in **Figure 11**, Indonesia's new capacity additions are divided into two phases. Phase 1 (2025–2029) will see the addition of 27.9 GW, including 12.2 GW of renewable energy, 12.7 GW of fossil fuels (9.3 GW of gas and 3.4 GW of coal under construction) and 3.0 GW of energy storage. Phase2 (2030–2034) will see a strong shift towards renewable energy and storage, with 37.7 GW coming from clean sources and just 3.9 GW from fossil fuels (2.8 GW from coal and 1.2 GW from gas). This two-phase approach highlights that, although renewable energy growth will accelerate in the later years, reliance on coal and gas in the early years will sustain high emissions and reinforce coal consumption in the near term.

3.2.3. IEA Scenarios and Outlook

Indonesia's current energy transition policy targets carbon neutrality by 2060. However, this commitment is not fully aligned with the International Energy Agency's (IEA) Net Zero Emissions (NZE) Scenario or the ambition of the Paris Agreement. According to IEA analysis, Indonesia would need to pursue a far more rapid and ambitious pathway for decarbonisation in the power sector, including major reductions in coal-fired generation and significantly higher deployment of renewables to achieve the 1.5°C goal (IEA, 2023a).

Figure 12. Electricity generation by type and share of total generation in Indonesia in the Announced Pledges Scenario, 2010-2060



Source: (IEA, 2022, p. 89)

The IEA's Net Zero Emissions (NZE) Scenario calls for an extensive transformation of Indonesia's electricity mix by 2060. As illustrated in **Figure 12**, unabated coal is almost entirely phased out by around 2040, and no additional coal plants are constructed beyond those already under construction. By mid-century, the system becomes overwhelmingly renewable-based, with solar PV, wind, hydropower, and geothermal providing the majority of generation. Fossil fuels play only a minor residual role, limited to plants with carbon capture, utilisation and storage (CCUS) and some gas capacity. By 2060, only about 3–4% of electricity generation comes from fossil fuels with CCUS, consisting of 7 GW of coal and 3 GW of gas capacity, while unabated gas falls to less than 1% and unabated coal will be fully eliminated.

However, this projection does not align with Indonesia's Electricity Supply Business Plan (RUKN), which assumes a much larger role for fossil fuels in the long term. The main differences are clear:

- In the NZE pathway, coal declines rapidly and disappears by 2040, while in RUKN, it remains a significant part of the mix.
- Renewables expand much faster in the NZE Scenario, supported by reforms such as auction pipelines and measures to address coal overcapacity.
- Fossil fuels with CCUS are projected to represent only 3–4% of generation by 2060, far below the levels projected in RUKN.

These differences highlight the need for accelerated coal retirement and a faster scale-up of renewables if Indonesia is to align with a net-zero trajectory.

3.2.4. WI Sector Scenarios

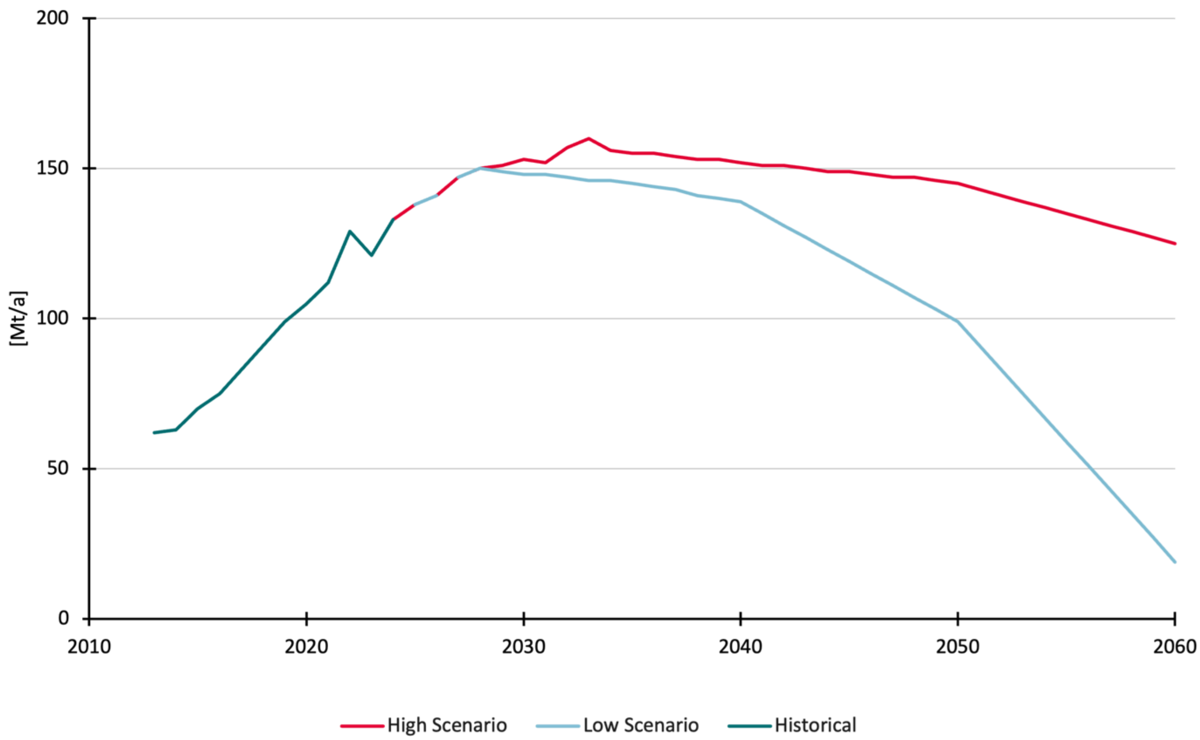
For domestic electricity generation, the WI (= Wuppertal Institute for Climate, Environment, Energy) High Scenario assumes a continued significant role for coal-fired power plants including the application of CCS beginning in 2031. This projection is based on a robust increase in overall electricity demand driven by strong economic expansion and industrialisation, necessitating the ongoing operation of coal power plants. The WI Low Scenario on the other hand assumes a declining amount of electricity from coal compared to the High Scenario and a significantly lower share of coal CCS in the future electricity mix.

To build the scenarios, historical data on coal capacity, electricity production and coal use from the ESDM Energy Handbook (MEMR Indonesia, 2025a) and future projections on coal capacity from RUKN (MEMR Indonesia, 2025c) and RUPTL (PLN Indonesia, 2025) are used (see **Figure 8**, **Figure 9, and Figure 11** in the previous chapters). According to RUKN, the coal capacity with CCS will amount to 53,2 GW in 2060 with no unabated coal fired power plants to be left. As these numbers include shares of captive coal fired power plants, the on-grid capacity is calculated as the difference between captive capacity and RUKN numbers. (The procedure to calculate captive capacity is outlined in Chapter 3.3.3.) In order to derive the respective coal demand in Mt, the capacity factor is assumed to stay constant and a conversion factor in Mt/TWh was identified. Using data on power production from PLN, IPP and PPU and overall coal consumption for power plants (MEMR Indonesia, 2025a) an average value of 0.57 Mt/TWh has been identified for the years 2013 – 2024. For the application of CCS however, efficiency of coal fired power plants is expected to be significantly lower. For our scenarios, we assume a 19% increased coal consumption for coal fired power plants with CCS (Viebahn et al., 2014). Finally, coal consumption for power plants has been calculated using the historical and projected data on power production and a factor of 0.57 Mt/TWh for power plants without CCS and increased 0.68 Mt/TWh when CCS is applied. Furthermore, we assume that all this electricity is generated using coal, not considering biomass cofiring. In consequence, our High Scenario assumes a higher coal demand in the mid to long-term compared to RUKN projections based on TWh.

In the short term until 2034, however, we assume that electricity production from coal develops according to the RUPTL RE Base Scenario. This leads to a peak in coal consumption of 160 Mt in 2033 in our High Scenario. From 2035 onwards a development of coal power plant capacity is assumed according to RUKN minus the captive share. This leads to a slight decrease down to 125 Mt in 2060.

In the Low Scenario a peak in coal consumption is assumed in 2028 already. This is based on a peak of electricity in that year according to RUKN. Furthermore, we assume that CCS is going to be used at a much lower share. RUKN assumes that after 2045 coal fired power plants run increasingly with CCS and by 2059 are completely substituted by CCS (or biomass co-firing - see **Figure 9**). However, CCS is not yet a commonly used technology in coal fired power plants and concerns exist that high shares of coal CCS are cost competitive to alternatives like renewables. In the IEA net-zero scenario for Indonesia (IEA, 2022), the share of fossil with CCUS in the electricity mix in 2060 is less than 3%. In comparison, RUKN assumes 18% of coal CCS (and biomass co-firing) and 9% of gas CCS. Even though, Indonesia has a high potential for CCS storage, we consider it doubtful that such high shares of CCS would be the economically most competitive solution in 2060. Consequently, in our Low Scenario we assume a substantially lower share of CCS: The coal capacity with CCS is only 15 % of what it is in the High Scenario all other non-CCS coal power plants are decommissioned. This corresponds to a 2.7% coal with CCS in the electricity mix, analogous to the IEA assumptions (but assuming no gas CCS - thus in our low scenario coal use is still higher than IEA, 2022). This assumption results in domestic on-grid coal use declining to 19 Mt in 2060.

Figure 13. WI High and Low Scenarios for domestic coal demand for on-grid electricity production



Source: Author's own illustrations based on own calculations

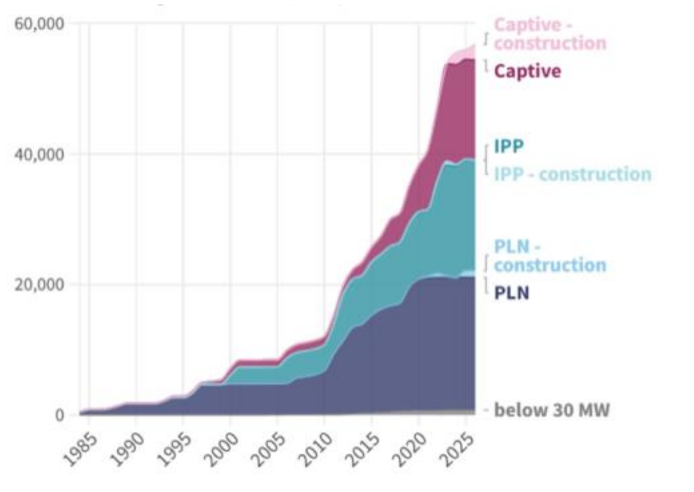
3.3. Industrial and Captive

3.3.1. Historic and Status Quo

Captive coal power, which refers to electricity generation systems owned and operated by industrial users outside of the national grid, is emerging as a key structural driver of coal demand in Indonesia. Historically, captive power plants played a relatively minor role in Indonesia's coal consumption. However, this has shifted significantly over the past decade.

Figure 14 presents the national coal power generation capacity in Indonesia from 1985-2025. From 1985 through the early 2010s, coal capacity additions in Indonesia were dominated by PLN (state-owned utility) and IPPs, with captive coal contributing to almost nothing (CREA & GEM, 2024). Around 2014, Indonesia experienced a significant shift in its industrial energy landscape marked by significant increase in captive coal power capacity, which continued to grow rapidly through 2025 (see **Figure 14**). This growth has been driven primarily by the expansion of captive coal plants supporting the mineral smelting and processing industries, particularly in nickel-producing regions such as Sulawesi and Maluku (Ember, 2025a).

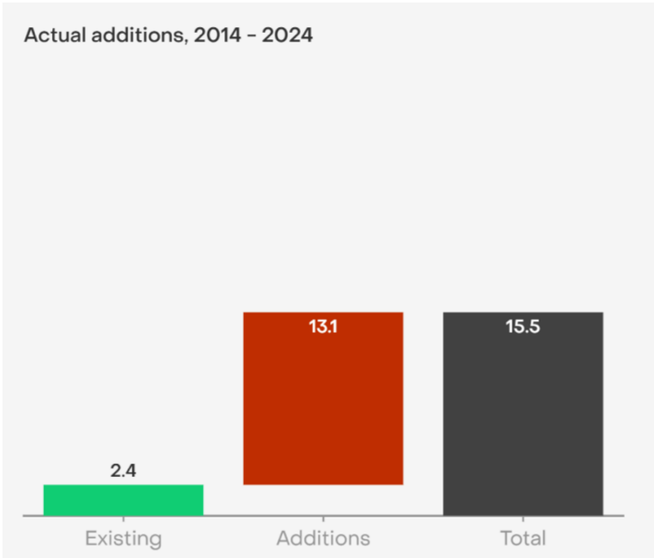
Figure 14. National coal power generation capacity (in MW)



Source: (CREA & GEM, 2024)

Between 2014 and 2024, captive coal capacity has surged from 2.4 GW in 2014 to 15.5 GW in 2024, with over 65% serving smelters (see **Figure 15**) (Ember, 2025c). This expansion of captive coal capacity has become a structural driver of Indonesia's overall coal power development, nearly matching the capacity additions for on-grid. Between July 2023 and July 2024 alone, the national coal-fired capacity increased by 7.2 GW, with 4.5 GW coming from captive projects (CREA & GEM, 2024). An additional 5 GW is already in the pipeline for smelter use by 2026, indicating continued rapid expansion (Ember, 2025c).

Figure 15. Captive coal-fired power plant historical capacity additions (in GW)



Source: (Ember, 2025c)

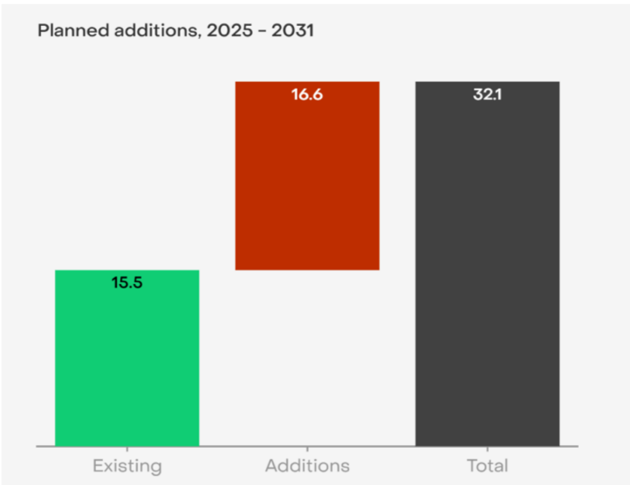
As captive plants are typically off-grid, they fall outside PLN's decarbonisation planning and emissions accountability. Presidential Regulation No. 112 of 2022 enforces a moratorium on new coal-fired power plants for grid electricity, with exemptions for plants listed in the previous RUPTL (2021–2030) and those serving National Strategic Projects or value-added industrial sectors like mineral processing and manufacturing.

These exemptions allow for the continued expansion of captive coal plants, particularly in energy-intensive sectors such as smelting and manufacturing, well beyond 2030. It is important to note that official electricity expansion plans, such as those shown earlier in **Figure 9** often include both grid-connected and captive coal power stations. This is why coal capacity is projected to grow despite the moratorium on coal. Consequently, Indonesia's coal moratorium primarily applies to on-grid electricity generation, while substantial off-grid industrial coal capacity continues to expand under policy exemptions. This creates a disconnect between official decarbonisation objectives and practical energy developments.

3.3.2. Future Outlook

Looking ahead, both the scale and share of captive coal are projected to increase. Indonesia's RUKN 2025-2060 forecasts 26.7 GW of new coal-fired capacity until 2031, 75% of which (over 16 GW) is expected to come from captive (Ember, 2025c) (see more in **Figure 16**). Consequently, captive coal capacity could amount to approximately 32.1 GW by 2031, accounting for around 40% of Indonesia's anticipated total coal-fired capacity of 76.5 GW (Ember, 2025c) (Ember, 2025a). CREA and GEM project a similar expansion. Proposed and under-construction projects could raise total captive capacity to 26.2 GW by 2026 (CREA & GEM, 2024). This signals a critical shift in the structure of domestic coal demand, with industrial users, particularly those in energy-intensive sector such as metals and minerals, emerging as the dominant consumers of coal power.

Figure 16. Captive coal-fired power plant planned capacity additions (in GW), 2025-2031



Source: (Ember, 2025c)

Even as PLN's coal-fired plants are expected to begin retiring post-2030 in alignment with the national energy transition roadmap, industrial coal demand is likely to sustain, or even increase overall coal consumption levels, potentially offsetting reductions from the grid-connected electricity generation. This would pose a significant challenge to Indonesia's ability to meet its climate targets under the Paris Agreement and the Just Energy Transition Partnership (JETP), particularly if captive plants remain unregulated and outside the scope of retirement schedules and emissions mandates.

Hence, unless Indonesia implements systemic policy reforms, including mandatory emissions reporting for captive plants, the integration of industrial coal into national transition strategies and a legally binding schedule for the early retirement of coal power stations, the country risks locking in a new wave of coal dependence.

3.3.3. WI Sector Scenarios

This component specifically addresses the demand from industrial facilities that operate their own coal-fired power plants to meet their energy needs, but also includes industrial coal use apart from power plants. Historical data on industrial coal demand show a sharp increase from 13 Mt in 2014 up to 99 Mt in 2024 (MEMR Indonesia, 2025a). To calculate data for the scenarios up to 2060, it is assumed that coal consumption will increase linearly with increased CCFPP capacity.

In our **WI High Scenario**, we assume that there is a high and increasing future demand for captive coal fired power plants and that those power plants which are being built will be used with high load factors. Specifically, we assume:

- Additional capacity in the construction or pre-permit status will be built according to CREA/GEM during the years 2025 and 2026 (CREA & GEM, 2024).
- In total, capacity additions between 2024-2031 will amount to 16.6 GW (Ember, 2025c).
- For the time after 2031 until 2060 no further capacity additions are assumed. The reasoning is that eventually also captive power generation will be regulated in a way to meet Indonesia's long-term climate neutrality target.
- Analogous to the power sector, the assumption has been made that captive coal fired power plants are retrofitted with CCS or decommissioned according to RUKN.

With these assumptions captive coal capacity would rise to 32.1 GW using 206 Mt of coal annually by 2031. Thereafter, coal demand would be more or less constant and then, after 2050 slowly decreasing down to 168 Mt in 2060.

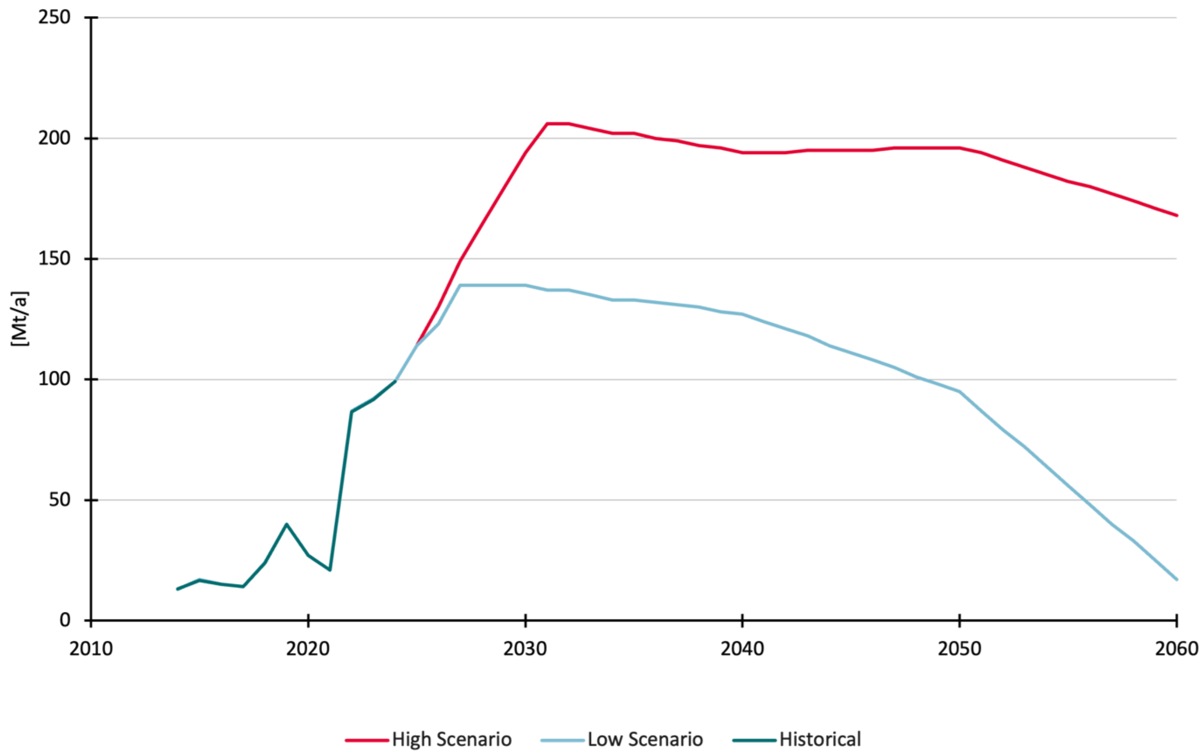
It needs to be noted that the projected coal demand in the WI High Scenario is higher than coal demand based on RUKN's projection for coal electricity production. The reason is that in RUKN, projected electricity production (in TWh) is relatively low compared to installed capacity (in GW). The resulting load factors may be realistic for on-grid production (specifically in times of overcapacity), but are in our view unrealistically low for privately owned captive industrial coal plants. We have therefore used RUKN capacity projections with load factors based on historical data (see Annex for more on methodology).

In the **WI Low Scenario**, we assume that the pipeline of future captive coal fired power plants will be much smaller compared to what has been planned or announced recently. This could be caused by lower economic growth in the respective sectors of the economy and/or increasingly competitive renewable energy (supported by the Presidential Regulation 112/2022), which would make it less attractive for industry to build new coal fired power plants. Additionally, if you assume that many countries engage in ambitious climate policy (including China, India and the US), then it seems quite likely that they will impose some sort of protection against high-carbon products (e.g. mechanisms similar to the EU-CBAM Carbon Border Adjustment Mechanism). Countries with strong domestic industry and high renewable shares in their energy mix (like China) could start implementing such policies even in the short- to mid-term. As a consequence, Indonesia's industry would be forced to reduce CO_2 emissions of its products, e.g. by higher shares of renewables and lower coal use. Based on these assessments we assume for captive coal in the Low Scenario that:

- Only power plants that are currently in the construction status will be built and no additional capacity is added after 2027.
- Renewables are more competitive compared to CCUS in most cases. Thus, analogous to the power sector, we assume that only 15 % of capacity will be switched to CCS in the Low Scenario. While this assumption might seem low when compared to with CCS targets set out in RUKN, it is still much higher than the CCS/CCUS potential for captive power areas identified by the JETP Indonesia Secretariat (2025). The Secretariat arguments that power plants need a minimum unit capacity of 600 MW to compensate for the additional energy demand and the added investment costs of CCS/CCUS. This size criterion is met by only 3% of the captive power plants listed in the JETP Captive Power Database. Among those plants, only three are co-located with potential storage sites identified by MEMR (JETP Indonesia Secretariat, 2025, p. 44).
- The remaining capacity is assumed to be replaced with renewable energies and thus being decommissioned.

These assumptions lead to a peak in capacity of 21.7 GW and 139 Mt of coal demand in 2027 already. In the long term, demand decreases gradually down to 17 Mt annually in 2060.

Figure 17. WI High and Low Scenarios for domestic coal demand for CCFPP and industrial use



Source: Author' s own calculations

3.4. Coal Downstreaming, Gasification, and other Value-Added Coal Use

A topic, which is discussed quite frequently in Indonesia is "coal downstreaming". Downstreaming refers to the conversion of coal into higher-value products such as Dimethyl Ether (DME), synthetic natural gas, fertiliser, and chemicals. Coal downstreaming has become a part of Indonesia's broader strategy for promoting energy self-sufficiency and import substitution, particularly to reduce reliance on liquefied petroleum gas (LPG), 70% of which is currently imported (IEEFA, 2025a).

According to official projections from the Ministry of Energy and Mineral Resources (MEMR), coal demand for downstreaming is expected to reach 28 million tons by 2030 and 34 million tons by 2040, a significant and growing share of domestic consumption, particularly as other markets mature or decline (MEMR Indonesia, 2025b). The state-owned investment firm called Danantara Indonesia is tasked with financing multiple coal gasification facilities across South Sumatera, South Kalimantan and East Kalimantan to help meeting these targets (MEMR Indonesia, 2025d).

However, the downstreaming strategy is facing significant economic and technical challenges. According to the Institute for Energy Economics and Financial Analysis, estimated DME production costs range from 470 USD to 651 USD per tonne, which is well above Indonesia's average subsidised LPG price of 365 USD per tonne (IEEFA, 2025a). The viability gap would require substantial ongoing government subsidies. The financial cost of the four major DME facilities is estimated to exceed 11 billion USD, raising substantial fiscal and investment risks. These issues came to light in 2023 when Air Products, an American company, withdrew from the Muara Enim DME project, citing serious doubts about its commercial viability (IEEFA, 2025a).

Beyond economic considerations, downstreaming introduces environmental and technological risks. Studies have shown that DME combustion produces more CO_2 per unit of energy than LPG, which could undermine Indonesia's emissions reduction targets unless carbon capture and storage (CCS) technology is used. According to IESR, for every 1.4 million tonnes of DME produced, about 4.25 million tonnes of CO_2 is emitted, five times the emissions of LPG production (AEER, 2020). Even with CCUS, the life cycle emissions of DME production are still relatively higher than those of LPG (IEA, 2022).

Despite the National Energy Grand Strategy and RUKN 2025-2060 continuing to prioritise downstreaming for future coal demand, the slow uptake, limited private investment and reliance on regulatory incentives raise concerns about the feasibility of achieving the 28 Mt target by 2030 or 34 Mt by 2040. Thus, while downstreaming remains a policy-driven growth that could potentially offset the decline in the export and power sector to some extent, its impact is likely to be limited by commercial and policy uncertainties, meaning that its role in the outlook for domestic coal demand is more aspirational than assured.

In our High Scenario, we assume that the national targets are achieved and extrapolate the coal demand for downstreaming to 46 Mt in 2060. In our Low Scenario, however, we assume that coal downstreaming will not be applied at scale and therefore set the coal demand to zero throughout the whole period.

4. Consolidated Projections and Discussion

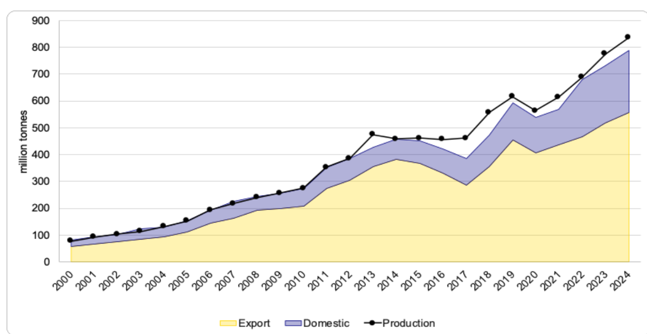
4.1. WI Scenarios

Based on the sector specific scenarios, which were developed in Chapter 2 and 3, we now present consolidated scenarios for the total coal production of Indonesia. In a nutshell, they are developed by simply adding up all sector contributions of the low scenarios to a consolidated WI (= Wuppertal Institute for Climate, Environment, Energy) Low Scenario - and respectively all high sector scenarios to a consolidated WI High Scenario.

Thus, these scenarios can be understood as the anticipated upper and lower limits of coal production in Indonesia – describing the most likely corridor within which future coal production will develop.

Does Production Equal Demand?

The Handbook of Energy and Economic Statistics of Indonesia gives both historical data for coal consumption (domestic), export and production. However, there is a gap: production in the last 10 years has consistently been higher than demand (see figure).



Historic coal demand and production data based on (MEMR Indonesia, 2025a)

A common reason for this difference is coal stock - the volume of coal mined may not be immediately sold, but put on stock piles (to be sold later). If this was the case, then production should be higher than demand in some years and lower in others. However, according to statistics, coal sales were almost always slightly lower than production between 2000 and 2012. But since 2013 cumulated production was higher than sales by 447 Mt - which is half of Indonesia's annual production in 2024. We find it doubtful that such large stock piles should exist. We assume that additional factors add to the difference between production and demand data (data inconsistency, transportation losses, etc.).

Since we do not have a clear explanation for the supply-demand mismatch, we assume in our scenarios that the coal demand (which we have calculated bottom up for each demand sector) equals production. What could be the errors resulting from this assumption?

- If you assume that production is consistently higher than demand (e.g. because of systematic data inconsistencies or transport loss etc.) - then the expected coal production could be slightly higher than our scenarios (deviation in past decade was 6%).
- If you assume that the gap mainly stems from stock piles - then future production should be significantly lower than in our scenarios, because the coal stock could meet a share of future demand.

But given the above-described uncertainties and possible causes, we find it reasonable to assume that future production will equal demand.

4.1.1. WI High Scenario

The WI High Scenario marks what we estimate to be the upper limit within which Indonesia's total coal production, including both export and domestic consumption, could develop in the future. Key drivers are:

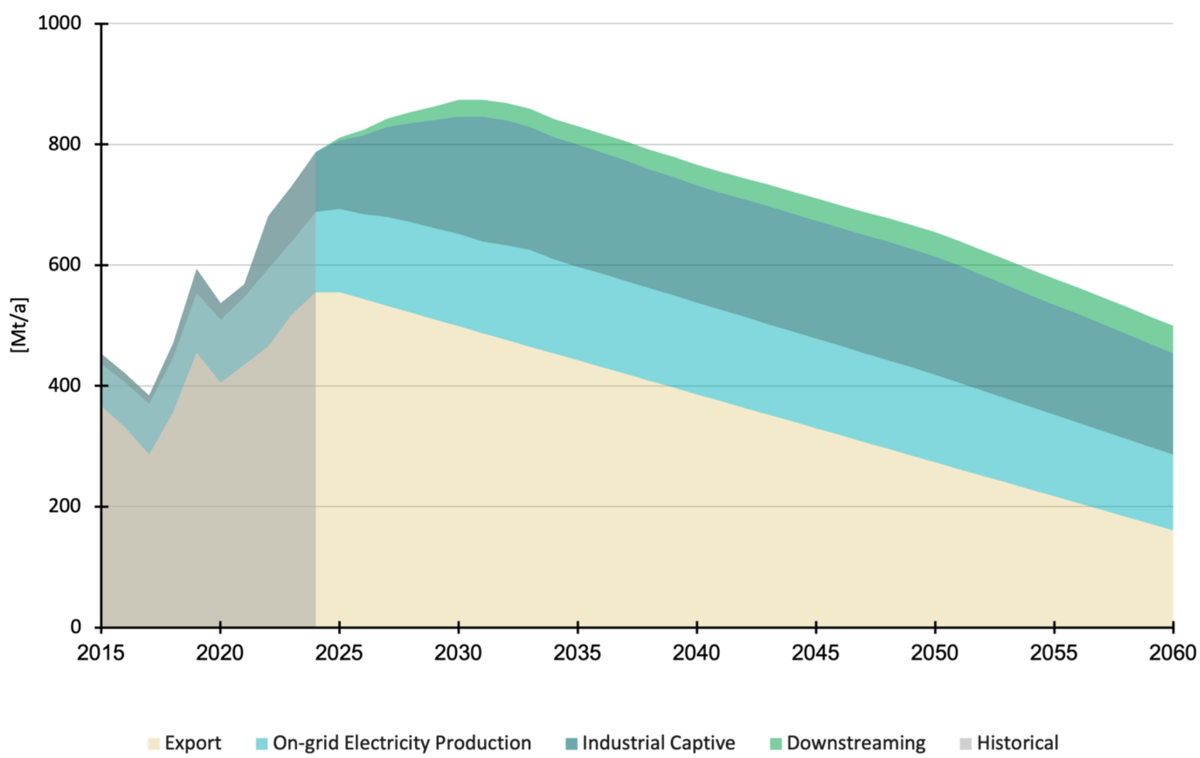
- **Exports** will gradually decline due to reduced imports mainly from China and India, which are not compensated by other countries. This is due to the importing countries' *existing* energy and climate policy and anticipated future technology development, i.e. increasing competitiveness of renewable energies (following IEA STEPS Scenario assumptions), as well as India's explicit strategy to reduce coal imports by raising domestic production to around 1.5 billion tonnes by 2030 (Ministry of Coal India, 2025).
- Indonesia's domestic coal demand for **on-grid electricity** production is based on RUPTL and RUKN projections. In our scenario on-grid capacity peaks in 2033 leading to an all-time high in coal demand for on-grid electricity in 2033 and a moderate decline with high shares of CCS in the long term.
- Coal demand from **captive coal fired power plants** is expected to increase sharply until 2031, following projections from (CREA & GEM, 2024) and RUKN. In the long term, installed capacity and coal consumption will only

slightly decrease, assuming that all captive coal power plants will use CCUS in 2060.

- Coal demand due to **downstreaming** (like gasification) is assumed to follow MEMR targets reaching 34 Mt in 2040. We extrapolated 46 Mt in 2060.

Based on these assumptions, overall coal production in Indonesia would strongly grow in the coming years, but decreasing growth rates would lead to a peak in production in 2031. After that the decrease of exports would no longer be compensated by growing domestic demand and overall production would decrease down to 500 Mt or about 60% of today's level.

Figure 18. Consolidated WI High Scenarios for coal demand for industrial captive, on-grid electricity production and export



Source: Author's own calculations

4.1.2. WI Low Scenario

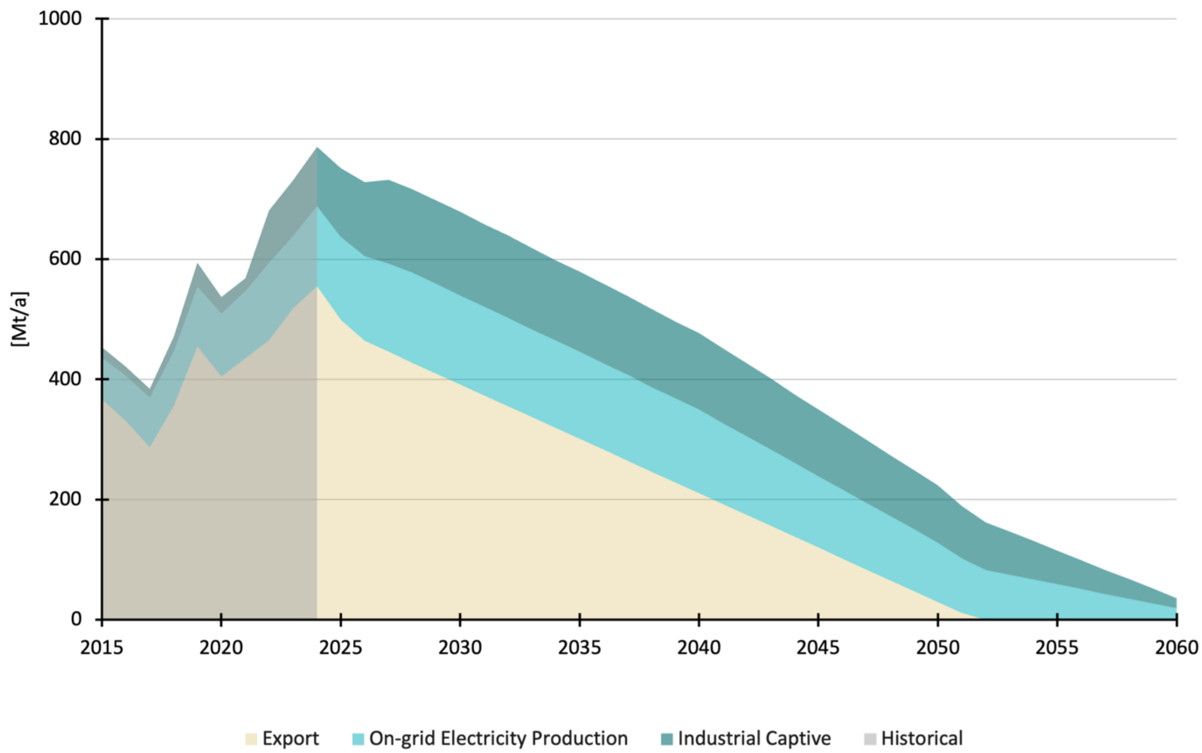
In contrast, the WI Low Scenario describes what we consider to be a realistic lower boundary of coal production in Indonesia. Key drivers are:

- **Export** declines immediately rather strongly due to current market conditions. In the long term it assumes that most countries implement a climate policy which is in line with the Paris Agreement (IEA NZE Scenario). Consequently, key coal importers like China and India reduce their coal consumption. As they focus on using primarily domestic coal, imports from Indonesia consistently decline to zero shortly after 2050.

- **Domestic on-grid demand** is assumed to follow RUPTL and RUKN projections with the respective additional coal power plants in the short term. However, for the long-term it is assumed that CCUS will not be as viable / competitive with renewables, so that coal use in on-grid power plants declines after 2028.
- For **captive coal fired power plants** we assume that only those that are currently under construction according to (CREA & GEM, 2024; Ember, 2025c) will be built and no additional capacity is added after 2027. In the long term, industrial companies will run their coal power plants increasingly in partial load schemes as renewables have become cost competitive for many applications. Only a smaller share of coal plants will employ CCUS.
- The assumption on **coal downstreaming** is that the contribution is only marginal as technologies are neither cost competitive nor in-line with Indonesia's climate targets.

Under these assumptions, coal demand in Indonesia already peaks in 2024 and is expected to gradually decrease down to 36 Mt in 2060, despite increasing domestic coal consumption in the short-term.

Figure 19. Consolidated WI Low Scenarios for coal demand for industrial captive, domestic power production and export

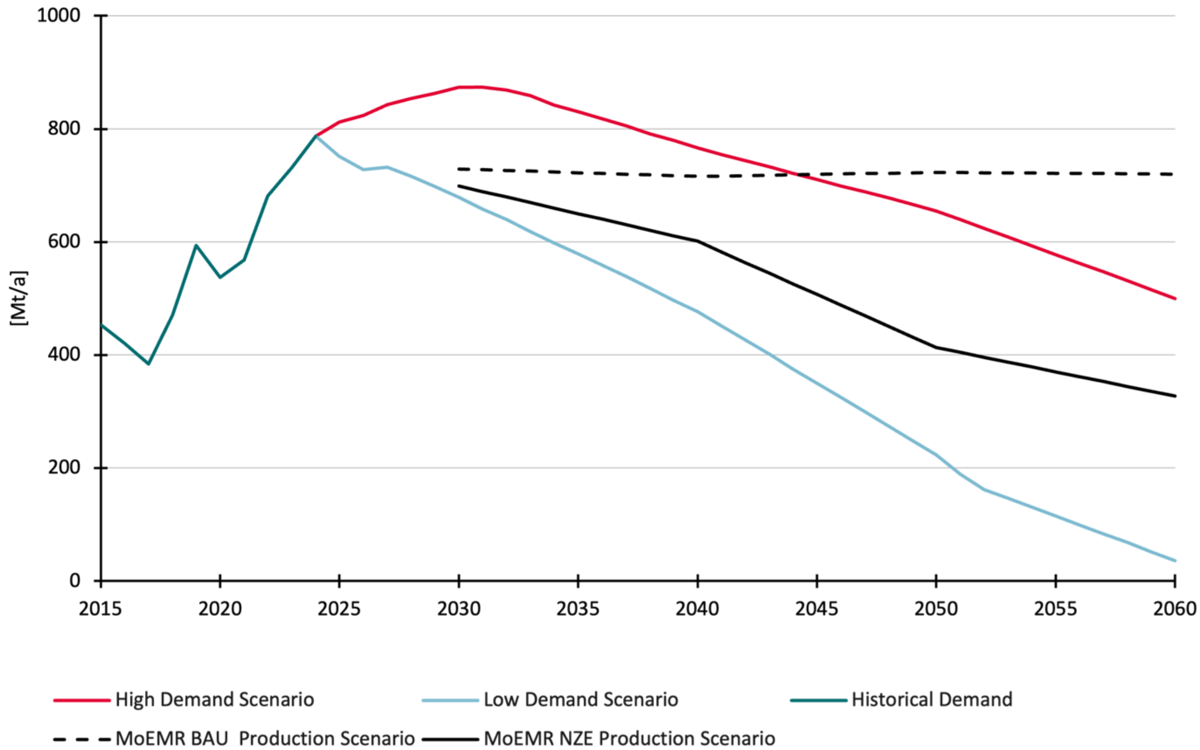


Source: Author' s own calculations

4.2. Discussion

The future development of coal production in Indonesia is fundamentally dependent on the interplay between national energy policy and global market dynamics. Our WI Scenarios define a corridor for the probable future development of demand for Indonesian coal production. They show that a peak in production is likely within the next 10 years. In particular, the WI Low Scenario predicts a decline beginning in 2025 already while the WI High Scenario projects an increasing demand up to 2031 and only a moderate decrease up to 2060.

Figure 20. Comparison of consolidated WI High and Low Scenarios



Source: Author' s own calculations

4.2.1. Comparison to MEMR Projections

To put these findings into context, projections regarding future coal production from the Ministry of Energy and Mineral Resources (MEMR Indonesia, 2022) are included in **Figure 20**. As these projections are from the year 2022, they do not include the rapid increase between 2022 and 2024. Even the higher Business-as-Usual (BAU) Scenario does not foresee a short-term increase in coal demand and production as in our High Scenario. In the long term, however, the WI High Scenario projects significantly lower amounts compared to the ministry's BAU Scenario. The ministry's Net Zero (NZE) Scenario, however, is right in the corridor of the WI Scenarios throughout the whole period until 2060. This comparison shows that in relation to our scenarios, the ministry's projections could underestimate coal production in the short term but rather overestimate its long-term development.

4.2.2. Interpretation of Scenarios and Sensitivities

The WI High and the WI Low Scenarios describe a corridor. According to our assessment it is much more likely that the future development of Indonesia's coal production will be "somewhere within" this corridor but rather unlikely that it will be outside of this corridor.

In chapter 4.1 we have summarized the key assumptions of our scenarios. If you compare those assumptions with what you personally consider more likely, then you can make your own assessment whether you expect coal production to be rather on the higher or the lower margin of the corridor. **In the following we discuss some key drivers** - specifically with an eye on whether future development could even be outside the corridor we sketch:

- **Global climate ambition:** While the short term is largely driven by existing policies, plans and markets - the long-term strongly depends on the level of global climate policy ambition.
    - The WI High Scenario is ruled by "no new policies / no new targets" (similar to IEA STEPS Scenarios). The Paris agreement would clearly not be reached. Reduction in coal use would largely be driven by economic competitiveness of renewables. Even when you assume that climate policy will completely fail in the mid to long-term, our estimate is that coal production would only be marginally above the WI High Scenario because renewables become increasing competitive with coal.
    - The WI Low Scenario is driven by high climate ambition in coal importing countries like China and India as well as the strategic priority to become less dependent on energy imports for energy security reasons. More ambitious global climate strategies would, in our view, hardly decrease coal exports below this scenario. However, if you assume a much more ambitious global climate regime in the mid-term (e.g. with a new and different government in the US and high climate ambitions of China and India), then the pressure on Indonesia to reduce its coal use beyond what is planned in the RUKN could lead to even lower domestic coal use.
- **CCUS** is clearly a game changer in the long-term. If you assume that the technology will become viable and cost-competitive against renewables, the WI High Scenario becomes more likely. However, we want to stress again that the domestic coal demand of the WI Low Scenario is based on IEA shares of CCUS use. Critiques exist that the IEA is overestimating the CCUS potential. Thus, if you assume a fairly ambitious global climate mitigation level and even less CCUS, then coal production in Indonesia could even drop below our Low Scenario.
- **Economic development**

- Clearly, our scenarios are long-term estimates. In the short-term peaks and drops of coal demand may appear. E.g. a new financial crisis or COVID 2.0 could lead to a downturn of the economy. In consequence coal production could even drop below the WI Low Scenario for individual years. In return, global political events (like the Russia-Ukraine war) could lead to short term demand spikes for coal even above the WI High Scenario. We estimate that this would only affect individual years, but would be extremely unlikely as long-term trends.
- Indonesia's domestic energy planning is based on the government's economic target of achieving 8% GDP growth per year. This target has been criticised as too ambitious, e.g. by the World Bank (World Bank, 2025). Assuming that economic growth would stay below this target for many years / decades, then energy demand would be lower than what is assumed in the RUKN. If this development was combined with high climate ambition and increased competitiveness of renewables, then domestic coal demand (both on-grid and captive) could be well below what we assume for our Low Scenario.

4.3. Relevance for Transition in Coal Regions

Coal mining regions in Indonesia (like East Kalimantan and South Sumatra) are economically highly dependent on the coal sector - a potential decline of mining volume would certainly impact those regions. Specifically, in East Kalimantan and South Sumatra, informal and formal discussions have started how to diversify the regional economies, to make them more resilient and support a transition towards a green, zero-carbon economy (IISD, 2025). However, to strategically plan this transition, a shared understanding of the time frame of a coal phase-down is key. A quick decline in the short-term would require different actions than a slow, gradual long-term development.

The above scenarios may already help regional stakeholders to anticipate possible pathways. But clearly, this national perspective would need to be broken down to a regional one. In this paper we have not assessed how the coal industry in the different coal regions in Indonesia could develop. The various mining sites differ with respect to competitiveness / costs per ton of coal mined, link to infrastructure - which is often stronger geared towards domestic use or export, quality of coal (which makes it more / less attractive for different customers) etc. Consequently, it may well be that the decline of coal mining may be faster or slower in the different regions compared to the pathway we describe for the national level.

Nevertheless, even though the above listed uncertainties exist, we derive the following key findings for local decision makers in coal regions in Indonesia:

- In the long-run coal mining will decline in Indonesia, in all current coal mining regions. The growth of coal mining volume, which we have seen in the past will not continue in the future. It is not a question IF coal mining will decline but only WHEN this will happen.
- For the short-term - for the next five years - we do not expect a dramatic change. We do not foresee a drastic decline of coal mining which would lead to mass unemployment in the short-term. A plateau on today's level is quite likely. Possible are also a slow and small further increase or the start of a decline. Market factors like economic development specifically in export countries will be the key drivers of this development - with similar ups and downs as in the past. But for 2030 we expect the coal mining volume to be only marginally higher if not smaller compared to today.
- In the long-term, 2040 and beyond, coal mining will most certainly decline. Unclear is however, whether this decline will be slow and gradual (down to levels comparable what it was in 2015) or steeper and further down to (almost) zero in 2060.

How should coal regions prepare for this development:

1. **Start now!**
   Even though the decline of coal mining may still take decades - so does the process of economic diversification and transformation. International experiences from coal regions around the world clearly show that such structural change is possible, but needs strategic planning and political support - over decades! - and cannot be achieved in a few years.
   So far, the decline has not started yet. Indonesia's coal regions are still in a good position to manage the process. Currently, unemployment rates are not high and public budgets profit from coal revenues. Using this position of strength is important in order to be able to steer the transition actively. Once the decline of coal mining leads to reductions in public revenues, it will be much more difficult to manage the process properly.
2. **A long-term strategy is key**
   Where do coal regions see themselves in 20 to 30 years? It is important to look beyond the immediate problems of today and to take a long-term perspective and plan strategically towards this vision. Key questions to be addressed are:

a. What infrastructure will be needed in the future - for economic sectors outside of coal?

b. How can education be improved for those who are children now, but will be the workforce in 20 years? Which kind of jobs will they be working in and what kind of education would they need to succeed in an economy which will be less and less dependent on coal?

c. How will demography change? Are inhabitants of coal mining regions expected to stay where they live today? Or are the expected to move either within the region or to other places in Indonesia?

3. **Quality of life - look beyond jobs**
As important as jobs are - there is more to quality of life and attractiveness of a region. Once coal mining declines, people may leave the region in search of job opportunities else, which could lead to a downward spiral of decline, making the region altogether unattractive. Internationally, many coal regions have managed to make their regions attractive by e.g. increasing living conditions, avoiding pollution, providing safe and healthy housing as well as good education, supporting culture, arts and leisure activities. All those activities need to fit to local conditions, but they must not be forgotten over purely economic perspectives.

4. **Ensuring fairness - protecting the most vulnerable**
The transition away from coal will impact different parts of society very differently. There will be winners and losers. And the most vulnerable groups will not be able to cope with the transition without support. In a first step it is important to find out who will potentially be affected and what their own capacities are to help themselves. Obviously, coal miners who risk losing their jobs may suffer from the transition. But informal workers who are indirectly linked to the coal sector (e.g. women providing food to miners) may be even more at risk and have lower capacities to find alternatives and help themselves. Identifying the most vulnerable groups is a key first step in managing the transition properly.

5. **Ensure thorough environmental rehabilitation**
Coal mining causes considerable environmental and economic damage, such as contamination of soil, groundwater and rivers, soil subsidence and impairment of the water balance. Rehabilitation must not be viewed as a liability but rather as the key element to protect citizens and increase the regional quality of life by creating a safe, clean and healthy environment. It is also a prerequisite to attract new businesses to the regions and create new jobs. The government needs to

enforce the polluter pays principle, ensuring early on that mining companies have the necessary financial resources for this task – even in case of premature closures that occur before depletion or in case companies should go bankrupt or be taken over by another company. Otherwise, the costs for mine closure and the so-called perpetuity costs from mining will represent a high financial risk for the general public.

For all these points, the timeline of the transition is obviously vital. Taking education and skilling as an example: Sudden and dramatic declines would lead to massive short-term job losses and call for immediate actions like re-skilling of workers (and social support for vulnerable groups). In a more gradual transition, many miners may retire or find jobs in other sectors themselves - but young people would need different (and better) education to be prepared for (and support) the economic diversification of the region.

We hope that the above sketched scenarios of coal demand are a good basis to support stakeholders and decision makers in the Indonesian coal regions in this long-term transition process.

5. Annex - Methodological Notes

5.1. International Energy Scenarios Analysed:

As background research for this report extensive research on existing energy and climate policy scenarios has been undertaken in October 2024 - this included meta-studies with relevance to coal; IEA, IRENA and European Commission scenarios (full list of references at the end of this chapter). Key scenario approaches and trends are:

- IEA scenarios (STEPS, APS, NZE): All three show coal demand peaking around 2022, followed by decline at different speeds. The Stated Policies Scenario (STEPS) projects only a gradual reduction, the Announced Pledges Scenario (APS) a sharper fall, and the Net Zero Emissions (NZE) Scenario a near-complete phase-out by 2050.
- DNV scenarios (ETO, PNZ): The Energy Transition Outlook (ETO) represents a 2.2°C pathway, with coal use declining slowly but remaining in the mix until mid-century. The Pathway to Net Zero (PNZ), aligned with a 1.5°C trajectory, envisions coal almost entirely phased out by 2050, except for limited use in industry, with a full exit from the power sector.
- European Commission's Global Energy and Climate Outlook (GECO 2023): In the 1.5°C scenario, energy from coal halves by 2030 and halves again by 2050, leaving around 0.9 Gt of coal still in use by mid-century.
- Minx et al. (2024) archetypes: Identify four types of trajectories: rapid phase-out, delayed phase-out, persistence, and resurgence. Even in persistence and resurgence cases, coal use in 2050 is far below 2020 levels.

Key take away from this scenario screening:

1. IEA scenarios can be used as a reliable source for coal export scenarios for Indonesia - key trends align with other scenario families.
2. Developments in China and India as key export countries will strongly define the total coal export volumes from Indonesia.
3. CCS is a potential game changer for the question of how much is being used globally. This is accounted for in the international scenarios - but should be analysed for domestic use in Indonesia.

These results were used as starting points for the assessments in this report.

International scenarios / meta-studies on coal trends, which were analysed:

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5.2. RUKN Forecasts on Electricity Consumption

As described in chapter 3, RUKN includes values for electricity combined for both on-grid (PLN grid) and captive (industry) coal fired power plants in its projections. It contains projections both in capacity (GW) and electricity generated (TWh). These two data are transferrable by the simple equation: capacity * load factor = electricity generated.

The load factor is normally not given in most publications / data sets, but needs to be calculated. When we compare historic data sets, including those of IEA and the ESDM Handbook of Energy & Economic Statistics of Indonesia, with resulting load factors in

RUKN, we find that the load factors in the past, and specifically load factors for captive coal fired power plants are higher than resulting load factors in RUKN.

We have no simple explanation, where this difference comes from. We find it unrealistic that load factors in the future should be lower than in the past for two reasons: i) In recent years there was rather an over-capacity in the PLN grid. Lower load factors in the future would imply an even stronger oversupply compared to what existed in the past. We see no signs for this in the RUPTL planning and consider this to be rather unrealistic. ii) Generally, low load factors make power plants less competitive (investment costs have to be met by less electricity being produced). Given that captive coal fired power plants are a) private investments aiming at competitive energy supply and b) technically, many industrial uses (like smelters) have use profiles with many full load hours per day - we find such low load factors for privately owned captive coal fired power plants to be highly unrealistic.

Thus, for our scenarios, we used the capacity (GW) projections in RUKN. We assume that these are very sound, as they mirror the planned and anticipated new (to be built) power plants. We £ them with average load factors (and later factors for coal use per electricity generated - mt per TWh), which we have derived from historical data sets.

In consequence, our High Scenario has higher coal demand in the short to mid-term compared to a demand based on RUKN projections for generated electricity (in TWh). In the logic of our two scenarios, this makes sense, as the High Scenario is the upper limit of possible future developments. Thus, our upper limit being higher than a possible RUKN (based on TWh) projection makes our assessment even more robust.

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