

ERIA Research Project Report FY2026, No. 3

The Socio-economic Implications of Coal Transition in ASEAN

The Socio-economic Implications of Coal Transition in ASEAN

Economic Research Institute for ASEAN and East Asia (ERIA)

Sentral Senayan II 6th Floor

Jalan Asia Afrika No. 8, Gelora Bung Karno

Senayan, Jakarta Pusat 12710

Indonesia

© Economic Research Institute for ASEAN and East Asia, 2026

ERIA Research Project Report FY2026, No. 3

Published in May 2026

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means electronic or mechanical without prior written notice to and permission from ERIA.

The findings, interpretations, conclusions, and views expressed in their respective chapters are entirely those of the author/s and do not necessarily reflect the views and policies of the Economic Research Institute for ASEAN and East Asia, its Governing Board, Academic Advisory Council, or the institutions and governments they represent.

Any error in content or citation in the respective chapters is the sole responsibility of the author/s.

Material in this publication may be freely quoted or reprinted with proper acknowledgement.

Please cite this content as:

ERIA (2026), 'The Socio-economic Implications of Coal Transition in ASEAN'. *ERIA Research Project Report FY2026, No.3*. Jakarta: ERIA.

List of Project Members

| | |
|-------------------------|--|
| Takahiko Tagami | Executive Researcher, Manager, The Institute of Energy Economics, Japan |
| Mai Kojima | Senior Researcher, The Institute of Energy Economics, Japan |
| Alloysius Joko Purwanto | Energy Economist, Economic Research Institute for ASEAN and East Asia |
| Robi Kurniawan | Programme Manager on Energy, Economic Research Institute for ASEAN and East Asia |

Contents

| | | |
|-----------|------------------------------------|-----|
| | Preface | iii |
| | List of Project Members | iv |
| | List of Figures | v |
| | List of Tables | vi |
| | List of Abbreviations and Acronyms | vii |
| | Executive Summary | ix |
| Chapter 1 | Background and Study Method | 1 |
| Chapter 2 | Overview of Viet Nam | 3 |
| Chapter 3 | Just Energy Transition in Viet Nam | 17 |
| Chapter 4 | Interviews | 45 |
| Chapter 5 | Conclusion | 50 |
| | References | 54 |
| | Appendix | 61 |

List of Figures

| | | |
|-------------|---|----|
| Figure 1.1 | Sustainable Coal Transition | 2 |
| Figure 2.1 | Trends of Total Energy Supply in Viet Nam | 4 |
| Figure 2.2 | Electricity Output and Composition in Viet Nam | 4 |
| Figure 2.3 | Trends in CO ₂ Emissions by Sector in Viet Nam | 5 |
| Figure 2.4 | Institutional Framework of the Electricity Sector | 9 |
| Figure 2.5 | Coal Production in Viet Nam | 10 |
| Figure 2.6 | Total Proven Coal Reserves at the End of 2020 (million tonnes) | 11 |
| Figure 2.7 | Coal-Fired Power Plants in Viet Nam | 13 |
| Figure 2.8 | Annual Steel Production by Ownership Type (million tonnes) | 14 |
| Figure 2.9 | Annual Steel Bar Production by Ownership Type (million tonnes) | 14 |
| Figure 2.10 | Coal Imports and Exports | 16 |
| Figure 3.1 | JETP Framework in Viet Nam | 22 |
| Figure 3.2 | Employment Factors for Coal, Wind, and Solar in Viet Nam | 24 |
| Figure 3.3 | Electricity Installed Capacity of Solar in Viet Nam | 29 |
| Figure 3.4 | Electricity Installed Capacity of Wind in Viet Nam | 29 |
| Figure 3.5 | Installed Solar Capacity in Viet Nam (Ground-Mounted and Rooftop), 2024 | 31 |
| Figure 3.6 | Installed Wind Capacity in Viet Nam, 2024 | 31 |
| Figure 3.7 | Combined Burners | 33 |
| Figure 3.8 | Direct Employment by Technology under the PDP8 Scenario | 38 |
| Figure 3.9 | NPV of Plants by Age, Technology, and Capacity | 42 |
| Figure 3.10 | Economic Loss of Plants Shut Down After 20 Years of Operation | 43 |

List of Tables

| | | |
|-----------|---|----|
| Table 2.1 | Overview of Viet Nam's Economic and Energy Indicators | 3 |
| Table 2.2 | Historical and Projected CO ₂ Indicators in Viet Nam | 5 |
| Table 2.3 | List of Coal-fired Power Plants under Construction | 8 |
| Table 2.4 | List of Coal-fired Power Plants Facing Difficulties in Implementation | 8 |
| Table 2.5 | Coal Production, 2007–2015 (million tonnes) | 11 |
| Table 2.6 | Coal Production in Viet Nam, 2020–2024 (thousand tonnes) | 11 |
| Table 2.7 | Coal-fired Power Plants in Viet Nam | 12 |
| Table 2.8 | Steel Trade (US\$ million) | 15 |
| Table 2.9 | Coal Trade (US\$ million) | 16 |
| Table 3.1 | Breakdown of IPG Public Finance by Country and Institution (US\$ million) | 18 |
| Table 3.2 | Trends in Coal Transition Policies in Viet Nam | 21 |
| Table 3.3 | Revised Feed-in Tariff Rates for Wind and Solar (D) | 26 |
| Table 3.4 | Price Framework for Solar and Wind, 2023 (D) | 27 |
| Table 3.5 | Price Frameworks for Solar, 2025 (D) | 28 |
| Table 3.6 | Fixed and Variable O&M by Technology Type | 41 |
| Table 4.1 | Key Findings from Interviews | 48 |

List of Abbreviations and Acronyms

| | |
|-----------------|--|
| ADB | Asian Development Bank |
| ADS | accelerated decarbonisation scenario |
| ASEAN | Association of Southeast Asian Nations |
| BOT | build–operate–transfer |
| CFB | circulating fluidised bed |
| CO ₂ | carbon dioxide |
| COP | Conference of the Parties |
| D | Vietnamese dong |
| ERIA | Economic Research Institute for ASEAN and East Asia |
| ESCAP | United Nations Economic and Social Commission for Asia and the Pacific |
| ETS | emissions trading system |
| EVN | Vietnam Electricity |
| FiT | feed in tariff |
| FY | fiscal year |
| GDP | gross domestic product |
| GFANZ | Glasgow Financial Alliance for Net Zero |
| GHG | greenhouse gas |
| GW | gigawatt |
| GWh | gigawatt hour |
| ILO | International Labour Organization |
| IPG | International Partners Group |
| JETP | Just Energy Transition Partnership |
| kWh | kilowatt hour |
| LNG | liquefied natural gas |
| MOIT | Ministry of Industry and Trade |
| MOU | memorandum of understanding |

| | |
|-----------------|---|
| Mt | million tonnes |
| MW | megawatt |
| NH ₄ | ammonia |
| NO _x | nitrogen oxides |
| NPV | net present value |
| O&M | operations and maintenance |
| PDP | Power Development Plan |
| PPA | power purchase agreement |
| PVN | Petrovietnam |
| SC | supercritical |
| Sub-C | subcritical |
| TRACTION | Transition Credits Coalition |
| UK | United Kingdom |
| US | United States |
| USC | ultra-supercritical |
| Vinacomin | Vietnam National Coal and Minerals Industrial Group |

Executive Summary

Coal remains strategically important for many Association of Southeast Asian Nations (ASEAN) economies as a stable and affordable source of electricity. At the same time, growing global pressure to reduce greenhouse gas emissions has intensified calls to phase down coal use. The environmental impacts of coal have long been recognised, and reducing coal consumption is widely viewed as essential to mitigating climate change. In practice, however, transitioning away from coal presents significant economic and social challenges.

At the 2021 United Nations Climate Change Conference (COP26), Viet Nam pledged to achieve net-zero emissions by 2050. Despite this commitment, coal is expected to continue playing a significant role in the country's energy mix through 2030. Coal consumption across ASEAN reached approximately 457 million tonnes in 2023, with Indonesia accounting for nearly half of total consumption (48%), followed by Viet Nam (21%).

In response to these challenges, the Just Energy Transition Partnership (JETP) was launched in Viet Nam in 2022. The initiative aims to support the development of regulatory frameworks and roadmaps for renewable energy deployment, particularly offshore wind and solar photovoltaic power. Although international partners have pledged financial support, implementation has progressed more slowly than anticipated. Recognising the broader implications of coal phase-out policies and the JETP framework, this study examines not only the energy transition itself but also its wider socio-economic impacts.

The report is organised as follows. Chapter 1 outlines the research background and methodology. Chapter 2 reviews the current landscape of energy and climate policy in Viet Nam. Chapter 3 analyses the JETP framework and potential pathways for coal transition. Chapter 4 presents insights from interviews with key stakeholders. The final chapter discusses emerging challenges and policy implications.

The analysis focuses on three key socio-economic dimensions of the coal transition:

Workers. In the short term, the transition away from coal is likely to result in job losses in mining and coal-fired power generation. However, the expansion of renewable energy industries could generate new employment opportunities over time. Effective reskilling programmes, education initiatives, and relocation support will be essential to mitigate social disruption and support affected workers.

Economy. Coal phase-out could lead to economic losses, particularly for recently built and large-capacity coal-fired power plants. At the same time, opportunities for

economic diversification exist in sectors such as manufacturing, electricity generation, and tourism, which could help offset transitional impacts.

Environment. Reducing coal use offers substantial environmental and public health benefits. However, additional environmental challenges associated with coal mining – such as land subsidence and mine water management – require further research and policy attention, as these issues were not fully addressed in earlier studies.

Viet Nam is strengthening its coal transition strategy, although implementation gaps remain. Current evidence suggests that upstream coal mining companies are generally better prepared for transition than downstream coal-fired power plant operators. While the transition could generate long-term economic and environmental benefits, several socio-economic challenges must be carefully managed.

This study offers several policy recommendations:

- Prioritise comprehensive reskilling and labour transition programmes for workers affected by coal phase-out.
- Develop gradual and technology-differentiated retirement strategies for coal assets while addressing regulatory and technological uncertainties.
- Conduct more detailed assessments of both environmental benefits and potential environmental risks associated with post-coal transitions, drawing on international experiences.
- Strengthen institutional co-ordination amongst government agencies, industry stakeholders, and international partners.

Viet Nam's experience may offer valuable lessons for other ASEAN economies seeking to implement a just energy transition. By carefully balancing energy security, economic development, and environmental sustainability, the country could provide an important model for managing coal transition across the region.

Chapter 1

Background and Study Method

Coal use is strategically important for Association of Southeast Asian Nations (ASEAN) countries as a stable source of electricity despite global pressure to phase out coal. The environmental impact of coal consumption has been widely discussed for years, and scaling down the use of coal to mitigate climate change is a vital issue that requires immediate attention. Therefore, any transition away from coal in the coming years must be carefully planned and implemented.

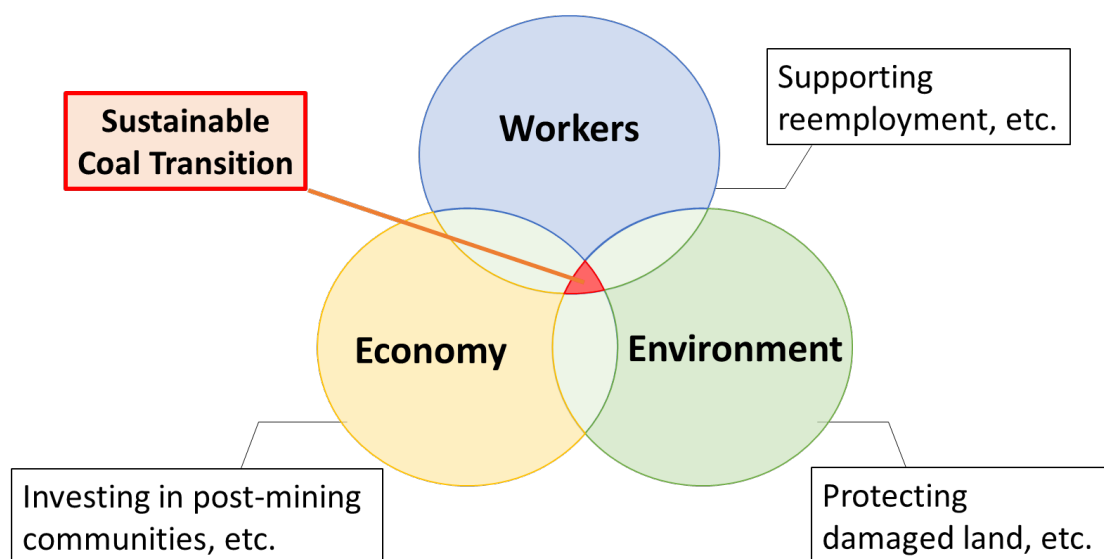
The concept of the coal transition aims to reduce coal dependency without causing harm to society. The Just Energy Transition Partnership (JETP) was announced at the 2021 United Nations Climate Change Conference (COP26) as an initiative to support the transition away from fossil fuels, with funding pledged for countries such as South Africa, Indonesia, Viet Nam, and Senegal.

We conducted a study in fiscal year 2024 regarding Indonesia's coal transition, and this report expands our research to Viet Nam. The study on Indonesia concluded that coal transition policies related to employment and business continuity are the primary concern for stakeholders in the short term. Meanwhile, technological development, such as replacing coal-fired plants with biomass power plants, requires a longer-term perspective. In Viet Nam, our findings are comparable but not identical.

Viet Nam relies heavily on coal for its energy needs. The country has substantial domestic reserves, especially of anthracite in the northern region. The difficulty of the coal transition in Viet Nam lies in the expectation that coal consumption and imports will continue to rise in the coming years. It is easy to imagine that such a transition will have far-reaching impacts on the population.

We believe that the socio-economic implications of the post-transitional situation in ASEAN necessitate a detailed investigation. These socio-economic aspects include employment, the economy, and the environment.

Figure 1.1. Sustainable Coal Transition



Source: Authors.

Workers in mining (upstream) and coal-fired power plants (downstream) will need to change occupations after the transition. Local economies will likely face financial challenges as people relocate. Additionally, there is a high possibility of environmental risks emerging after the closure of mines and power plants. This is illustrated in Figure 1.1, where the three overlapping circles (shown in red) represent the components of a sustainable coal transition.

Needless to say, these factors are highly contingent upon national policies. Therefore, we will first review the relevant national policies and examine how they influence the local level, through case studies of selected regions, focusing on the transition period between 2030 and the net-zero target year of 2050.

Policy recommendations will be provided based on the findings of this study and will address the following aspects:

- Identifying institutional issues in the energy transition and implementing policy proposals
- Ensuring sustainable future coal transition policies for ASEAN countries

In addition to reviewing previous studies, we conducted face-to-face interviews in Hanoi with representatives from government agencies, institutions, and companies. We would like to express our deep appreciation to all participants for sharing their insights.

We believe that the experiences of ASEAN countries can serve as a valuable reference for other nations undergoing coal transitions in the near future. By accelerating the decarbonisation of ASEAN Member States, this project will enlarge the scope of coal transition policies from a socio-economic perspective.

Chapter 2

Overview of Viet Nam

1. Overview

This chapter provides an overview of the current role of coal in Viet Nam's energy system and economy as a basis for assessing the implications of a potential coal transition. Coal remains a strategically important source of electricity and industrial energy in Viet Nam, underpinning continued economic growth. At the same time, coal is the largest contributor to the country's carbon dioxide (CO₂) and greenhouse gas (GHG) emissions, making its future use central to meeting national climate commitments.

1.1. Basic Information

The tables and figures below show key economic and demographic indicators for Viet Nam.

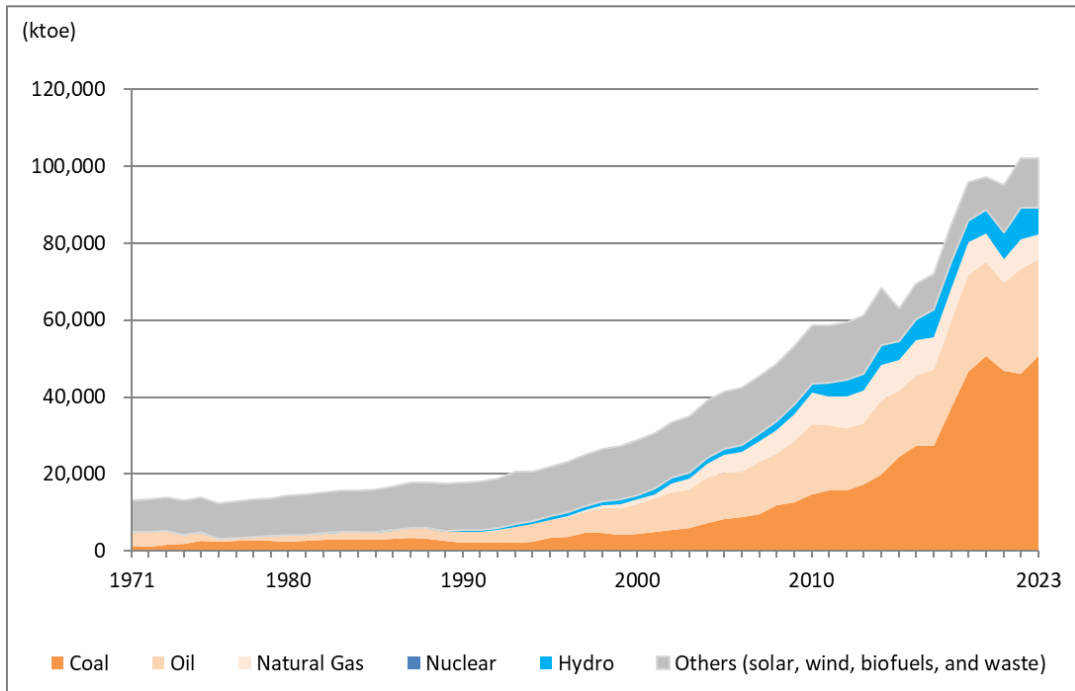
Table 2.1. Overview of Viet Nam's Economic and Energy Indicators

| Indicator | 1990 | 2000 | 2010 | 2023 |
|--|------|------|------|-------|
| Population (millions) | 65.5 | 77.2 | 87.5 | 100.4 |
| Real GDP (US\$ billion, 2020 base year) | 47 | 98 | 190 | 405 |
| Per capita GDP (US\$ thousand) | 0.07 | 0.13 | 0.22 | 0.40 |
| Total primary energy supply (million tonnes of oil equivalent) | 18 | 29 | 59 | 102 |
| Final energy consumption (million tonnes of oil equivalent) | 16 | 25 | 48 | 69 |
| Energy self-sufficiency rate (%) | 102 | 139 | 113 | 60 |

GDP = gross domestic product.

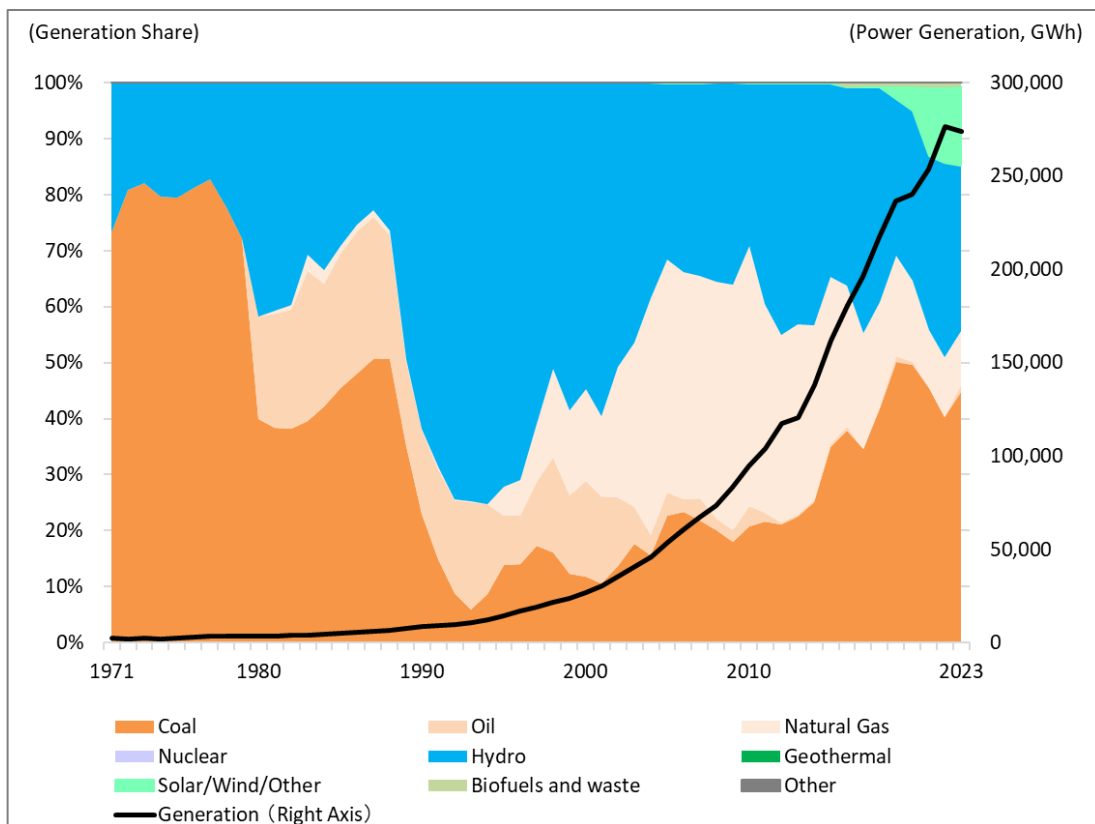
Source: International Energy Agency (2025a; 2025b; 2025c).

Figure 2.1. Trends of Total Energy Supply in Viet Nam



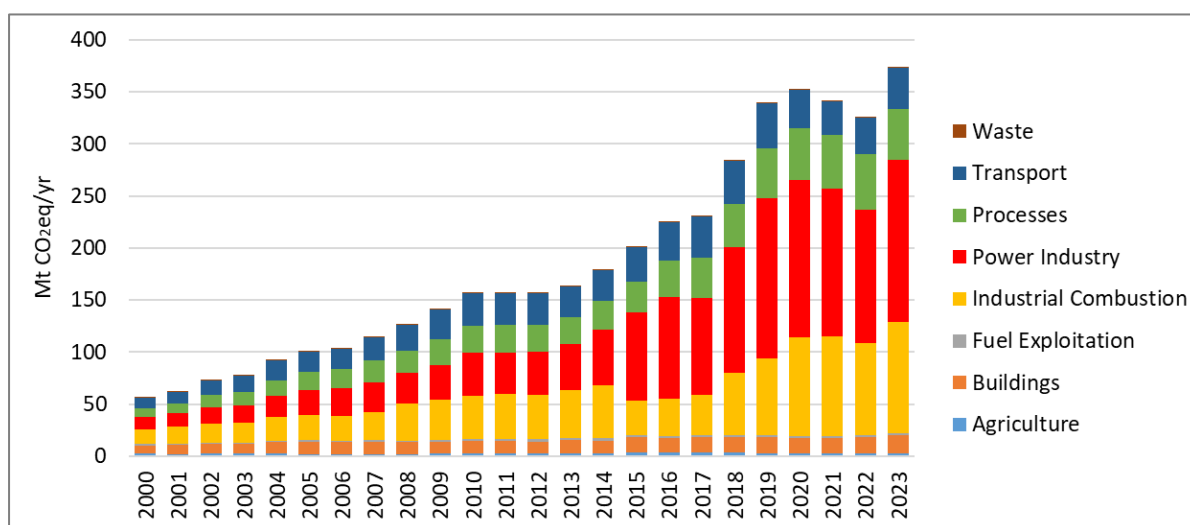
ktoe = kilotonnes of oil equivalent.
Source: IEA (2025b).

Figure 2.2. Electricity Output and Composition in Viet Nam



GWh = gigawatt-hour.
Source: IEA (2025b).

Figure 2.3. Trends in CO₂ Emissions by Sector in Viet Nam



Mt CO₂eq = megatonnes of carbon dioxide equivalent.

Source: Emissions Database for Global Atmospheric Research (EDGAR) Community GHG Database (a collaboration between the European Commission, Joint Research Centre (JRC), IEA, and comprising IEA-EDGAR CO₂, EDGAR CH₄, EDGAR N₂O, EDGAR F-GASES version EDGAR_2024_GHG (2024) European Commission).

Table 2.2. Historical and Projected CO₂ Indicators in Viet Nam

| Indicator | 1990 | 2000 | 2019 | 2020 | 2030 | 2040 | 2050 |
|---|------|------|------|------|------|------|------|
| CO ₂ intensity (tonnes of carbon per US\$ million, 2015) | 160 | 196 | 484 | 486 | 478 | 423 | 375 |
| CO ₂ per energy (tonnes of carbon per toe) | 0.26 | 0.42 | 0.86 | 0.87 | 0.91 | 0.93 | 0.95 |

toe = tonne of oil equivalent.

Source: Kimura, Phoumin, and Purwanto (2023).

Viet Nam is one of the region's fastest-growing economies, with a gross domestic product (GDP) growth rate of 7.1% in 2024.¹ The country primarily relies on coal for its energy supply, especially for electricity generation. It also produces other fossil fuels, including oil and natural gas. Although the overall share of fossil fuel reserves is relatively small, Viet Nam has emerged as an important oil and gas producer in Southeast Asia over the past few decades. Economic reforms have facilitated foreign investment in these sectors. On the demand side, rapid economic growth, industrialisation, and an expanding export market have led to a surge in domestic energy consumption.

¹ World Bank Group, 'GDP Growth (Annual %) - Viet Nam.

<https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=VN> (accessed 27 October 2025).

Viet Nam's energy demands continue to rise (see Figure 2.1). Since 2018, coal has surpassed hydropower to become the largest source of electricity generation (see Figure 2.2). Coal now accounts for 122,646 gigawatt-hours (GWh), or 44.8% of total electricity generation (IEA, n.d.-a). However, due to the pace of development, Viet Nam's fossil fuel production has fallen well short of its demand for coal and oil.

Currently, Viet Nam's CO₂ emissions are the second-highest in Southeast Asia, making global climate policy an urgent issue. According to EDGAR data, the power industry was the largest source of CO₂ emissions in 2023, accounting for about 40% of total emissions (see Figure 2.3). Furthermore, according to Kimura, Phoumin, and Purwanto (2023), both CO₂ intensity and CO₂ per unit of energy increased more than threefold from 1990 to 2019. In the business-as-usual scenario, CO₂ intensity is projected to slightly decrease by 2050, whereas CO₂ per unit of energy is expected to rise in 2050 (see Table 2.2).

Viet Nam submitted its updated nationally determined contribution (NDC) in 2022 (Socialist Republic of Viet Nam 2022), setting more ambitious targets than its 2020 NDC. In the NDC 2022 update, emission reduction targets for energy; agriculture; land use, land-use change, and forestry (LULUCF); waste; and industrial processes increased from 9% to 15.8% (unconditional contribution) by 2030, compared to the 2014 base year, and from 27% to 43.5% (conditional contribution).

At COP26 in 2021, Viet Nam pledged to achieve net-zero emissions by 2050 and joined the Global Coal to Clean Power Transition Statement, which aims to accelerate a transition away from unabated coal power generation (UN Climate Change Conference UK, 2021).

However, recent trends show that coal consumption and imports are rising and are expected to continue doing so. According to the IEA (2024), Viet Nam is the second-largest consumer of coal in ASEAN countries, accounting for 21% of ASEAN countries' coal use (IEA, 2024). Coal demand is projected to expand from 106 megatonnes (Mt) in 2024 to 128 Mt by 2027. Coal imports are also expected to rise correspondingly. In 2024, Viet Nam became the fifth-largest importer of thermal coal in the world (IEA 2024: 63). The IEA (2024: 64) notes that 'the only countries with notable growth in thermal coal imports over the next three years are estimated to be the Philippines, Viet Nam and Bangladesh'.

These figures demonstrate that transitioning away from coal in Viet Nam will not be an easy path forward.

1.2. Energy Policy

Viet Nam is the second-largest GHG emitter amongst ASEAN countries. In recent years, Viet Nam has enacted several new pieces of environmental policy legislation, including

the National Strategy on Green Growth for 2021–2030 (Decision No. 1658/QĐ-TTg)² in 2021 and the National Climate Change Strategy until 2050 (Decision No. 896/QĐ-TTg)³ in 2022.

In May 2023, the government of Viet Nam adopted the Power Development Plan (PDP8) (Decision No. 500/QĐ-TTg), which outlines the country's long-term strategy for developing its power sector through 2050.⁴ The plan prioritises renewable energy and declares a gradual phase-out of coal-fired power plants. Under PDP8, Viet Nam plans for coal-fired power capacity to reach about 30,127 megawatts (MW) by 2030, but no new coal facilities in the pipeline will proceed after 2030. Plants operating for 20 years will be converted to biomass or ammonia, whilst those operating for over 40 years will be closed if fuel conversion is not feasible.

In July 2023, the government approved the National Energy Master Plan for the 2021–2030 period, delineating the overall framework for Viet Nam's energy development (Decision No. 893/QĐ-TTg).⁵ The plan anticipates that coal production will remain between about 41 million and 47 million tonnes annually from 2021 to 2030, peaking around 39 million tonnes by 2045, and then declining to approximately 33 million tonnes by 2050. The plan also reiterates the gradual retirement of coal-fired power plants and the conversion of coal-fired power facilities to biomass or ammonia.

In January 2024, the government approved the Strategy for Development of Viet Nam's Coal Industry to 2030, with a vision to 2045 (Decision No. 55/QĐ-TTg).⁶ Under this strategy, coal output is expected to reach around 45 million–50 million tonnes per year by 2030 and gradually decrease to around 38 million–40 million tonnes from 2031 to 2045.

In April 2025, Viet Nam revised PDP8 and approved the implementation plan (Decision No. 768/QĐ-TTg).⁷ The revised PDP8 is based on the primary assumption of an average GDP growth rate of about 10% annually from 2026 to 2030, and about 7.5% annually from 2031 to 2050. The revision sets out a bolder emphasis on renewable energy (excluding hydropower), setting a target for renewables to account for 74%–75% of total power generation by 2050. Although Decision No. 500/QĐ-TTg recognises captive power as a legitimate and growing part of Viet Nam's energy system, particularly for renewable self-supply, Decision No. 768/QĐ-TTg does not provide detailed guidance for industrial self-

² Decision No. 1658/QĐ-TTg: <https://thuviennhadat.vn/van-ban-phap-luat-viet-nam/decision-1658-qd-ttg-2021-national-green-growth-strategy-for-2021-2030-period-504659.html>

³ Decision No. 896/QĐ-TTg: <https://thuvienphapluat.vn/van-ban/EN/Tai-nguyen-Moi-truong/Decision-896-QD-TTg-2022-approving-the-National-strategy-for-climate-change-until-2050/525126/tieng-anh.aspx>

⁴ Decision No. 500/QĐ-TTg: <https://thuvienphapluat.vn/van-ban/Thuong-mai/Quy-dinh-500-QD-TTg-2023-Quy-hoach-phat-trien-dien-luc-quoc-gia-2021-2030-tam-nhin-2050-566461.aspx>

⁵ Decision No. 893/QĐ-TTg: <https://vanban.chinhphu.vn/?docid=208351&pageid=27160>

⁶ Decision No. 55/QĐ-TTg: <https://vanban.chinhphu.vn/?pageid=27160&docid=209535>

⁷ Decision No. 768/QĐ-TTg: <https://vanban.chinhphu.vn/?pageid=27160&docid=213388>

generation. Regarding coal, the plan suggests policies to phase out coal-fired power plants by 2050. New coal facilities in the pipeline are expected to be implemented by 2030, except for the five coal-fired power plants listed in Table 2.3.

Table 2.3. List of Coal-fired Power Plants under Construction

| Plant Name | Planned Capacity (MW) | Expected Operational Phase | Combustion Technology |
|----------------------|-----------------------|----------------------------|-----------------------|
| Na Duong 2 | 110 | 2025–2030 | CFB |
| An Khanh – Bac Giang | 650 | 2025–2030 | CFB |
| Vung Ang 2 | 1,330 | 2025–2030 | USC |
| Quang Trach 1 | 1,403 | 2025–2030 | SC |
| Long Phu 1 | 1,300 | 2025–2030 | SC |

CFB = circulating fluidised bed, SC = supercritical, USC = ultra-supercritical.

Note: Combustion technologies are explained further in Section 1.5.

Source: Decision No. 768/QĐ-TTg and Global Energy Monitor, Global Coal Plant Tracker, July 2025 release (accessed 7 October 2025).

Although no additional coal-fired power plants are permitted for construction in the future, the projects listed in Table 2.4 may proceed if certain conditions, such as financial arrangements, are met.

Table 2.4. List of Coal-fired Power Plants Facing Difficulties in Implementation

| Plant Name | Planned Capacity (MW) | Expected Operational Phase | Combustion Technology |
|------------|-----------------------|----------------------------|-----------------------|
| Nam Dinh 1 | 1,200 | 2025–2030 | Unknown |
| Quang Tri | 1,320 | 2025–2030 | USC |
| Vinh Tan 3 | 1,980 | 2025–2030 | SC |
| Song Hau 2 | 2,120 | 2025–2030 | SC |

SC = supercritical, USC = ultra-supercritical.

Source: Decision No. 768/QĐ-TTg and Global Energy Monitor, Global Coal Plant Tracker, July 2025 release (accessed 7 October).

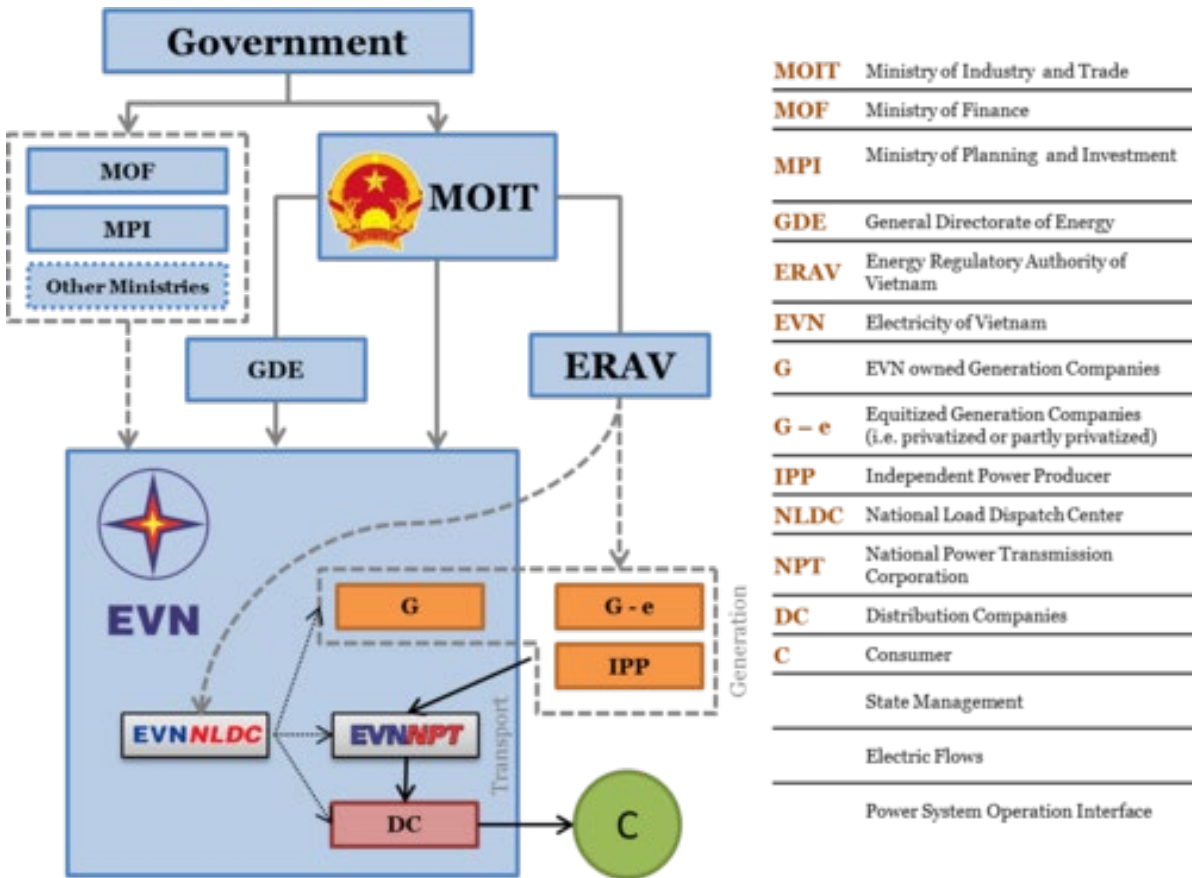
PDP8 also envisions transitioning from coal power plants to biomass or hydrogen-based systems, which will be further discussed in Chapter 3, Section 2.2.

1.3. Energy market

The Ministry of Industry and Trade (MOIT) is the governing body in charge of supervising energy industries, including electricity, coal, oil, gas, and renewable energy (see Figure 2.4). It also oversees the formulation of laws, policies, strategies, and master plans

related to the energy industry.

Figure 2.4. Institutional Framework of the Electricity Sector



Source: Energypedia (https://energypedia.info/wiki/Vietnam_Energy_Situation).

Currently, the MOIT comprises 13 departments and agencies. Amongst them, the Energy Efficiency and Sustainable Development Department and the Oil, Gas, and Coal Department are responsible for the coal transition.

Under the MOIT, the Energy Regulatory Authority of Viet Nam is responsible for developing and regulating the electricity market. Vietnam Electricity (EVN) is a state-owned company responsible for ensuring power supply, overseeing electricity generation, and managing the power transmission system.

Two other major state-owned companies, Vietnam National Coal and Minerals Industrial Group (Vinacomin) and Petrovietnam (PVN), also participate in power generation. However, their primary operations focus on mining and oil/gas production, respectively.

1.4. Coal production

As shown in Figure 2.5, coal mining in Viet Nam is concentrated primarily in the north of the country. Quang Ninh province and the Red River Delta are the two main coal fields. The Quang Ninh coal basin accounts for approximately 90% of the country's total domestic coal output. The Red River Delta area remains under exploration until 2030, with plans to initiate pilot mining operations before 2040.⁸

Figure 2.5. Coal Production in Viet Nam



| No. | Mine Name | Opening Year | Type |
|-----|---------------------|--------------|-------------|
| ① | Khanh Hoa Coal Mine | 1970 | Surface |
| ② | Mine at Khe Sim | 1997 | Underground |

Source: Global Energy Monitor.

According to Decision No. 20/2003QD-TTg⁹ (the development plan for Viet Nam's coal industry in the 2003–2010 period with consideration of prospects to 2020), Viet Nam had 52 coal mines with around 40 million tonnes per year of total capacity.

Table 2.5 shows that the ratio of surface mining and underground mining was roughly equal from 2007 to 2013 (Le and Bui, 2020).

⁸ Decision No. 55/QD-TTg: <https://vanban.chinhphu.vn/?pageid=27160&docid=209535>

⁹ <https://thuviennhadat.vn/van-ban-phap-luat-viet-nam/quyet-dinh-20-2003-qd-ttg-quy-hoach-phat-trien-nganh-than-viet-nam-giai-doan-2003-2010-co-xet-trien-vong-den-nam-2020-50487.html>

Table 2.5. Coal Production, 2007–2015 (million tonnes)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|--------------|--------------|--------------|--------------|-------------|--------------|--------------|--------------|-------------|
| Surface | 27 | 25 | 26 | 27 | 26 | 22 | 21 | 17 |
| Underground | 16 | 18 | 18 | 20 | 21 | 21 | 22 | 20 |
| Others | 2.39 | 1.84 | 2.02 | 0.5 | 0.71 | 0.51 | 0.65 | 0.5 |
| Total | 45.39 | 44.84 | 46.02 | 47.5 | 47.71 | 43.51 | 43.65 | 37.5 |

Source: Le and Bui (2020, p.105).

According to our recent interviews, around 20% of mines are currently open-pit, whilst 80% are underground. Open-pit mining is planned to shut down by 2035.

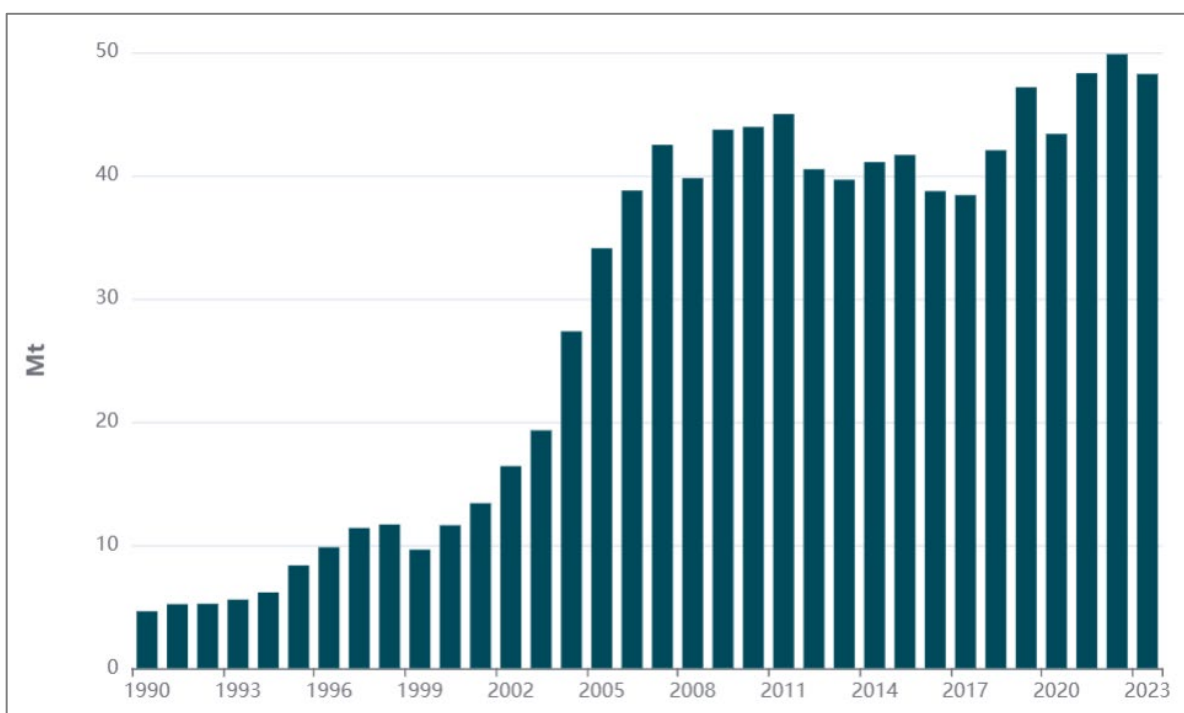
From 2020 to 2024, coal production remained steady at around 45 million tonnes annually (see Table 2.6 and Figure 2.6).

Table 2.6. Coal Production in Viet Nam, 2020–2024 (thousand tonnes)

| | 2020 | 2021 | 2022 | 2023 | 2024 |
|------------|--------|--------|--------|--------|--------|
| Production | 44,598 | 48,316 | 49,688 | 47,171 | 45,315 |

Source: Statistical Publishing House (2024).

Figure 2.6. Total Proven Coal Reserves at the End of 2020 (million tonnes)



Source: Enerdata (<https://yearbook.enerdata.net/coal-lignite/coal-production-data.html>).

Vinacomin contributed to most of the coal production in Viet Nam, producing approximately 37.2 million tonnes of coal in 2024 (Vietnam+, 2025a). According to recent reports, Vinacomin produced 24.1 million tonnes of coal in the first seven months of 2025 (Viet Nam News, 2025a).

1.5. Coal Consumption

According to Global Energy Monitor,¹⁰ currently, 74 coal-fired power plants are operating in Viet Nam (see Table 2.7). Many of these plants use subcritical (Sub-C) technology, which combusts coal at a thermal efficiency of less than 38%, followed by supercritical (SC) technology with a thermal efficiency of between 38% and 40%. However, the operating capacity of Sub-C and SC is nearly the same. More efficient ultra-supercritical (USC) technology plants have been introduced in recently built or planned projects.

Table 2.7. Coal-fired Power Plants in Viet Nam

| | Operating | | Announced or Under Construction | |
|--------------|---------------|------------------|---------------------------------|------------------|
| | Capacity (MW) | Number of Plants | Capacity (MW) | Number of Plants |
| Sub-C | 11,930 | 38 | 0 | 0 |
| SC | 9,529 | 15 | 2,603 | 4 |
| USC | 600 | 1 | 2,520 | 4 |
| CFB | 2,040 | 10 | 110 | 1 |
| Unknown | 3,035 | 10 | 0 | 0 |
| Total | 27,134 | 74 | 5,233 | 9 |

CFB = circulating fluidised bed, SC = supercritical, Sub-C = subcritical, USC = ultra-supercritical.

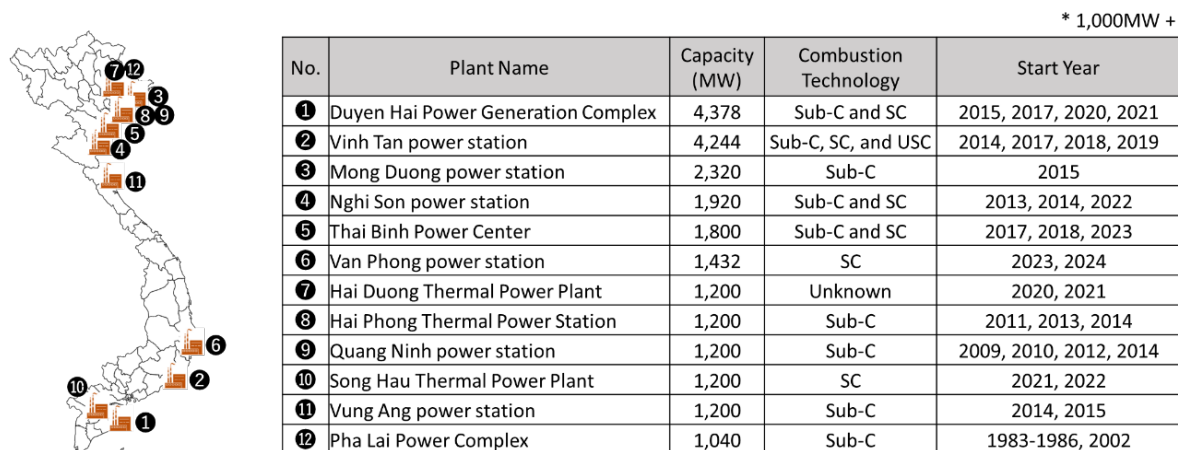
Note: A CFB boiler increases the gas velocity in the furnace/combustor to activate the particles and gases, which, in turn, improves the combustion reaction.

Source: Global Energy Monitor, Global Coal Plant Tracker, July 2025 release (accessed 7 October).

As shown in Figure 2.7, the main coal-fired power plants are located in the north and south of Viet Nam. Sub-C plants are mostly located in the north, close to Quang Ninh, which holds the largest domestic anthracite coal reserves.

¹⁰ Global Energy Monitor, Global Coal Plant Tracker, July 2025 release (accessed 7 October).

Figure 2.7. Coal-Fired Power Plants in Viet Nam



Source: Global Energy Monitor.

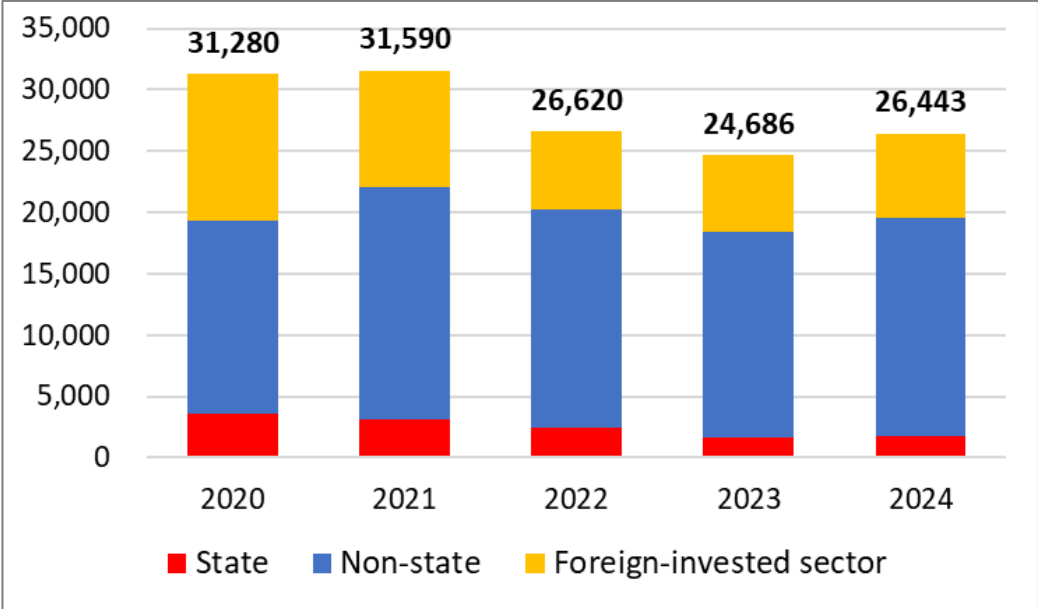
According to EVN, coal-fired power accounted for 54.3%, or 84.6 billion kilowatt-hours (kWh), of electricity generation in the first half of 2025, with total electricity production reaching 155.79 billion kWh (EVN, 2025). Other sources of power generation included hydropower (36.5 billion kWh), solar power (13.63 billion kWh), gas turbines (10.27 billion kWh), and wind power (6.71 billion kWh). Imported electricity accounted for 3.24 billion kWh (2.1%). EVN has emphasised 'the inspection and monitoring of power plants, especially coal-fired thermal power plants in the North, to ensure the availability and reliability of the units' (EVN, 2005).

Aside from the national company, several foreign companies from Japan, the Republic of Korea (henceforth Korea), and China operate coal-fired power plants under build–operate–transfer (BOT) contracts. Under these agreements, a private company receives a concession from the public sector to build and operate a facility. Although the Government of Viet Nam has officially decided not to construct new coal-fired power plants, this does not apply to projects that have already been signed, as stated above (see Chapter 1, Section 1.2. Energy policy).

Some previously planned projects have also been revived. PVN, for instance, announced plans to relaunch the Long Phu 1 coal-fired plant project, according to newspapers (Vietnamnet, 2025). The plant was scheduled to be completed around 2018 and 2019 in partnership with Russia's Power Machines and PVN, but the project has faced several setbacks. In June 2019, a report on the implementation progress of the plant in the revised Power Development Plan 7 was published (Ministry of Industry and Trade, 2019), indicating that the completion year was delayed to 2030 due to the US embargo imposed on Power Machines (U.S. Department of the Treasury, 2018). According to the report, PVN was seeking a new engineering, procurement, and construction contractor for the plant since Power Machines had announced an end to the contract (Vietnam Investment Review, 2022). In January 2025, PVN held a launch ceremony for the project, with a new completion target set for 2027.

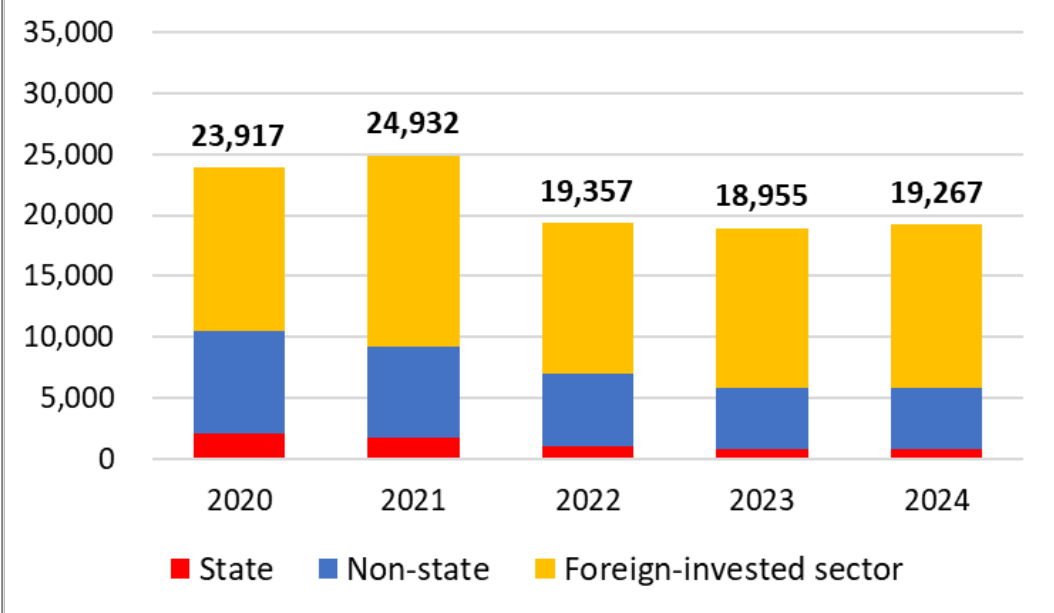
Apart from power generation, industrial processes, such as steelmaking, use coal to reduce iron ore by stripping away oxygen (IEA, n.d.-b). The steel industry has emerged as a leading manufacturer in Viet Nam, producing more than 25 million tonnes of steel and 20 million tonnes of steel bars (see Figure 2.8 and Figure 2.9).

Figure 2.8. Annual Steel Production by Ownership Type (million tonnes)



Source: Statistical Publishing House (2024).

Figure 2.9. Annual Steel Bar Production by Ownership Type (million tonnes)



Source: Statistical Publishing House (2024).

Unlike the power industry, the steel industry largely relies on non-state companies and foreign investors. Non-state companies, such as Hoa Phat Group, which is the largest steel manufacturer in Viet Nam, produces most of the crude steel, whilst some foreign companies are responsible for the majority of steel bar production.

According to a news report by Viet Nam News, 'the steel industry relies on 42 per cent scrap steel (mainly imported) and 58 per cent blast furnace production using iron ore. The domestic production of HRC [hot-rolled coil] is eight million tonnes per year, whilst the demand is 10 million tonnes, making the industry dependent on imports and vulnerable to price changes' (Viet Nam News, 2024). China is the main source of imported steel, supplying it at a relatively lower price. In 2023, Hoa Phat Group announced plans to develop green steel to reduce GHG emissions (Hòa Phát, 2023).

Viet Nam was once a major exporter of anthracite, but exports have declined due to increased domestic demand for power generation and steel manufacturing. Circular No. 15/2013/TT-BCT established the conditions for coal export, with the government requiring documentation and reporting obligations for exporters.¹¹ In trade terms, Viet Nam's iron and steel imports exceed exports (see Table 2.8).

Table 2.8. Steel Trade (US\$ million)

| | | 2020 | 2021 | 2022 | 2023 | 2024 |
|--------------|-------------------------|---------|----------|----------|----------|----------|
| Export Value | Iron and Steel | 5,258.9 | 11,790.5 | 7,989.3 | 8,347.1 | 9,077.6 |
| | Iron and Steel Products | 3,077.2 | 3,978.6 | 4,674.0 | 3,988.2 | 4,593.7 |
| Import Value | Iron and Steel | 8,067.0 | 11,528.3 | 11,921.3 | 10,430.3 | 12,584.4 |
| | Iron and Steel Products | 4,543.1 | 5,313.0 | 5,412.9 | 5,351.1 | 6,497.2 |

Source: Statistical Publishing House (2024).

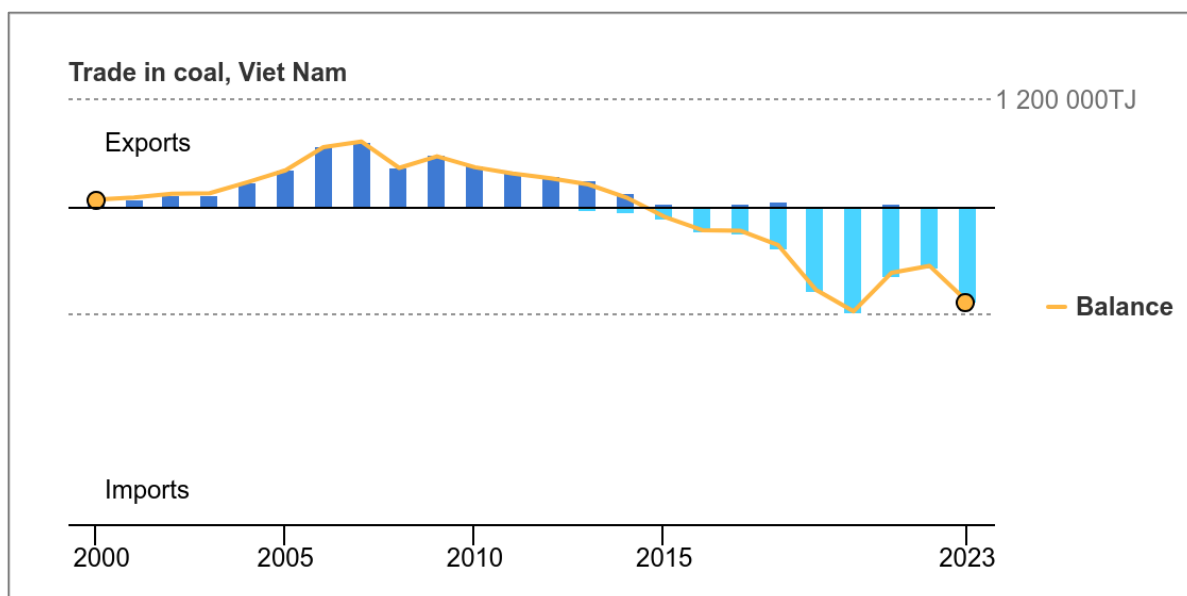
TheGlobalEconomy.com (n.d.) estimates that Viet Nam consumed around 91 million tonnes of coal in 2023. Considering that Viet Nam produces around 45 million tonnes of coal per year, it appears that the country relies heavily on imported coal.

1.6. Coal Trade

According to the IEA (2024, p.58), 'Viet Nam joined the top five importers during 2024 ... Imports into Viet Nam are expected to have gained almost 19% in 2024 amid strong demand and stable domestic production.' The primary use for coal imports is thermal power generation (Do, 2025). Viet Nam's coal imports have surpassed exports since 2015 (see Figure 2.10).

¹¹ Circular No. 15/2013/TT-BCT: <https://faolex.fao.org/docs/pdf/vie164818.pdf>

Figure 2.10. Coal Imports and Exports



Source: IEA, 'Viet Nam, Coal' (<https://www.iea.org/countries/viet-nam/coal>).

In 2024, Indonesia was the largest coal exporter to Viet Nam, followed by Australia and Russia (Center for WTO and International Trade, 2025). Although imports from the Lao PDR are small, the two countries have agreed to strengthen cooperation in coal trade. Table 2.9 shows that coal imports have been steadily growing while export value has been fluctuating from 2020 to 2024. This growing import trend will likely continue in the future, and Viet Nam will be amongst the countries 'with notable growth in thermal coal imports over the next three years' (IEA 2024, p.62).

Table 2.9. Coal Trade (US\$ million)

| | 2020 | 2021 | 2022 | 2023 | 2024 |
|--------------|-------|-------|-------|-------|-------|
| Export value | 119.6 | 246.1 | 411 | 249.1 | 161.2 |
| Import value | 3,778 | 4,471 | 7,120 | 7,167 | 7,619 |

Source: Statistical Publishing House (2024).

If Viet Nam can successfully phase out coal, imports would naturally decline, leading to significant cost savings. The next chapter examines the prospects for a coal transition in Viet Nam.

Chapter 3

Just Energy Transition in Viet Nam

1. Historical Background

The Master Plan on Development of Vietnam's Coal Industry through 2020, with the Prospects towards 2030 Taken into Consideration (Decision No. 60/QD-TTg), was formulated in January 2012,¹² and subsequently revised as Decision No. 403/QD-TTg in March 2016.¹³ The decision ensures the development of a competitive coal industry with advanced technology that is able to meet domestic demand for power generation and operate sustainably. Coal output was expected to reach 55 million–57 million tonnes, with coal demand expected to reach 156.6 million tonnes, by 2030.

In July 2023, the government approved the National Energy Master Plan for the 2021–2030 period, outlining the overall framework for Viet Nam's energy development (Decision No. 893/QD-TTg).¹⁴ The decision included the revision that coal production would remain about 41 million–47 million tonnes per year from 2021 to 2030, peaking at about 39 million tonnes by 2045, before declining to about 33 million tonnes by 2050. Coal imports are expected to continue to increase and peak at about 85 million tonnes in 2035, then gradually decrease to about 50 million tonnes in 2045, with imports ceasing by 2050. The plan also mentioned the gradual retirement of coal-fired power plants and conversion to biomass or ammonia.

The Just Energy Transition Partnership (JETP) was declared by Prime Minister Phạm Minh Chính at COP26 in 2021. In response to the statement, Decision No. 2157/QD-TTg established a National Steering Committee (Ban Chỉ đạo quốc gia) for operationalisation.¹⁵

Earlier, in February 2020, Viet Nam had already published the Politburo's Resolution No. 55-NQ/TW,¹⁶ setting out the country's energy development strategy to 2030 and outlook to 2045. The resolution mentioned reducing the share of coal-fired power plants whilst maintaining the domestic coal supply. It also prioritised upgrading coal-fired power plant

¹² Decision No. 60/QD-TTg: <https://thuvienphapluat.vn/van-ban/Tai-nguyen-Moi-truong/Decision-No-60-QD-TTg-Approving-the-master-plan-on-development-of-vietnam-s-138232.aspx>

¹³ Decision No. 403/QD-TTg: <https://vietnamlawmagazine.vn/decision-no-403-qd-ttg-of-march-14-2016-5391.html>

¹⁴ Decision No. 893/QD-TTg: <https://vanban.chinhphu.vn/?docid=208351&pageid=27160>.

¹⁵ Decision No. 2157/QD-TTg: https://datafiles.chinhphu.vn/cpp/files/vbpg/2021/12/2157.signed_01.pdf

¹⁶ Politburo's Resolution No. 55-NQ/TW: <https://thuvienphapluat.vn/van-ban/EN/Tai-nguyen-Moi-truong/Resolution-55-NQ-TW-2020-orientations-of-strategy-for-national-energy-development/519058/tieng-anh.aspx>

technologies, such as introducing USC technology. In Viet Nam, most plants are designed to operate with anthracite coal, which can be predominantly extracted domestically. Sub-C technology, which combusts coal with a thermal efficiency of less than 38%, is the dominant type of plant in Viet Nam, and SC technology with a thermal efficiency of 38%–40% is also used when companies import coal from abroad.¹⁷ Transitioning to USC technology, meaning categorisation as an efficient plant, can allow for combustion coal with a thermal efficiency of 41%–43%. High-temperature (over 593 degrees) and high-pressure steam can achieve greater power generation efficiency, which, in turn, can reduce fuel and, thus, CO₂ emissions.

The National Climate Change Strategy until 2050 (Decision No. 896/QĐ-TTg), published in July 2022, introduced gradual transition policies, such as halting the development of new coal-fired power plants after 2030 and reducing the scale of coal power capacity after 2035.¹⁸

In December 2022, Viet Nam and the International Partners Group (IPG), consisting of the European Union, the United Kingdom (UK), the United States (US), Japan, Canada, Germany, France, Italy, Denmark, and Norway, announced the 'Political Declaration on Establishing the Just Energy Transition Partnership with Viet Nam'. The declaration pledged to mobilise funds, more than US\$8 billion from the IPG and US\$7.75 billion from the Glasgow Financial Alliance for Net Zero (GFANZ),¹⁹ to support Viet Nam's just energy transition (see Table 3.1). The US withdrawal from the JETP in March 2025 (Cocks et al., 2025) may not collapse the entire framework, but could make it slower, costlier, and more uncertain.

Table 3.1. Breakdown of IPG Public Finance by Country and Institution (US\$ million)

| | Country Total | Grants/ Technical Assistance | Concessional Loans | Commercial Development Finance Institution Instruments |
|----------------|---------------|------------------------------|--------------------|--|
| Canada | 59 | 4 | 55 | |
| Denmark | 10 | 10 | | |
| European Union | 920 | 185 | 735 | |
| France | 525 | 1 | 524 | |
| Germany | 672 | 63 | 399 | 210 |
| Italy | 528 | | | 528 |

¹⁷ As we will examine later, both Sub-C and SC are categorised as inefficient plants in Japan, and upgrading techniques are being considered. There may be technical difficulties in implementing new technology (such as ammonia co-firing) into Viet Nam's current facilities.

¹⁸ Decision No. 896/QĐ-TTg: <https://thuvienphapluat.vn/van-ban/EN/Tai-nguyen-Moi-truong/Decision-896-QD-TTg-2022-approving-the-National-strategy-for-climate-change-until-2050/525126/tieng-anh.aspx>

¹⁹ GFANZ will be further assessed in Section 2.4. Funding.

| | Country Total | Grants/ Technical Assistance | Concessional Loans | Commercial Development Finance Institution Instruments |
|--|---------------|------------------------------|--------------------|--|
| Japan | 342 | 2 | | 340 |
| Norway | 251 | 1 | | 250 |
| United Kingdom | 304 | 4 | | 300 |
| United States | 1,050 | 50 | | 1,000 |
| Asian Development Bank | 2,100 | | 1,000 | 1,100 |
| Dutch Entrepreneurial Development Bank | 315 | | | 315 |
| Other | 1,000 | | | 1,000 |
| Total | 8,077 | 322 | 2,713 | 5,043 |

Source: Socialist Republic of Viet Nam (2023, p.97).

The Secretariat for Implementation of the JETP was established by Decision No. 845/QĐ-TTg²⁰ in July 2023 and approved by Decision No. 1009/QĐ-TTg²¹ in August 2023. Decision No. 1009/QĐ-TTg sets a transition roadmap for 2030 and beyond, targeting a renewable energy share of 47% and limiting the total scale of coal-fired power plants to no more than 30,127 MW by 2030. The roadmap also included the prohibition of new coal plant construction and the phase-out of existing plants after 2030. By 2050, the share of renewables is expected to reach 80%–85%. To accelerate the transition from coal to clean energy, four policy plans were mentioned: (1) negotiating the reduction of existing coal-fired power plants,²² (2) developing a roadmap to reduce GHG emissions, (3) transforming coal for alternative uses, and (4) advancing technologies to improve power efficiency. Especially for technological development, pilot studies for carbon capture, sequestration, storage, and utilisation (CCUS); ammonia co-firing for coal-fired power; and methane recovery in coal mining were highlighted.

To encourage the JETP, four working groups were established from August to November 2023.²³ These comprised: (1) the General (Synthesis) Working Group, established by the Minister of Natural Resources and Environment, (2) the Technology and Energy Working Group, established by the MOIT, (3) the Finance Working Group, established by the Minister of Finance, and (4) the Institutional, Policy and Investment Working Group, established by the Minister of Planning and Investment.

²⁰ Decision No. 845/QĐ-TTg: <https://datafiles.chinhphu.vn/cpp/files/vbpg/2023/7/845-ttg.signed.pdf>

²¹ Decision No. 1009/QĐ-TTg: <https://datafiles.chinhphu.vn/cpp/files/vbpg/2023/9/1009-ttg.signed.pdf>

²² The plan does not differentiate between coal-fired power plants and captive plants.

²³ <https://jetpen.dcc.gov.vn/Working-Group>

At COP28 (in 2023), Prime Minister Phạm Minh Chính published the Resource Mobilization Plan (RMP) (Socialist Republic of Viet Nam, 2023), representing a key milestone for implementing the JETP.

In January 2024, the government approved the Strategy for Development of Viet Nam's Coal Industry to 2030, with a vision to 2045 (Decision No. 55/QĐ-TTg), which projects coal output to reach around 45 million–50 million tonnes per year by 2030, and gradually decrease to around 38 million–40 million tonnes in the period from 2031 to 2045.²⁴

Decision No. 266/QĐ-TTg, the Global Coal to Clean Power Transition Statement, was adopted in February 2025, aligning Viet Nam's efforts with global low-carbon trends and mobilising domestic and international resources for clean power development.²⁵ The roadmap describes simultaneously reducing emissions from coal-fired power plants and reducing the number of plants. Pilot projects for installing carbon capture systems and decommissioning a total of 540 MW of capacity at Ninh Binh (100 MW) and Pha Lai 1 (440 MW) plants are planned by 2030 if efficiency and emission reduction targets are not met. Both plants, located in the north, began operation in the 1970s and 1980s. Moreover, from a technical perspective, pilot co-firing projects of biomass or ammonia with coal to reduce CO₂ emissions are planned by 2030. Phase 2031–2040 strictly requires retiring inefficient or ageing coal plants, and bans any new coal plants from being approved. Around 1,160 MW of plants that have reached the end of their economic life are expected to be retired by 2045. Pha Lai 2 (600 MW), Na Duong (110 MW), and Formosa Dong Nai (450 MW) are amongst those to be decommissioned if fuel conversion is not achieved. Except for Formosa Dong Nai, these facilities are located in the north. Ultimately, a total of 3,335 MW of coal plants will be retired by 2050 if they do not convert their fuel type or install carbon capture systems, including Uong Bi MR (600 MW), Hai Phong 1 (600 MW), Quang Ninh (1,200 MW), Cao Ngan (115 MW), Cam Pha 1 & 2 (600 MW), and Son Dong (220 MW).

The revised PDP8, approved in April 2025, also includes coal strategies (Decision No. 768/QĐ-TTg).²⁶ The plan suggests policies to phase out coal-fired power plants by 2050. New coal facilities in the pipeline will be implemented by 2030, but no new projects will be allowed.

Recently, in April 2025, Viet Nam launched the JETP portal,²⁷ which is expected to introduce the implementation of the project.

Table 3.2 summarises the main coal transition policies in Viet Nam.

²⁴ Decision No. 55/QĐ-TTg: <https://vanban.chinhphu.vn/?pageid=27160&docid=209535>

²⁵ Decision No. 266/QĐ-TTg: <https://datafiles.chinhphu.vn/cpp/files/vbpg/2025/02/266-ttg.signed.pdf>

²⁶ Decision No. 768/QĐ-TTg: <https://vanban.chinhphu.vn/?pageid=27160&docid=213388>

²⁷ <https://jetpen.dcc.gov.vn/>

Table 3.2. Trends in Coal Transition Policies in Viet Nam

| | | |
|---------------|-------------------------------------|--|
| February 2020 | Politburo's Resolution No. 55-NQ/TW | ➤ Reducing the share of coal-fired power plants whilst maintaining the domestic coal supply |
| July 2022 | Decision No. 896/QD-TTg | ➤ No new development of coal-fired power plants after 2030 ➤ Reduction in the scale of coal power capacity after 2035 |
| May 2023 | Decision No. 500/QD-TTg | ➤ No new coal facilities in the pipeline will be implemented ➤ Plants that have been operating for 20 years will be converted to biomass or ammonia |
| July 2023 | Decision No. 893/QD-TTg | ➤ Gradual retirement of coal-fired power plants |
| August 2023 | Decision No. 1009/QD-TTg | ➤ The total scale of coal-fired power plants is to be no more than 30,127 MW until 2030 |
| February 2025 | Decision No. 266/QD-TTg | ➤ Pilot projects for installing carbon capture systems and decommissioning |
| April 2025 | Decision No. 768/QD-TTg | ➤ Phase out coal-fired power plants by 2050 |

Source: Compiled by authors.

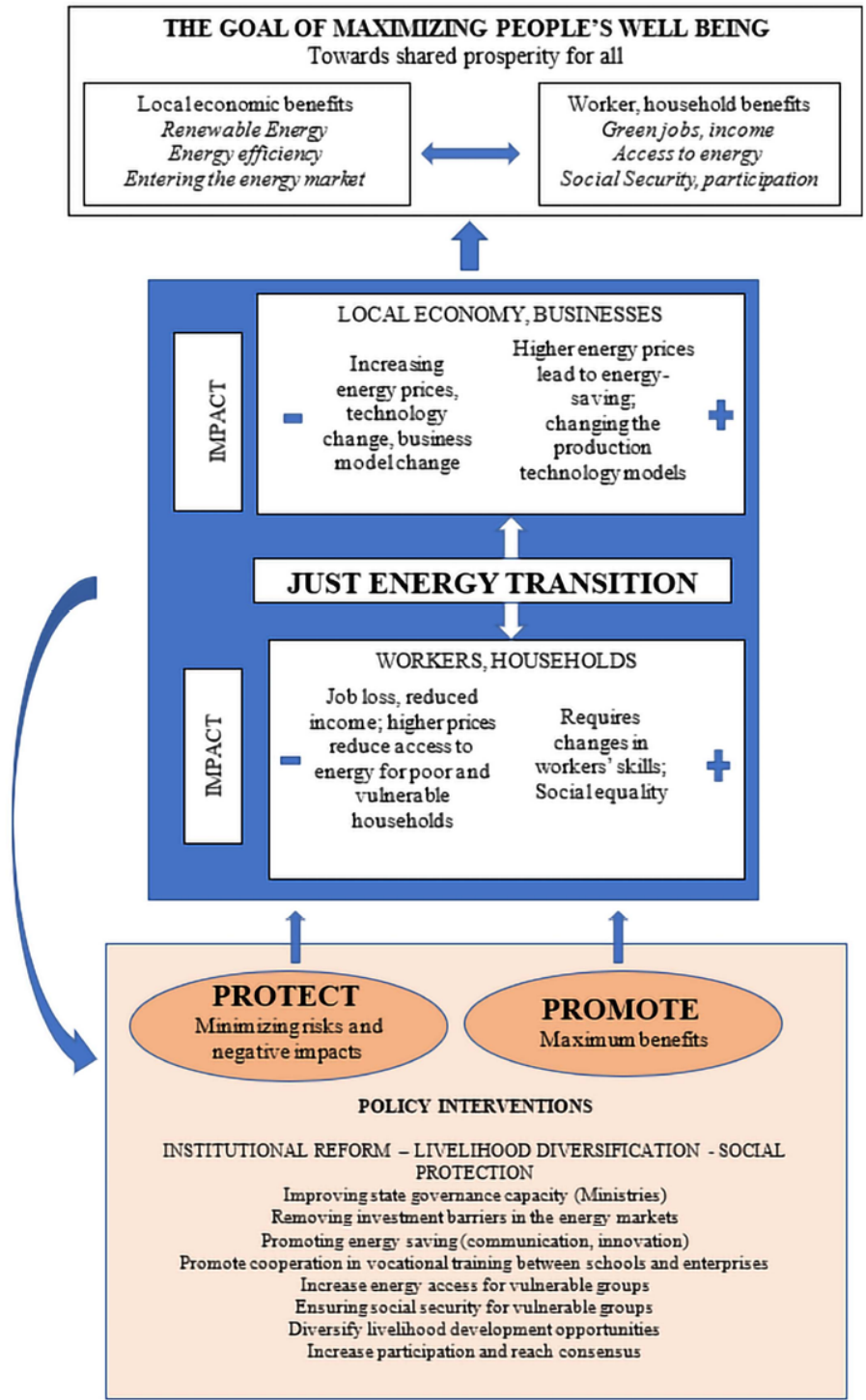
2. Transition Plan

A just transition is needed to ensure that existing environmental threats are alleviated without causing harm to society. The International Labor Organization (ILO) indicates that 'a just transition for all towards an environmentally sustainable economy ... needs to be well managed and contribute to the goals of decent work for all, social inclusion and the eradication of poverty' (ILO, 2015, p.4). Similarly, the Resource Mobilisation Plan states that 'the overall goal is to maximize people's wellbeing. More specifically, to ensure that workers, households and businesses affected by the energy transition (a) have access to energy and energy security, (b) can benefit from sustainable and inclusive economic development and seize business and employment opportunities generated by the transition, (c) are protected from negative effects of the transition, and (d) participate in the energy transition process' (Socialist Republic of Viet Nam, 2023, p.80). We also share

this view, believing that appropriate policy measures are necessary for achieving these objectives.

Figure 3.1, included in the Resource Mobilisation Plan, is a conceptual diagram illustrating the JETP’s framework in Viet Nam.

Figure 3.1. JETP Framework in Viet Nam



Source: Socialist Republic of Viet Nam (2023, p.81).

Although we share the view of the Resource Mobilisation Plan, we would like to further clarify the just transition from a socio-economic point of view, focusing specifically on workers, the economy, and the environment. The socio-economic aspects of the coal transition encompass these elements (see Figure 1.1). For example, workers in mines (upstream) and coal-fired power plants (downstream) will need to secure new employment following the transition. Local economies may struggle financially as workers and their families move to different locations. There are also significant risks to the environment that may arise after the closure of mines and power plants. The three overlapping circles in Figure 1.1 (shown in red) represent these elements of a sustainable coal transition.

In the following sections, we also review the challenges of financing the coal transition. Finally, we assess the broader socio-economic impacts by analysing the relevant models. We will also observe the possible business model of closing coal-fired power plants.

2.1. Workers

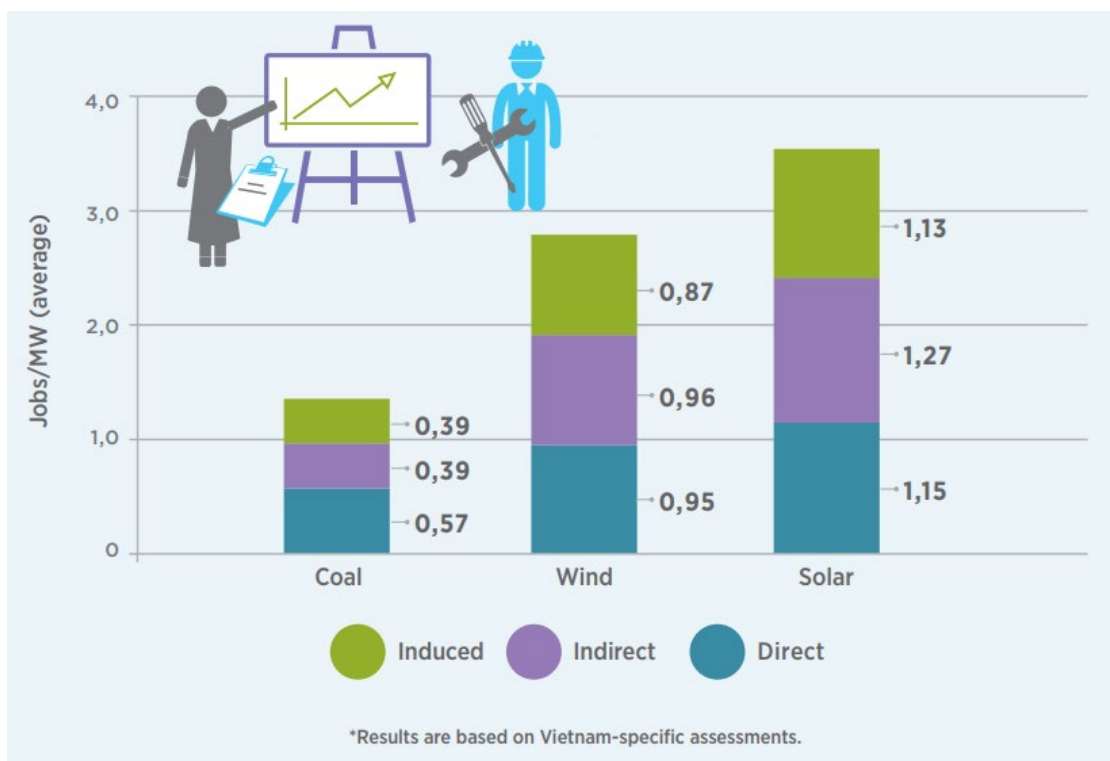
Job loss is one of the most pressing issues of the energy transition. The exact number of affected workers remains uncertain, but the Resource Mobilisation Plan estimates that about 35,000 people are employed in the coal-fired power industry and between 77,000 and 111,000 in mining, amounting to a minimum of 112,000 workers across the coal sector. Statistics from the United Nations Industrial Development Organization (n.d.) show that 78,004 employees were working in the mining of coal and lignite in 2022, which is consistent with the Resource Mobilisation Plan. A 2024 news report states that there are currently up to 100,000 Vietnamese workers involved in the coal industry (Dương, 2024), which may indicate that the number of workers has decreased in recent years. Coal mining companies in Viet Nam have been gradually reducing the number of employees whilst maintaining overall production levels (Nguyễn, 2024).

Within the coal mining sector, companies often face a lack of workforce stability. Recently, Vinacomin has strived to improve working conditions, for instance, by upgrading technologies to reduce the risk of accidents and building new dormitories to improve employee retention rates (Viet Nam News, 2025-c). It is also collaborating with textile firms in Quang Ninh, the largest coal-producing area, to create job opportunities for miners' wives.

The Resource Mobilisation Plan highlights the potential for retraining and employment shifts from coal to clean energy sources like solar and wind. The benefits of renewables were also pointed out by a 2020 joint study by the Institute for Advanced Sustainability Studies, the Independent Institute for Environmental Issues, and the Green Innovation and Development Centre (IASS/UfU/GreenID, 2020). The study suggests that renewables are cheaper than extending the grid, can create more employment, and will have an overall positive impact on people's health. In terms of employment, replacing coal power

plants with wind or solar can more than double the number of jobs per average MW capacity (see Figure 3.2).

Figure 3.2. Employment Factors for Coal, Wind, and Solar in Viet Nam



Note: In this figure, commas are used as the decimal separator.

Source: Reprinted from IASS/UfU/GreenID (2020, p.12).

According to a COBENEFITS (2019) report, construction and installation jobs are numerous but temporary. Operation and maintenance create stable, local jobs, but require different skills. By 2030, it is anticipated that the need for more higher-skilled workers in the power industry will increase by 31% for positions in construction and installation, and by 25% for operation and maintenance. Currently, there is limited local technical expertise for solar and wind power sector in Viet Nam. Many developers recruit engineers who are not specifically trained for the renewable energy sector or rely on foreign experts.

There are several points to consider. First, skill matching will be a challenge for reemployment. A report by Agora Energiewende, ICSC, and IESR (2023, pp.37–8) indicates that ‘in 2021, 63 percent of the workforce in the mining and quarrying industry had attained at least a basic level of education, either vocational training or intermediate, college or university education, and beyond, 71 percent of the employees in thermal power plants have a university degree’. A supposed value chain of renewable energy includes project development, manufacturing, distribution, construction, installation, operation, and maintenance. As the Resource Mobilisation Plan points out, some jobs for

renewable energy might require different skill sets, and, thus, training for workers is a significant priority.

Another concern is job stability. Even if displaced workers can find new jobs, it remains uncertain how long they will be able to retain those positions. Some jobs might offer only temporary or part-time work and require frequent relocation. Such instability could create social and financial strain on workers and their families.

Finally, electricity prices warrant careful attention. According to the Energy and Environment Consultancy Joint Stock Company (VNEEC, 2023), electricity bills account for approximately 30%–40% of the average monthly income of poor households, which make up 7.52% of the population. If the shift towards renewable energy increases costs more than they already are, people who lost their jobs in the coal-related sectors will suffer twice as much.

2.2. Economy

In March 2019, the government approved the provision of energy savings (Decision No. 280/QĐ-TTg).²⁸ The National Program on the economic and efficient use of energy promotes technical support, scientific/technological research and product development, market transformation, and training and development of human resources for the 2019–2030 period. Although the decision does not set a specific reduction or phase-out target for coal-fired power plants, reducing demand will slow growth in the energy supply, including coal-fired generation. In this framework, coal companies have been required to develop roadmaps towards the goal of energy savings and energy efficiency.

The government has also strengthened its commitment to renewable energy investment. Under the new PDP8, renewable energy is targeted to reach a 74%–75% share rate by 2050.²⁹ For solar energy specifically, the plan intends for 50% of office buildings and 50% of households to have rooftop solar systems by 2030, with a potential of 963,000 MW in total.

Several studies show the development of domestic supply chains for renewable energy technologies in Viet Nam. The solar manufacturing chain is characterised by a high degree of concentration in upstream segments, particularly in polysilicon refining, ingot and wafer production, and advanced cell fabrication. These stages are capital-intensive, require highly specialised process engineering and quality control, and benefit significantly from economies of scale. Manufacturing capacity for cells and modules is developing in Viet Nam, though China has been dominating the market (IEA, 2022). There is a growing trade network involving various countries that does not include China. For instance, trade between Viet Nam and the US has been growing since 2017. However,

²⁸ Decision No. 280/QĐ-TTg: <https://vanban.chinhphu.vn/default.aspx?pageid=27160&docid=196453>

²⁹ Decision No. 768/QĐ-TTg: <https://vanban.chinhphu.vn/?pageid=27160&docid=213388>

the IEA (2022) points out that domestic production in the US can lower overall CO₂ emissions since Viet Nam heavily relies on their energy mix in fossil fuels.

The supply chain dynamics of wind energy differ substantially from solar. Wind projects, particularly offshore wind, involve large and heavy components, offering opportunities for localisation when domestic industries possess competencies in steel fabrication, marine logistics, or offshore engineering. Viet Nam’s long-standing oil and gas sector, together with shipbuilding and heavy fabrication capacity located near major ports, positions the country favourably for the localised production of turbine towers, foundations (monopiles or jackets), and cable infrastructure (Norwegian Embassy in Hanoi and Innovation Norway, 2023). However, the manufacture of wind turbine nacelles, generators, and blades remains significantly more challenging. These components require advanced composite manufacturing, specialised tooling, and sophisticated process control systems. The absence of a fully defined long-term offshore wind deployment schedule in Viet Nam has thus far constrained commitments to large-scale turbine assembly or blade production.

Historically, northern Viet Nam developed as a centre for heavy industry and export-oriented manufacturing, whilst southern Viet Nam evolved as a hub for electronics assembly, logistics, and distributed energy services. These patterns condition how renewable manufacturing capacities are distributed. Domestic supply-chain development will be most successful if industrial policy aligns with regional strengths. For example, incentives for component manufacturing are required in the north, whereas support for operation and maintenance can encourage business in the south.

At the legal level, the Government of Viet Nam first introduced a feed-in tariff (FiT) policy in 2011 to guarantee a fixed price per kWh for electricity generated from renewable sources, initially for wind power and later extended to solar in 2017. The prices of wind and solar were revised to increase in 2018 and 2020, respectively (see Table 3.3).

Table 3.3. Revised Feed-in Tariff Rates for Wind and Solar (D)

| Renewables | Feed-In Tariff Rate | Commercial Operation Date | Decision |
|------------|--|--|--|
| Wind | Onshore wind: 1,928/kWh Offshore wind: 2,223/kWh | Before 1 November 2021 | First introduced in 2011 and revised in 2018 (Decision No. 39/2018/QĐ-TTg) |
| Solar | Ground-mounted: 1,644/kWh Floating: 1,783/kWh Rooftop: 1,943/kWh | Between 1 July 2019 and 31 December 2020 | First introduced in 2017 and revised in 2020 (Decision No. 13/2020/QĐ-TTg) |

Source: Decision No. 39/2018/QĐ-TTg and Decision No. 13/2020/QĐ-TTg.

However, several concerns arose regarding the power purchase agreement (PPA). EVN, the sole offtaker, is not required to purchase electricity, resulting in revenue uncertainty for project developers. Furthermore, the PPA does not offer a government guarantee for EVN's commitments to purchase electricity (International Union for Conservation of Nature, 2022). In 2022, the MOIT announced a two-year pilot programme for renewable energy producers to sell clean electricity directly to private off-takers (Thompson and Chow, 2022). These direct PPAs will encourage companies to invest in their own renewable energy production.

FiTs in solar and wind expired after 2020 and 2021, respectively. In 2023, Decision No. 21/2023/QĐ-BCT established a ceiling electricity price mechanism for solar and wind power plants (see Table 3.4).³⁰ The purpose of the decision was to provide a framework for determining electricity prices for renewable projects that commenced operation after the expiration of the previous FiT schemes.

Table 3.4. Price Framework for Solar and Wind, 2023 (D)

| | Price Ceiling |
|----------------------|---------------|
| Ground-mounted solar | 1,184.90/kWh |
| Floating solar | 1,508.27/kWh |
| Onshore wind | 1,587.12/kWh |
| Offshore wind | 1,815.95/kWh |

Source: Decision No. 21/2023/QĐ-BCT.

In November 2023, Circular 19/2023/TT-BCT established a methodology for building annual electricity generation price brackets for specified solar and wind power plants rather than setting a fixed tariff.³¹ The electricity generation pricing framework ranges from the minimum value (D0/kWh) to the maximum value. For solar plants, the maximum value of the bracket should consider the average annual radiant intensity across the North, Central, and South. For wind plants, new wind projects will face a ceiling tariff value determined annually under this method. The actual price for a given project will depend on negotiations within the approved price bracket.

In 2024, Viet Nam issued Decree No. 80/2024/ND-CP, which established two direct PPA models between private renewable energy developers and private electricity consumers (Hauber, 2024).³² The wheeling model allows private developers to build renewable

³⁰ Decision No. 21/2023/QĐ-BCT: <https://thuvienphapluat.vn/van-ban/Tai-nguyen-Moi-truong/Quyết-dinh-21-QĐ-BCT-2023-khung-gia-phat-dien-nha-may-dien-mat-troi-dien-gio-chuyen-tiep-549601.aspx>

³¹ Circular 19/2023/TT-BCT: https://vepg.vn/wp-content/uploads/2024/08/19_2023_TT-BCT_588713.pdf

³² Decree No. 80/2024/ND-CP: <https://thuvienphapluat.vn/van-ban/Thuong-mai/Nghi-dinh-80-2024-ND-CP-co-che-mua-ban-dien-truc-tiep-giua-Don-vi-phat-dien-voi-Khach-hang-615882.aspx>

energy facilities, selling output at a wholesale price to EVN, which then transmits this energy via its grid to the buyer. The fully private model permits developers to build and own generation and transmission infrastructures, thereby selling power directly to consumers.

Decision No. 988/QĐ-BCT, issued in April 2025, approves the electricity generation price framework for solar power plants in Viet Nam (see Table 3.5).³³ It specifies maximum electricity generation prices (excluding value-added tax) for solar power plants, categorised by region (North, Central, and South) and plant type (ground-mounted or floating), with and without battery energy storage systems. It shows that the tariff rates reflect lower solar radiation in the North (hence higher tariffs) and higher radiation in the South (hence lower tariffs) under the region-based system.

Table 3.5. Price Frameworks for Solar, 2025 (D)

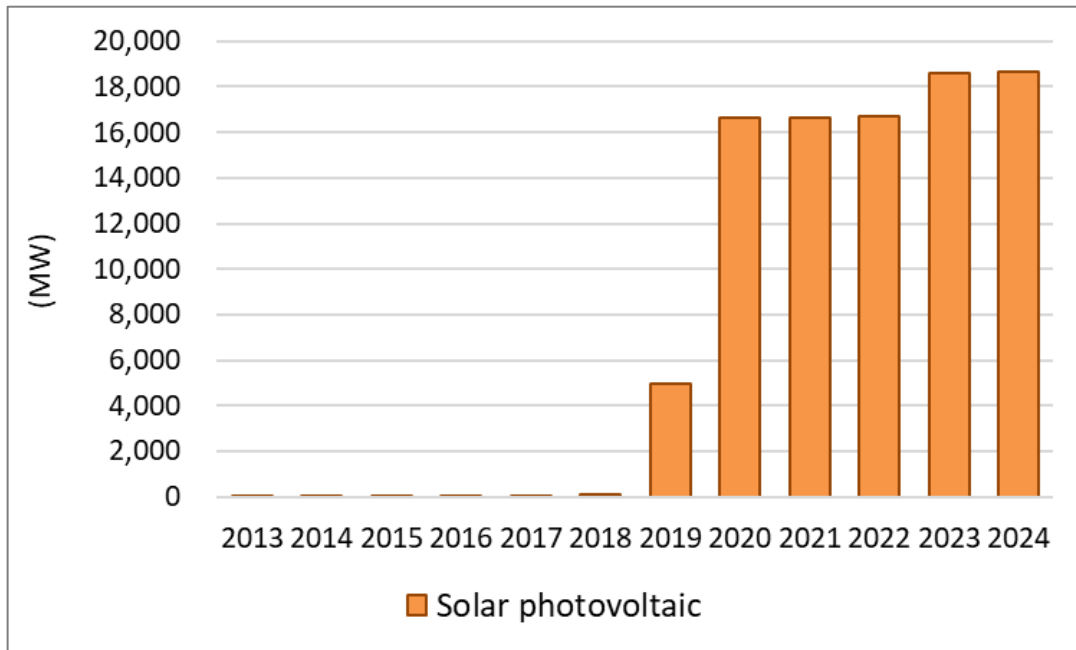
| | North | Central | South |
|------------------------------|--------------|--------------|--------------|
| Ground-mounted | 1,382.7/kWh | 1,107.1/kWh | 1,012.0/kWh |
| with battery storage systems | 1,571.98/kWh | 1,257.05/kWh | 1,149.86/kWh |
| Floating | 1,685.8/kWh | 1,336.1/kWh | 1,228.2/kWh |
| with battery storage systems | 1,876.57/kWh | 1,487.18/kWh | 1,367.13/kWh |

Source: Decision No. 988/QĐ-BCT.

The FiT scheme substantially increased the installed electricity capacity of both solar and wind power generation (see Figure 3.3 and Figure 3.4). However, as shown in Figure 3.3, the installed capacity of solar has since stagnated.

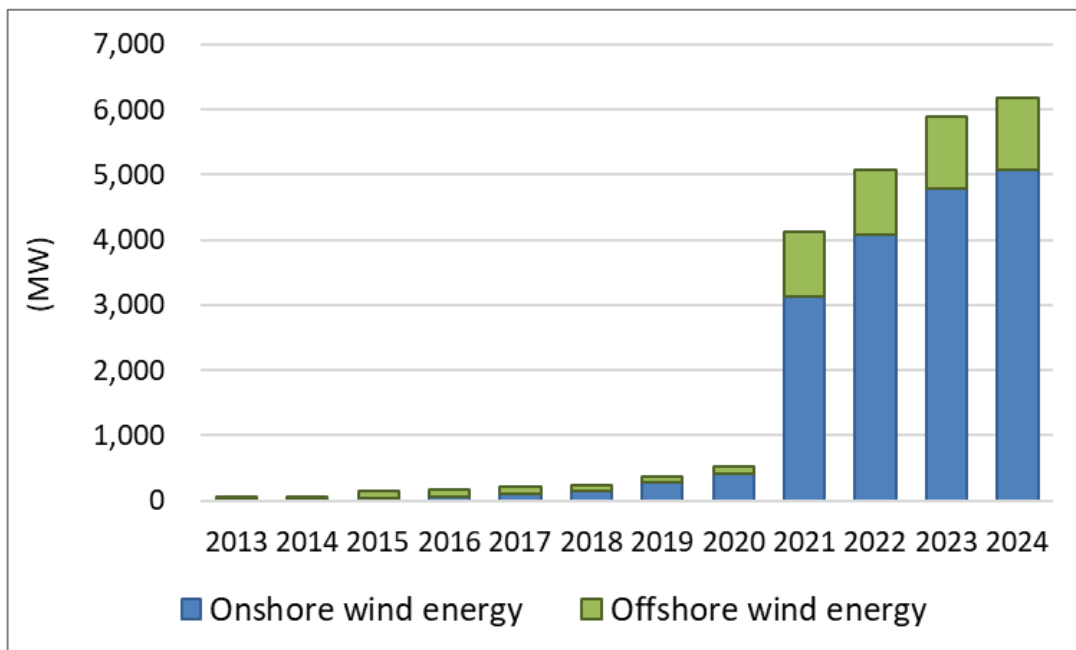
³³ Decision No. 988/QĐ-BCT: <https://thuvienphapluat.vn/van-ban/Tai-nguyen-Moi-truong/Quyết-dinh-988-QĐ-BCT-2025-khung-gia-phan-dien-nha-may-dien-mat-troi-651205.aspx>

Figure 3.3. Electricity Installed Capacity of Solar in Viet Nam



Source: IRENA Renewable Energy Statistics database.

Figure 3.4. Electricity Installed Capacity of Wind in Viet Nam



Source: IRENA Renewable Energy Statistics database.

Wind power has enormous potential in Viet Nam. According to the revised PDP8,³⁴ offshore wind is set to reach 6,000–17,032 MW in operation during the 2030–2035 period and aims for 113,503–139,097 MW by 2050. To support this development, regulatory

³⁴ Decision No. 768/QĐ-TTg: <https://vanban.chinhphu.vn/?pageid=27160&docid=213388>

frameworks for wind power have recently been strengthened. Decree No. 58/2025/ND-CP, published in March 2025, set incentives for certain offshore wind projects.³⁵ It has also been stipulated that at least 80% of the electricity produced by offshore wind power plants must be purchased under long-term contracts (with EVN or relevant buyers) for up to 15 years. In addition to domestic companies, foreign investors can participate in or bid for offshore wind projects as well.

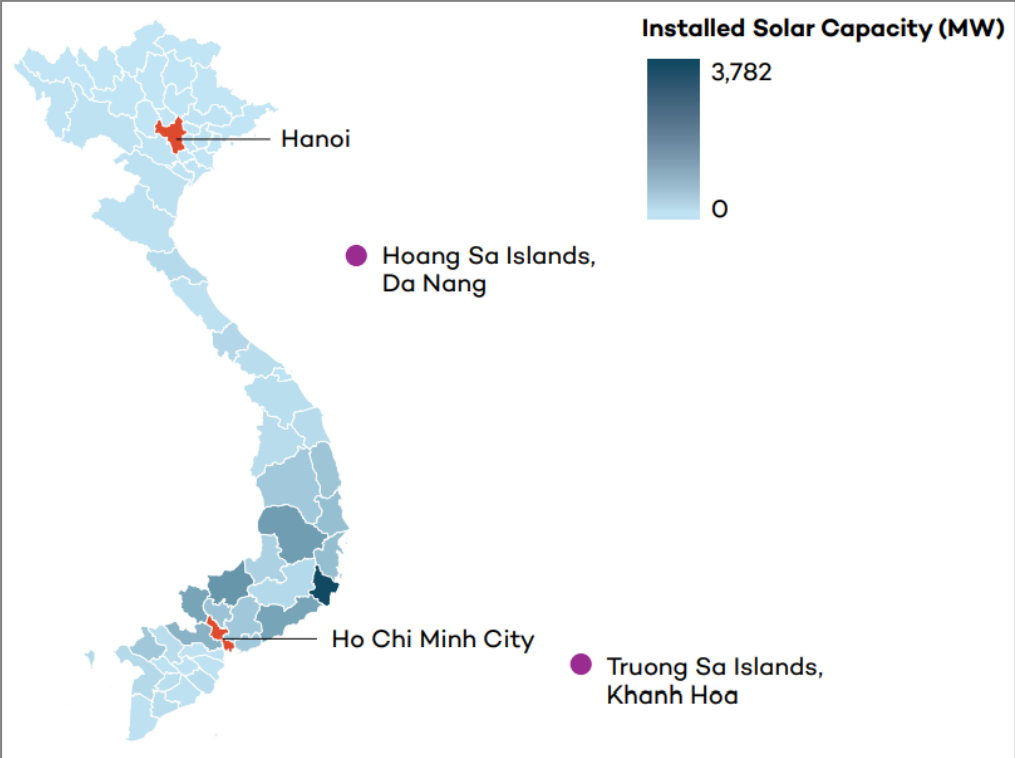
Circular No. 12/2025/TT-BCT, issued in February 2025, provides guidance for prices and allows flexibility in the PPA.³⁶ Under this circular, PPA prices must be based on (1) reasonable and valid costs over the project's economic life, and (2) a financial internal rate of return no greater than 12%.

Although the government has supported the development of renewable energy, there are several major challenges, such as grid capacity and transmission. EVN manages the country's electricity grid, managing power plants totalling 29.9 gigawatts (GW), which accounted for 37% of the national generation capacity in 2023 (Halsey et al., 2025). Many solar and wind projects have also been developed in the southern and central provinces, where resource potential is high. However, the primary electricity demand centres are Hanoi (in the north) and Ho Chi Minh City (in the south), which require power transmission (see Figure 3.5 and Figure 3.6).

³⁵ Decree No. 58/2025/ND-CP: <https://vanban.chinhphu.vn/?pageid=27160&docid=213011>

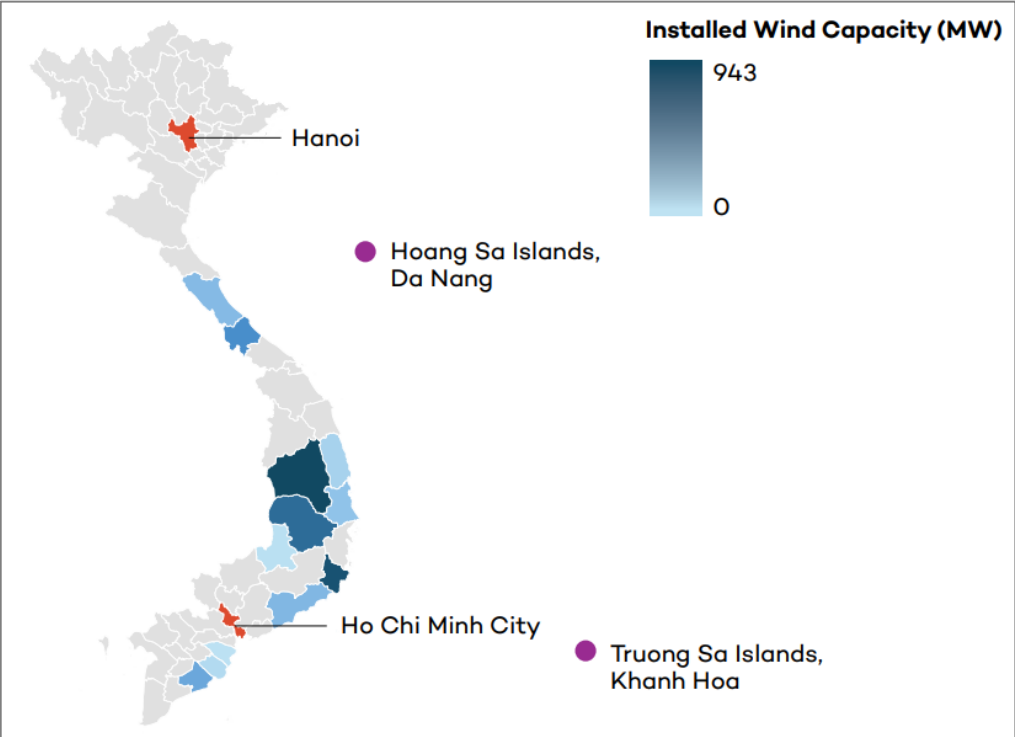
³⁶ Circular No. 12/2025/TT-BCT: <https://thuvienphapluat.vn/van-ban/Thuong-mai/Thong-tu-12-2025-TT-BCT-nguyen-tac-tinh-gia-dien-de-thuc-hien-du-an-dien-luc-643343.aspx>

Figure 3.5. Installed Solar Capacity in Viet Nam (Ground-Mounted and Rooftop), 2024



Source: Halsey et al. (2025, p.38).

Figure 3.6. Installed Wind Capacity in Viet Nam, 2024



Source: Halsey et al. (2025, p.39).

Due to the power transfer from production to consumption sites, the World Bank (2022a) estimates that 15%–25% of output in existing projects is being curtailed, on average, and in extreme cases, up to 80% for some solar projects in the south. The discrepancy between production and consumption has also been observed in coal. Thus, continued support will be necessary to satisfy energy demand in a sustainable manner.

Moreover, the expansion of renewable energy projects, fuelled by FiTs, has contributed to EVN's financial deficit from power purchase payments (Nguyen and Hauber, 2025). As the cost of solar, wind, and battery storage systems continues to decline globally, there is a possibility that Viet Nam can replace FiTs with transparent auctions. Project developers have been encouraged to optimise design, specifications, and implementation through competitive and transparent bidding.

It is important to note that the government appears to be phasing out FiTs and may move towards auctions or negotiated prices for new projects. The earlier FiT regime was successful in rapidly scaling renewable energy capacity, but it also produced spatially uneven development outcomes. Most solar and wind were built in the South-Central provinces, therefore causing oversupply in specific regions. At the same time, the northern grid experienced comparatively lower renewable penetration, partly due to weaker irradiation and wind speeds. The shift away from FiTs will address the need for greater alignment between project siting and regional grid capacity, reflecting a maturation of the sector and the state's evolving approach to system planning.

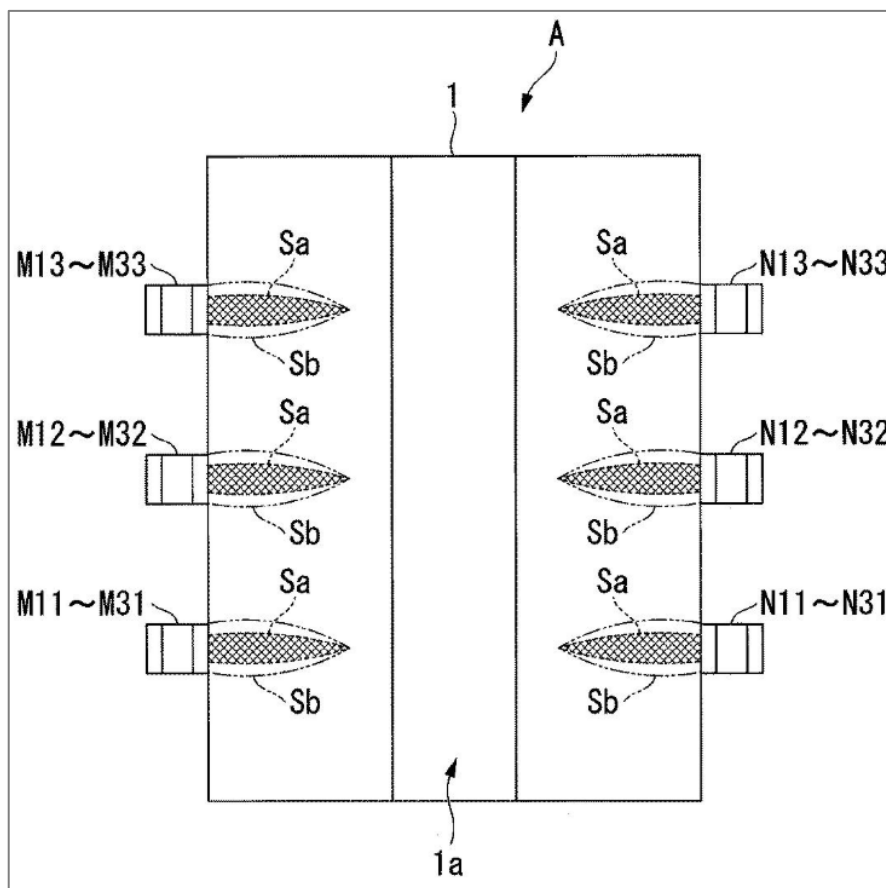
As discussed further in Chapter 4 (Interview), there is a possibility of utilising existing coal-fired plants. One potential option is the introduction of biomass co-firing. Erex Co., Ltd., a Japanese retail electricity supplier, announced that it has begun testing biomass co-firing in Viet Nam (Erex, 2025). Together with Vinacomin Power Holdings, the Na Duong Power Plant (two 55 MW units) has begun to combust biomass fuel (wood chips) at co-firing rates of up to 20%. Na Duong Power Plant, located in the north of Viet Nam, has been operating since 2004. Cao Ngan Power Plant (two 57 MW units), located in the north of Viet Nam, is also planned to conduct biomass co-firing tests in the autumn of 2025.

Ammonia co-firing technology is still undergoing demonstration testing, but it is one of the promising technologies that can take advantage of existing plants. Ammonia (NH_3) is a compound of nitrogen and hydrogen that can be directly used as fuel and does not emit CO_2 . However, reduced boiler efficiency due to low flame temperature and increased nitrogen oxides (NO_x) emissions are the main challenges of ammonia combustion.

In Japan, IHI Corporation, a Japanese engineering company, and JERA, a Japanese power generation company, have been cooperating to promote the conversion of coal-fired boilers to ammonia since 2021. They discovered that optimising the burner structure enables stable combustion and maintains a low level of NO_x emissions. IHI Corporation

holds a patent for a burner that can be used for existing coal-fired facilities.³⁷ The combined burner injects and burns carbon fuel (such as pulverised coal) as well as ammonia fuel. The ammonia combustion burners (Sa in Figure 3.7) are located in the centre and surrounded by the carbon fuel combustion burners (Sb in Figure 3.7).

Figure 3.7. Combined Burners



Note: The combined combustion furnace A has burners M11-33 and N11-33. Furnace 1 is vertical and cylindrical, and the combustion gases will be released from the bottom of Furnace 1a.

Source: J-PlatPat, Patent No. 7049773.

By using this technology, Hekinan Thermal Power Station Unit 4, in Aichi Prefecture, succeeded in converting 20% of coal into ammonia. Both companies aim to conduct large-scale tests by 2028 to achieve a conversion of 50% or more.

Research is also underway on ammonia mono-fuel combustion. IHI Corporation has a test facility for this technology that focuses on suppressing NOx emissions, and it is working on further improving the technology. Additionally, Mitsubishi Heavy Industries, a Japanese engineering and electronics company, has developed ammonia burners. The company tries 'combusting coal and ammonia in separate burners (single-fuel firing

³⁷ Patent No. 7049773.

burners) to co-firing them in the boiler' (Yamashita et al., 2023, p.1).

Control of NO_x emissions will be critical when introducing co-firing technology into Viet Nam's coal-fired plants. Japan has taken several measures to reduce NO_x emissions since the 1970s. Low NO_x technologies for coal-fired power plants in Japan can be divided into combustion improvement and flue gas treatment technologies. However, in Viet Nam, the exact measures regarding NO_x are unclear. Applying the current Japanese co-firing technology may cause an increase in NO_x emissions despite reducing CO₂. It is said that 'most coal power plants in Viet Nam were originally designed and operated with Anthracite coal standards' (Phuong and Quang, 2020), and may require different technological adaptations.

Currently, most plants in Viet Nam use Sub-C technology, which combusts coal with a thermal efficiency of less than 38% due to the characteristics of domestic anthracite (Energy and Environment Consultancy Joint Stock Company, 2023). SC technology, with a thermal efficiency of 38%–40%, is also used when the company imports coal from abroad. Both technologies are categorised as inefficient plants in Japan, and upgrading techniques are being considered. Therefore, there should be a thorough assessment before introducing co-firing technologies.

Hydrogen co-firing represents another emerging avenue, though its development remains relatively nascent. Kansai Electric Power Company, a Japanese electric company, recently launched a demonstration project at the Himeji Second Power Plant (a natural gas-fired facility) in April 2025. The company utilises existing gas turbine facilities for hydrogen co-firing, with a co-firing ratio of 30%. Nevertheless, more research and technological developments are required when introducing hydrogen into coal-fired power plants.

Recently, Viet Nam and the Asian Development Bank (ADB) signed a memorandum of understanding (MOU) on cooperation in the energy and power sector (Ministry of Industry and Trade of the Socialist Republic of Vietnam, 2025). Aligning with PDP8, the MOU lists three priority areas for the next five years. First, Viet Nam and ADB will propose a roadmap for introducing biomass, green ammonia, and green hydrogen co-firing technologies at coal- and gas-fired power plants. Second, they will support the development of regional power grids, the construction of international power transmission lines, and the promotion of cross-border electricity trade. Finally, the partnership will advance the expansion of battery energy storage systems and the establishment of legal frameworks to improve the stability and adaptability of the power system to higher shares of renewable energy. ADB will provide a technical assistance programme for up to US\$1.4 million.

Some projects to revitalise the former coal-related economy have focused on tourism. Quang Ninh, which holds the largest coal reserves, has articulated a policy goal of transitioning to a green economy by 2030. One of its primary ambitions is to become an

international tourism hub. The province is home to Ha Long Bay, a World Heritage Site that attracts a substantial number of tourists. In 2022, it was reported that 'roughly ten million tourists visited the province in the first ten months of 2022, three and a half times higher than the figure in 2021. The figure is expected to top 11.5 million by year end' (Viet Nam News, 2022). Exploring coal-mine-based tourism could be a valuable experience for tourists (DTiNews, 2025). The province has also attempted to integrate virtual reality technologies into its tourism sector, and several museums have adopted digital tools to attract tourists (Hung, 2025).

Tourism holds potential for reemploying workers from the coal sector in a new industry. However, several challenges remain. For instance, opening up to coal-related tourism will likely require coordination amongst mining authorities, environmental authorities, and tourism departments. Furthermore, closed mines also need rehabilitation or environmental cleanup, which will take time and money. If these regulatory and environmental concerns are resolved, the tourism industry would be one of the most promising options for coal-phasing communities.

2.3. Environment

The Law on Environmental Protection 2020 established requirements for environmental impact assessments, pollution control, emissions, and ambient environmental standards.³⁸ The coal industry, encompassing mining, coal power plants, and steel production, must comply with these obligations.

In 2024, Decision No. 215/QĐ-TTg set a strategy for the energy sector to protect the environment.³⁹ Regarding the coal mining industry, the decree requires mines to adopt pollution prevention, ecological restoration, and land/water protection. However, whilst the decree identifies several environmental risks, it does not provide particularly detailed technical requirements or a comprehensive policy framework.

Circular No. 45/2024/TT-BTNMT, the National Technical Regulation on Industrial Emissions, specifies permissible pollutant emission limits for industrial emission sources.⁴⁰ These are detailed in QCVN 19:2024/BTNMT, which categorises coal power plants as industrial emission sources subject to these standards.⁴¹

³⁸ Law on Environmental Protection and Decree No. 08/2022/ND-CP: https://winrock.org/wp-content/uploads/2023/02/LuatBVMT-Eng_20230203.pdf

³⁹ Decision No. 215/QĐ-TTg: <https://thuvienphapluat.vn/van-ban/Tai-nguyen-Moi-truong/Quy-et-dinh-215-QD-TTg-2024-Chien-luoc-phat-trien-nang-luong-quoc-gia-Viet-Nam-den-2030-600877.aspx>

⁴⁰ Circular No. 45/2024/TT-BTNMT: <https://thuviennhadat.vn/van-ban-phap-luat-viet-nam/circular-45-2024-tt-btnmt-promulgating-national-technical-regulation-on-industrial-emission-648183.html>

⁴¹ QCVN 19:2024/BTNMT: https://moitruongachau.com/vnt_upload/law/02_2025/Quy_chuan_Viet_Nam_QCVN_19_2024_BTNMT.pdf

Regarding the development of carbon pricing, Decree No. 06/2022/ND-CP on the mitigation of GHG emissions and the protection of the ozone layer provided detailed guidance on GHG inventories, the allocation of emission quotas, and carbon market roadmaps.⁴² Decision No. 01/2022/QĐ-TTg promulgated a list of sectors and facilities emitting GHGs that must conduct GHG inventories, including the energy, transport, construction, industry, agriculture, and waste sectors.⁴³ In 2025, Decree No. 119/2025/ND-CP established a legal framework for emissions quotas and a pilot emissions trading scheme (ETS).⁴⁴ The Ministry of Agriculture and Environment allocates GHG emission quotas, and for the FY 2025–2026 phase, emission allowances will be allocated before 31 December 2025 amongst thermal power plants, iron and steel production, and cement production. These sectors can use carbon credits for no more than 30% of the allocated GHG emission quota from several international projects. International carbon credit exchange and offset mechanisms include Article 6.2 and 6.4 of the Paris Agreement. According to S&P Global (2025), 'Viet Nam's ETS will cover only 27 crude steel production facilities in total of over 300, but these already constitute over 80% of the steel sector's emissions. The same with the cement industry.'

Although such legal and regulatory frameworks, such as on actual permissible emission levels, are relatively recent, many plants may have exceeded these limits in the past. Owners and operators must introduce pollution control and monitoring technologies, which will increase operational costs.

In addition to the national legislation, there have been several initiatives at the regional level. Quang Ninh province, in particular, has made strong commitments to protecting the environment. According to an article published by Vietnam Energy Online (2020), 'since 2009, all new mining investments in the province must be provided for approval of environmental impact assessment reports and commit to environmental protection before they are considered for land lease agreements. In addition, the province has issued guidelines on natural resource management and environmental protection in mineral activities, established the Quang Ninh Environmental Protection Fund (EPF), and approved urgent coal industry environmental protection solutions for the 2016-2020 period.'

2.4. Funding

Many of Viet Nam's coal power projects are currently facing a dire lack of investment. Global coal divestment trends, which began to accelerate in the early 2010s, have

⁴² Decree No. 06/2022/ND-CP: <https://climate-laws.org/documents/decreed-no-062022nd-cp-on-mitigation-of-green-house-gas-ghg-emissions-and-protection-of-ozone-layer-5a50>

⁴³ Decision No. 01/2022/QĐ-TTg: <https://thuvienphapluat.vn/van-ban/Tai-nguyen-Moi-truong/Quy-dinh-01-2022-QD-TTg-co-so-phat-thai-khi-nha-kinh-phai-thuc-hien-kiem-ke-khi-nha-kinh-501161.aspx>

⁴⁴ Decree No. 119/2025/ND-CP: <https://vanban.chinhphu.vn/?pageid=27160&docid=213875>

exacerbated this situation. A major milestone came in 2015, when Norway decided to sell off its US\$900 billion sovereign wealth fund (Carrington, 2025). At COP27 in 2022, the International Partners Group (IPG), which includes Canada, Denmark, France, Germany, Italy, Japan, the United Kingdom, the European Union, and Norway, announced a commitment to mobilise US\$7.75 billion to support Viet Nam's coal transition.

Moreover, several international financial alliances have promoted coal divestment. Amongst them, the Glasgow Financial Alliance for Net Zero (GFANZ), launched at COP26 (in 2021), established a Working Group for Viet Nam's JETP in 2022 (GFANZ, 2022). The initial members were Bank of America, Citi, Deutsche Bank, HSBC, Macquarie, Mizuho Financial Group, MUFG, Prudential Plc, Shinhan Financial Group, SMBC Group, and Standard Chartered. The group initially aimed to mobilise at least US\$7.75 billion. Under GFANZ, the Net-Zero Banking Alliance is an industry-led group comprising banks. However, with the withdrawal of key members like Bank of America, Citi, HSBC, Macquarie, Mizuho Financial Group, MUFG, and SMBC Group, the Alliance has agreed to cease operation recently (Jessop and Furness, 2025). The announcement has left the future of JETP support uncertain.

Although a total of at least US\$15.5 billion in support was announced in 2022, Wischermann (2024) points out that this amount is 'a mere fraction of the total amount' required for the coal transition in Viet Nam, and estimates that 'US\$134.7 billion until 2030, and another US\$364 billion to US\$511 billion for the period from 2031 to 2050' are needed for the JETP.

Do and Burke (2023) argue that the political desire to attract international support, both financially and technically, for green growth initiatives is one of the most important drivers for the coal transition. Decision No. 500/QD-TTg (PDP8) indicates that a total of about US\$119.8 billion (approximately US\$12 billion per year) is needed to develop power generation from 2021 to 2030.⁴⁵ However, the International Union for Conservation of Nature (IUCN) has observed that 'most renewable energy projects in Viet Nam have been developed by domestic companies' (ICUN, 2022), which do not have the financial capacity for future investment. Therefore, new investment regulations and mechanisms must be implemented.

3. Socio-economic Impact Model

We reviewed recent literature and studies that model and quantify the socio-economic impacts of the coal transition in Viet Nam.

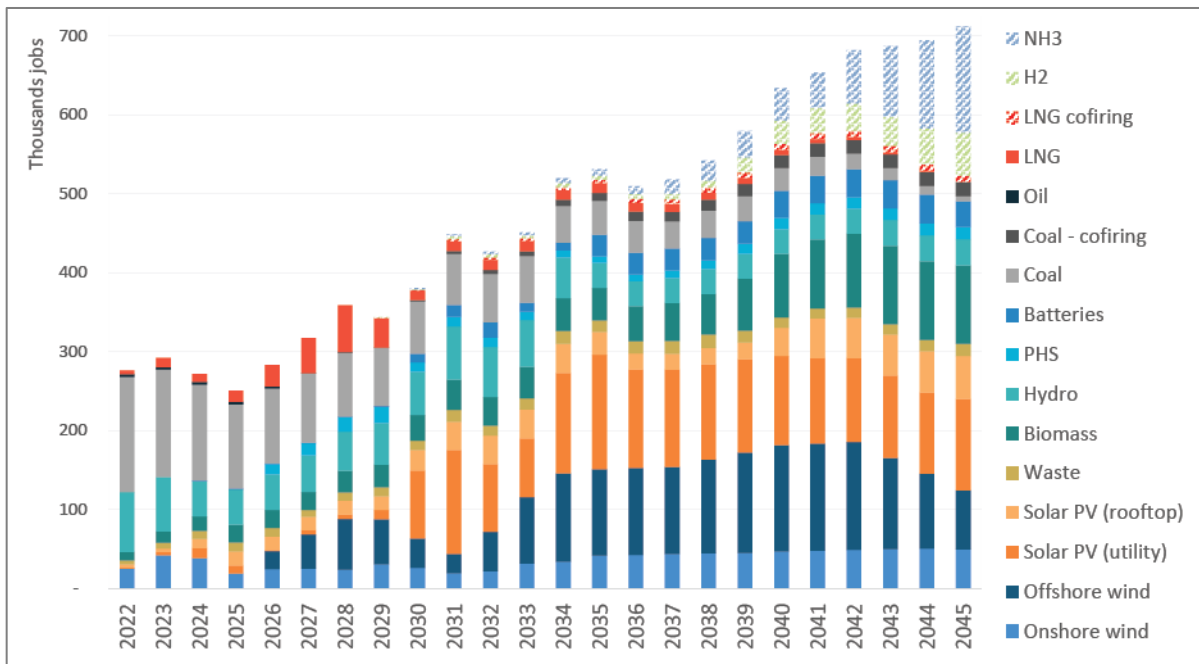
⁴⁵ Decision No. 500/QD-TTg: <https://thuvienphapluat.vn/van-ban/Thuong-mai/Quy-dinh-500-QD-TTg-2023-Quy-hoach-phat-trien-dien-luc-quoc-gia-2021-2030-tam-nhin-2050-566461.aspx>

3.1. Impact Assessment of Workers and the Economy

Employment modelling for power generation plans, compared with the PDP8 plan, estimates that around 300,000–500,000 full-time employees will be needed by 2035, excluding those in the ammonia and hydrogen sectors (Fekete, Marquardt, and Hambrecht, 2025). These estimates assume 6.9 GW of coal-fired plants currently in the pipeline for construction by 2030 and the decommissioning of older plants in accordance with PDP8. By the 2030s, solar and wind technologies will account for more than half of the direct labour force. According to a CASE study, ‘jobs related to new coal-fired power plants will quickly decrease, whilst coal mining jobs will reduce more gradually and overall job loss will be less than job creation in the renewable energy industries’ (Fekete, Marquardt, and Hambrecht, 2025, p.4).

Figure 3.8 illustrates the direct employment figures expected in the coal-fired power generation industry under the PDP8 scenario.

Figure 3.8. Direct Employment by Technology under the PDP8 Scenario



Source: Reprinted from Fekete, Marquardt, and Hambrecht (2025, p.22, Figure 4).

For coal-fired electricity production, ‘the current labour force of about 140 thousand FTE [full-time employees] will gradually decrease to close to 6.5 thousand FTE by 2045 and 0 by 2050’ (Fekete, Marquardt, and Hambrecht, 2025, p.35). According to the CASE study, ‘the next years would show a steep decline, as construction of new coal-fired power plants, accounting for about 30% of coal jobs, is ending. Jobs for operation, maintenance and supply of fuels will remain and decline much more slowly’ (Fekete, Marquardt, and Hambrecht, 2025, p.35). Coal-fired power plants retrofitted to co-firing (biomass or ammonia) are not expected to reach 20,000 direct jobs by 2045, far fewer than the

number of positions that will be lost in coal power generation.

The employment impacts of ammonia and hydrogen remain uncertain and are not included in the above calculations. However, the CASE study estimates that the retrofitting and expansion of ammonia and hydrogen power plant infrastructure, along with renewable energy capacities to generate electricity for electrolysis, could require nearly 450,000 full-time employees. This encompasses 200,000 for the upgrades and expansions of ammonia and hydrogen power facilities, and 250,000 jobs dedicated to the production of hydrogen and ammonia. The study also suggests that by 2050, 50% of the labour force will be associated with the construction, operation, and maintenance of ammonia and hydrogen plants, whilst electricity generation will account for a maximum of 7% of overall output. However, it should be noted that the study is not sure whether the planned hydrogen and ammonia would be imported or produced domestically. Therefore, Figure 3.8 excludes the expected employment for both hydrogen and ammonia.

3.2. Impact Assessment of the Economy and the Environment

The World Bank (2022b) compared two scenarios for the Viet Nam economy: the currently proposed policy scenario, based on the draft of PDP8, and the accelerated decarbonisation scenario (ADS), which envisions an 80% reduction in annual power sector emissions by 2040. The ADS is intended to strengthen the renewable energy mix and storage capacities.

In Viet Nam, the ADS will require 52% higher upfront investment than the currently proposed scenario, with an additional US\$12 billion in stranded coal assets, stemming from the early retirement of 15 GW of coal-fired plants, in addition to 4–5 GW reaching the end of their useful lives. However, it would also reduce fuel imports, cut long-term system costs when environmental damages are included, and minimise exposure to carbon border tariffs.

The World Bank (2022c) further analysed the total costs and potential sources of funding for the transition from 2022 to 2040. The analysis shows that even with a discount rate of 6%, estimating fewer investments, approximately US\$368 billion will be needed for adaptation and mitigation activities. From a socio-economic perspective, US\$33 billion worth of investments will be necessary for social programmes, which are categorised as a mitigation activity. The government requires stakeholder dialogue, income support for affected workers, labour reskilling programmes, and land or environmental remediation to repurpose assets. These investments may have implications for long-term employment, inflation, exchange rates, current account balances, and other factors. To cover the cost, private (US\$184 billion), public (US\$130 billion), and external (US\$54 billion) funding is expected.

From an environmental standpoint, a total of US\$54 billion in environmental damage

costs will be saved under the ADS. However, these environmental costs require further analysis and are outside the scope of the World Bank report.

The Economic and Social Commission for Asia and the Pacific (ESCAP) also calculated the human health and environmental benefits of a coal-exit scenario by 2050 compared to the PDP8 plans, which are estimated to be valued at US\$3.6 billion for human health and US\$1.2 billion for environmental damage reduction, or a combined total of US\$4.8 billion (in 2023 US dollars) (ESCAP, 2023).

The large difference in environmental benefits between the World Bank and ESCAP estimates derives from their modelling approaches (ESCAP, 2023). Whilst the World Bank's ADS emphasises the potential for decarbonisation driven by the decline in the costs of renewable options and the savings achieved from decreased fuel expenses, the ESCAP model, based on a simulation framework considering the full life-cycle effects of phasing out coal, accounted not only for all impacts from extraction to combustion but also for how a coal exit would affect the remaining energy sources and the energy sector as a whole. ESCAP estimates that coal-fired capacity emits about 6.3 million tonnes of CO₂ per year per 1,000 MW, assuming an 80% capacity factor, and it considers the value of reduced environmental damage as a whole. ESCAP's calculation is much smaller in magnitude because it excludes long-term global impacts.

In summary, the World Bank provides a more comprehensive and global analysis, whilst ESCAP's projections are more reflective of realistic near-term benefits that Viet Nam itself would experience in health and local environmental quality. It is important to note that in both cases, phasing out coal is a strategy that carries no economic damage.

Although Viet Nam has adopted laws to mitigate environmental damage from the coal industry (as discussed in Chapter 3, Section 2.3. Environment) additional measures are still necessary. For example, former coal mining sites in Japan continue to experience land subsidence and mine water problems (Kojima, 2022). The absence of preventative measures has left residents living in perpetual fear, even 50 years after mines were shut down. Although difficult to quantify, such long-term environmental consequences should be factored into future cost assessments.

3.3. Economic Losses

For coal-fired power plants, net present value (NPV) analysis shows that the newer and larger plants tend to be more profitable, except those using circulating fluidised bed (CFB) technology.

Let us assume, based on Decision No. 500/QD-TTg,⁴⁶ that plants operating for 40 years will be closed (baseline lifetime = 40 years). Companies' revenue can then be calculated

⁴⁶ Decision No. 500/QD-TTg: <https://thuvienphapluat.vn/van-ban/Thuong-mai/Quy-dinh-500-QD-TTg-2023-Quy-hoach-phat-trien-dien-luc-quoc-gia-2021-2030-tam-nhin-2050-566461.aspx>

as follows:

C = plant capacity (MW)

CF = capacity factor

H = hours/year = 8,760

G = annual generation = C * CF * H

P = electricity price

Electricity price (P) derives from recent news (Vietnam+, 2025b), converted using the exchange rate of D1 = US\$0.000038.

R = annual revenue = G * P

Companies' expenditures can be expressed as:

AFC = annual fuel cost = G * fuel cost per MWh = G * coal price (US\$/tonne) * coal (t/MWh)

Coal (t/MWh) = heat rate (GJ/MWh) / energy content of coal (GJ/tonne)

As the energy content of coal (GJ/tonne), we set anthracite as 25, bituminous as 23, lignite as 15, and unknown as 20.9.

The coal price derives from recent reports indicating that 'Viet Nam spent [US\$]7.29 billion importing 60.6 million tonnes of coal from global markets' (Center for WTO and International Trade, Vietnam Chamber of Commerce and Industry, 2025).

Fixed and variable operation and maintenance (O&M) costs are calculated by plants' technology, following the Vietnamese Technology Catalogue 2019 (Embassy of Denmark, Hanoi, 2019) (see Table 3.6).

Table 3.6. Fixed and Variable O&M by Technology Type

| | Fixed O&M (US\$/MWh/year) | Variable O&M (US\$/MWh) |
|-------|------------------------------|----------------------------|
| Sub-C | 39,400 | 0.7 |
| SC | 41,200 | 0.12 |
| USC | 56,600 | 0.11 |
| CFB | 43,960 | 1.29 |

Source: Embassy of Denmark, Hanoi (2019).

Annually, companies will spend:

AFOM = annual fixed O&M = fixed O&M rate * C

AVOM = annual variable O&M = variable O&M rate * G

Therefore,

$$\text{AOP} = \text{annual operating profit} = R - \text{AFC} - \text{AFOM} - \text{AVOM}$$

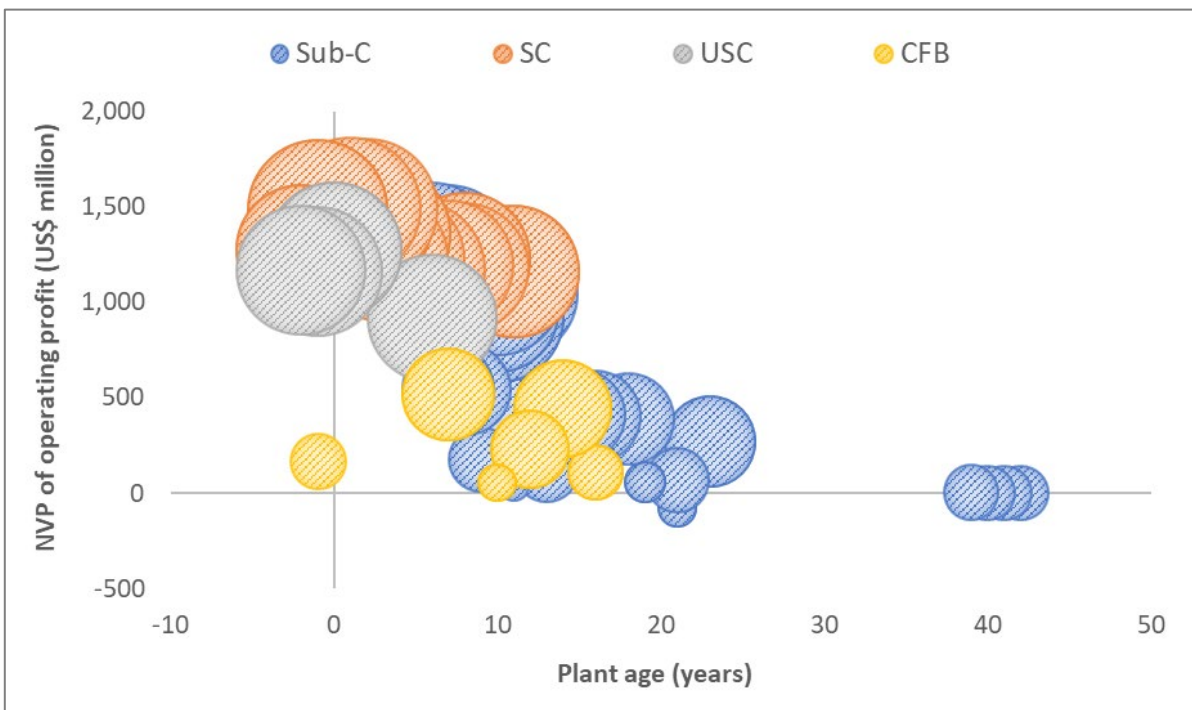
NPV can be calculated as:

$$\text{NPV} = \text{AOP} * (1 - (1 + \text{discount rate})^{-(\text{remaining years})}) / \text{discount rate},$$

where the discount rate (r) is set as 6%, following Coleman (2021) and the World Bank (2022c).

Figure 3.9 shows the NPV of operating profit. The plants are assumed to be closed after 40 years. Details on the data and results are shown in the Appendix.

Figure 3.9. NPV of Plants by Age, Technology, and Capacity



Source: Global Energy Monitor, Global Coal Plant Tracker, July 2025 release (accessed 7 October 2025).

We can see from the figure the following:

a. Plant age (x-axis)

Younger plants will retain a large NPV due to their longer remaining operational lifespan. Older plants, particularly those using Sub-C technology, have a lower NPV, which makes their decommissioning more economically sound.

b. Technology (colour coding)

Newer technologies, such as USC, generally have higher efficiency and lower fuel costs.

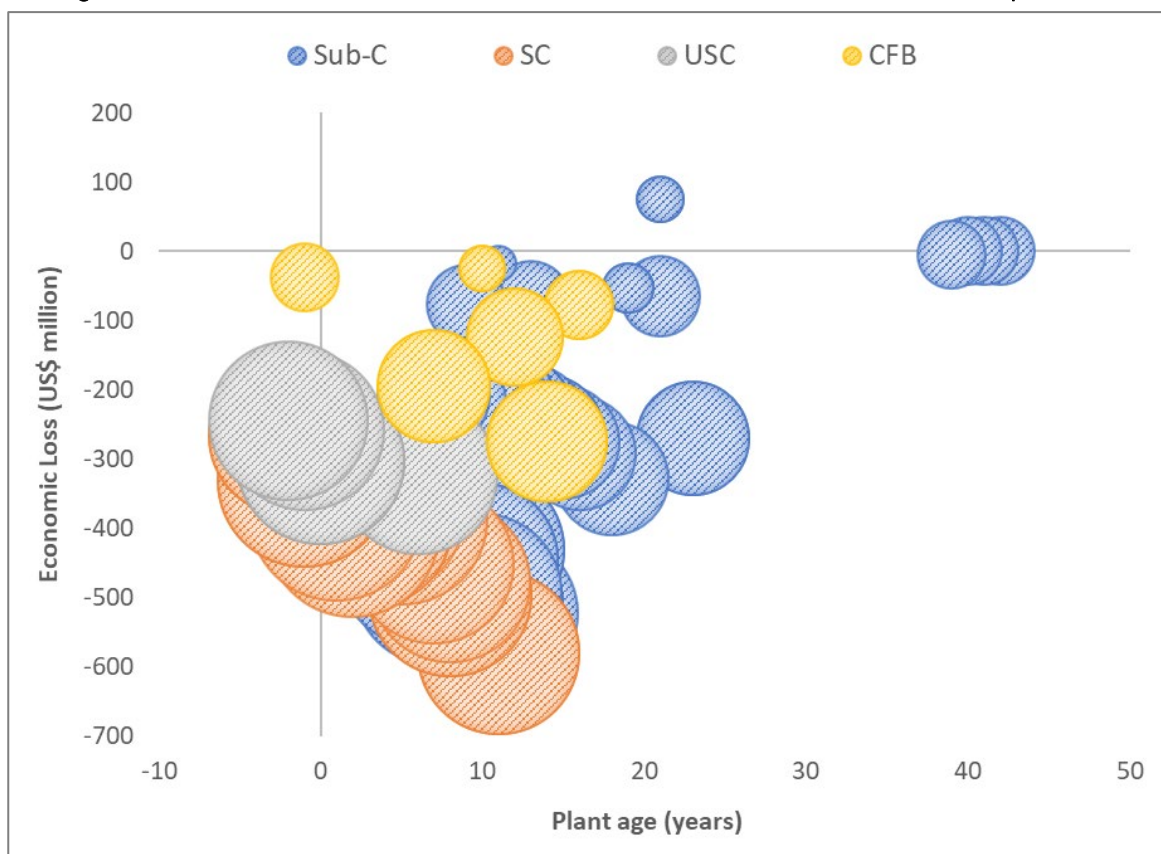
In contrast, older technologies, such as Sub-C, are typically less efficient and have smaller NPVs. CFB plants, although often considered cleaner and included in future construction plans, appear less profitable. This is possibly because of lower efficiency and smaller capacities. Whilst CFB plants have high fuel flexibility, allowing the use of low-grade domestic anthracite, they are not economically efficient.

c. Capacity (bubble size)

The bubble size represents the capacity of plants. The figure shows that larger plants have relatively higher NPVs. This may imply that higher-capacity plants generate electricity more profitably than smaller ones.

We assume that coal-fired power plants that have been in operation for 20 years will be shut down. The economic loss compared to a 40-year transition period is shown in Figure 3.10.

Figure 3.10. Economic Loss of Plants Shut Down After 20 Years of Operation



Source: Global Energy Monitor, Global Coal Plant Tracker, July 2025 release (accessed 7 October 2025).

Plants that are younger and have larger capacities will lose more money. Old plants using Sub-C technology have already generated operating profits, so shortening their phase-out period will have less impact. This suggests that technology-specific compensation

schemes might be helpful for easing the financial burden of the transition for coal-fired power plant operators.

From the above analysis, we can see that the early retirement of coal-fired power plants results in economic losses, especially for newer and higher-capacity facilities. Recently invested or constructed plants will face the greatest economic impact. Since foreign investors are involved in operating plants in Viet Nam, shutting those plants down early may result in significant economic loss and potentially trigger compensation claims or investment disputes. To ensure a more sustainable coal transition, Viet Nam should implement a retirement plan that considers both plant age and technology type, along with compensation mechanisms backed by international finance.

Following our analysis, we concluded that the total economic loss from early plant retirement is estimated at US\$22 billion, amounting to US\$680,800 per MW of loss.

Overall, whilst the coal transition entails a loss of business profits, it can yield more employment than is currently provided by the coal industry and reduce environmental damage costs. The main challenges ahead will be job relevance, uncertainty of technical development, and the rehabilitation costs of the environment.

Closing coal-fired power plants is only feasible when operators are provided with viable replacement revenue models that enable a smooth financial and operational transition away from coal. ADB (2024) outlines a financial and operational model for managed early retirement of coal-fired power plants. Instead of simply shutting down operations, the model requires that plants be repurposed for clean energy, grid modernisation, and energy storage. The business plan also incorporates worker support, reskilling, and local economic adjustment so that the coal phase-out does not negatively impact host communities.

Furthermore, the World Bank (2024) identifies how coal retirement can be economically viable only when it is paired with a replacement income model that maintains financial stability for plant owners, utilities, and regional economies. The business plan emphasises that coal plants should be treated as transitionable infrastructure assets. In practice, a plant's existing connection to the transmission network, land, and industrial facilities can be leveraged to support renewable generation or carbon capture storage.

Coal plants have valuable infrastructure, such as grid access and transmission capacity. These sites can be repurposed to host industrial or commercial zones to diversify local economies, generating long-term tax and employment gains. Coal phase-out must function not as a shutdown, but as a managed transformation in which the coal plant's revenue stream is replaced rather than eliminated. The viability of coal retirement depends on creating alternative revenue streams that maintain financial stability for workers, the economy, and the environment.

Chapter 4

Interviews

1. Interviews

We conducted face-to-face interviews in Hanoi during 21–23 July 2025, where representatives of the government, institutions, and companies generously shared their perspectives on Viet Nam's coal transition.

1.1. Government

The global energy transition process has had direct impacts on Viet Nam's energy system. The government foresees that the energy system may be completely changed from the present, driven by declining costs of renewable energy, increasingly intelligent and flexible power system dispatching technologies, and shifts in consumption and production behaviours. These developments will place significant pressure on the need to convert input fuel sources across the transportation, construction, agricultural, and industrial sectors.

Regarding the energy sector, the officials expressed concern that fossil fuel sources for domestic electricity production will be scarce, thus leading to higher and more ambiguous fuel prices. National energy security is an issue that demands a long-term strategy. Therefore, shifting the coal industry towards more sustainable development is entirely consistent with the Viet Nam's policy orientation and goals of developing sustainable energy sources.

Government and ministerial agencies are interested in promoting research and proposing appropriate policy mechanisms for a Just Energy Transition. One example is knowledge-sharing with interested parties. The government has acknowledged that developing knowledge exchange programmes to enhance capacity on issues related to the development and implementation of energy transition policies and the plans of stakeholders in coal mining areas is required in the future.

Whilst the government of Viet Nam is attempting to finance the coal phase-out plan domestically, it remains open to seeking international support. Officials emphasised that ensuring national energy security, developing new sustainable business models, and supporting workers are the most important features in achieving a successful coal transition.

The MOIT has directed PVN and EVN to develop a roadmap to cut coal consumption. Alongside this, worker reemployment is another major concern. Plans include rehiring

affected workers in the garment manufacturing or electricity industries with retraining programmes to facilitate this transition.

Following an organisational change in 2022/2023, the MOIT now comprises 13 departments and agencies. Amongst them, the Industry Agency, the Energy Efficiency and Sustainable Development Department, and the Oil, Gas, and Coal Department are responsible for the coal transition. The Industrial Safety Techniques and Environment Agency supervises the working environment in coal mines, such as the rules surrounding how to use dynamite or machinery.

Currently, there are 20 coal mining companies operating in Viet Nam, mostly located in Quang Ninh province. All surface mines will be closed due to environmental reasons. Former surface mining sites have been transformed into parks with planted trees. Ongoing underground mines are planned to close by 2050. The government envisions that as coal-fired power plants shut down, wind and solar power will take their place in the national energy mix.

1.2. Institutions

Viet Nam aims to achieve net-zero by 2050. Recently, the government has decided to ban all fossil fuel-powered motorcycles in the downtown area of Hanoi, starting in July 2026. At the same time, the country is expanding renewable energy development, particularly wind, solar, and hydro power. FiT schemes for solar are also pervasive in the country (see Chapter 3, Section 2.2. Economy).

Nevertheless, coal will remain the main energy source for Viet Nam until 2030. It is estimated that coal imports and exports will increase by around 46 billion–53 billion tonnes per year from 2021 to 2030, and then decrease by 44 billion tonnes per year from 2041 to 2050.

Currently, Viet Nam relies on coal for almost 40% of its electricity generation. In order to shift to gas, wind, solar, and hydro power, substantial financial investments are required. The government aims to reduce its coal dependency to less than 20% by 2045.

However, progress has been slower than expected. Although the JETP pledged US\$15 billion in support, it is behind schedule. The carbon market could be a possible funding source, but no legal framework has yet been established.

To reduce coal consumption, Decision No. 266/QD-TTg was signed in February 2025 to implement the transition from coal to clean power.⁴⁷ Aligning with PDP8, Decision No. 1009/QD-TTg officially approved the JETP in 2023.⁴⁸

⁴⁷ Decision No. 266/QD-TTg: <https://datafiles.chinhphu.vn/cpp/files/vbpg/2025/02/266-ttg.signed.pdf>

⁴⁸ Decision No. 1009/QD-TTg: <https://datafiles.chinhphu.vn/cpp/files/vbpg/2023/9/1009-ttg.signed.pdf>

Carbon capture and storage projects for coal-fired power plants are expected to receive strong JETP support, alongside other renewable initiatives. Nevertheless, coal will remain the dominant energy source due to its cheap price.

Approximately 100,000 people are working in the coal mining industry in Viet Nam,⁴⁹ with around 20% in open-pit and 80% in underground mining. Open-pit mining will begin closing down from 2035. In Quang Ninh province, where most of the mining sites are located, it is difficult for miners to find new jobs, compelling many to oppose shutting down the mines. Needless to say, support for workers is an absolute necessity.

1.3. Companies

One of the companies interviewed manages and operates three coal-fired power plants and six gas power plants (two of which are under construction).

Aligning with the PDP8 and Net-Zero by 2050 goals, the company will not build any new coal-fired plants. The existing three coal plants will continue operating until the end of their 40-year lifespans, until around the 2050s. As some of their plants are relatively small (around 100 MW), their closure will have a limited impact.

In this context, gas power plants play a critical role in ensuring stability in energy supplies. Gas Blue Whale (Ca Voi Xanh Gas Field) is a promising project for securing the company's energy supply. Corporate decisions are guided by regulatory, technological, and cost-related considerations.

Several advanced technologies for coal-fired power plants, such as hydrogen and ammonia co-firing, have received significant support from Korean and Japanese companies. The company has signed MOUs with these partners, but details about the costs and practical steps for transitioning the coal-fired plants remain unclear. Moreover, worker training programmes are still under discussion.

The coal mining companies are taking steps to support the national coal transition. One coal mining company has begun investing in and installing solar panels in its open-cast mining sites whilst also introducing energy-saving measures in line with the government policy.

The coal mining company anticipates that overall energy consumption will rise as production expands. Both underground and open-pit coal mines require increasing amounts of energy for transportation, ventilation, and drainage, particularly as mining depths grow.

As government representatives mentioned, surface mining will be gradually replaced by underground mining due to problems related to dust. This transition is also expected to contribute to emission reductions. The company expects that although mining output will

⁴⁹ This is consistent with what we found in Chapter 3, Section 2.1. Workers.

remain unchanged until 2030, the rate of energy consumption and emissions will decrease. The primary reason for this stems from underground mining. Currently, underground coal mining is getting deeper in Viet Nam, but the mechanisation of transportation, pumping, drainage, and ventilation contributes to reducing energy consumption and, thus, emissions.

Conversely, as mine boundaries expand and deepen, water inflow into the pits increases, requiring greater drainage capacity and higher electricity consumption for pumping systems. Furthermore, many open-pit mines are gradually approaching their final exploitation limits, so energy costs for pumping, draining, and transportation are increasing.

2. Views on the Coal Transition

Our interviews with policymakers, institutions, and companies revealed a strong political will for transition, accompanied by concerns about energy security, funding delays, and worker displacement. Table 4.1 summarises some key findings.

Table 4.1. Key Findings from Interviews

| | Findings |
|-------------|--|
| Workers | <ul style="list-style-type: none"> ➤ Difficult to find new jobs for workers. ➤ Plans to be rehired in the garment manufacturing or electricity industries (government). |
| Economy | <ul style="list-style-type: none"> ➤ Need support for advanced technologies, e.g. hydrogen and ammonia co-firing (companies). ➤ Need more incentives to support renewable projects (institutions). |
| Environment | <ul style="list-style-type: none"> ➤ Open-pits will shut down (only underground mining will remain) due to environmental concerns. ➤ Open-pit coalfields to be converted to solar power. |

Source: Authors.

Regarding workers, the coal transition will heavily impact employment, especially in mining regions like Quang Ninh province. Surface mine workers will potentially lose their jobs, whilst underground miners are expected to be affected more gradually until 2050. The government has proposed plans for reemployment programmes, including training for new sectors such as garment manufacturing and electricity generation. Education and retraining initiatives are being designed to help coal workers adapt to new technologies.

In terms of the economy, the government prioritises balancing energy security with decarbonisation goals. Companies are also working to realign strategies towards renewable energy whilst maintaining stability of the power supply. Economic diversification is emerging, particularly in Quang Ninh, where former coal sites are being developed into tourist destinations and parks. However, hydrogen and ammonia co-firing may take more time to be implemented, and additional incentives are required to improve renewable projects.

For the environment, the government is closing surface mines for environmental reasons, and many reclaimed mining areas, especially in Quang Ninh province, are being redeveloped for solar power. This focus contrasts with the findings of Do and Burke (2023), who noted that 'local air pollution concerns were perhaps not a major motivator for the thermal coal phase-out decision' (Do and Burke, 2023, p.5).

Chapter 5

Conclusion

Viet Nam's energy system is heavily reliant on coal, which currently supplies about 40% of its electricity. Despite declaring a net-zero target by 2050, coal consumption continues to expand, primarily due to economic growth and industrialisation.

The JETP, established in 2022, aims to support Viet Nam's shift from coal to cleaner energy through policy reforms and international funding. Viet Nam declared that no new coal-fired plants will be developed after 2030, and existing plants will gradually be phased out or converted to biomass or ammonia.

Despite strengthening its coal transition plans, implementation gaps remain. Modelling results indicate that a coal transition would create more employment and save on environmental damage costs. However, there are several socio-economic difficulties that are worth taking into account. For instance, there may be resistance from workers, particularly in coal-dependent communities where alternative jobs are scarce. Job stability and wage differences between coal and renewables or other sectors are also key social concerns. Technologies of hydrogen and ammonia co-firing are still in the nascent stages of development. Financing and investments have faced considerable delays and uncertainties. Whilst legal and regulatory frameworks have been intended to protect the environment, future policies should also address post-coal damage, such as land subsidence or mine water problems.

To overcome these challenges of job relevance, uncertainty about technical development, and the rehabilitation costs of the environment, we make the following recommendations:

- Prioritise effective reskilling programmes for affected workers as the core of transition policies.
- Adopt gradual, technology-differentiated retirement plans for coal assets whilst also managing technological and regulatory uncertainties.
- Carefully examine post-coal environmental damage, drawing on experiences from earlier coal transitions.
- Ensure strong institutional coordination between the government, companies, and international partners.

Ultimately, Viet Nam's experience could serve as a model for a just transition in other economies, balancing energy security, economic growth, and environmental sustainability.

From a financial and investment point of view, although Viet Nam is moving forward with transitioning away from coal, controversial decisions may arise in the future. As mentioned in Chapter 2, 1.5. Coal Consumption, many foreign companies are operating coal-fired power plants under BOT contracts. Recently, Viet Nam has proposed to exempt the worldwide minimum corporate tax for foreign coal-fired power operators (Guarascio and Vu, 2025). The worldwide minimum is an agreement established by the OECD that imposes a minimum 15% tax on multinational corporations. The Ministry of Finance in Viet Nam announced a plan to grant tax-exempt status for foreign coal operators, specifically Mitsubishi, Marubeni, Sumitomo, Korea Electric Power Corporation (Korea), AES Corporation (United States), and China Southern Power Grid. Although this exemption will result in a loss of tax revenue equalling approximately US\$426 million over 20 years, the government expects that this exemption will be necessary to attract foreign investment. However, if this tax exemption is implemented, it may create incentives for continued coal plant operation and thus weaken the motivation for early retirement.

There are several points worth mentioning that we did not touch upon in our report. First is the potential of liquefied natural gas (LNG), which can replace coal. Quang Ninh, the largest coal-producing province, is planning to facilitate LNG plants (Viet Nam News 2025b). According Viet Nam News (2025b), 'the Quang Ninh LNG Power Plant project includes a 1,500 MW combined-cycle gas turbine power plant, a 500 kV distribution yard, infrastructure, technical facilities, and an LNG import terminal capable of handling 1.2 million tonnes of LNG per year.' It is expected to produce 9 billion kWh of electricity per year, which may replace the current coal-fired power plants' capacity. However, supply constraints and high costs remain as concerns, as three companies control 70% of the global gas turbine market (Rathi et al., 2025). These companies are reportedly sceptical whether recent increases in demand for turbines will be sufficient to recoup the investments required for new manufacturing capacities. Moreover, LNG power plants are not carbon-free. As demonstrated in our interviews, the Gas Blue Whale project is promising, yet it nevertheless seems difficult to replace all coal power in the future.

Second, we did not touch upon the possibility of pumped storage hydropower, which is a clean energy storage method that is essential for a reliable and stable electric grid. Recently, the European Union announced that it will provide Viet Nam with a total of €430 million for the Bac Ai Pumped Hydro Storage Project (European Commission, 2025). However, given the high capital costs associated with such infrastructure, it will be difficult for pumped hydropower to substitute for coal power in the short term.

Last but not least, we could not examine transition credits for the early retirement of coal-fired power plants. For example, the Transition Credits Coalition (TRACTION) was established by the Monetary Authority of Singapore at COP28 (in 2023), and it published

an interim report on transition credits (Monetary Authority of Singapore, 2024).⁵⁰ The report clarifies the challenges and opportunities of transition credits from the perspectives of (a) supply, (b) risk analysis, and (c) demand.

(a) Supply: Multiple transition credit methodologies have emerged globally. Following either a project-based approach (which credits emissions reductions from the early retirement of individual coal-fired power plants) or a sectoral approach (which credits emissions reductions across the power sector at the national or sub-national level). Both approaches have high integrity standards and guidelines for a just transition. TRACTION aims to identify common factors that would increase integrity from different approaches and use them to expand transition credits in the future.

(b) Risk analysis: The use of transition credits is complex and entails multiple risks. Despite the need for urgent financing, there is a frequent timing mismatch when cashflow from the sales of transition credits is only generated after the verification of emissions reductions. This mismatch is particularly significant in Asia, where coal-fired power plants are relatively newer in terms of operational life. To avoid such risks, the report proposes combining conventional financing instruments (e.g. debt and/or equity) and innovative financing instruments (e.g. carbon credits insurance and advance market commitments).

(c) Demand: All buyers prioritise high integrity and the credible use of transition credits. Thus, transition credits generated from projects that are directly related to the buyer's businesses will be more appealing to voluntary buyers. Some companies acquire credits before regulations are introduced, which implies that there is strong demand for high-integrity credits. TRACTION will continue to identify relevant market schemes to increase interest from potential buyers. It will also incorporate elements of high integrity and risk mitigation tools to secure demand from buyers.

The report shows a case study of ACEN Corporation (part of the Ayala Group), which implemented the world's first Energy Transition Mechanism. ACEN, which operates several renewable energy projects in the Philippines, used the mechanism to accelerate the phase-out of a 246 MW coal-fired power plant owned by South Luzon Thermal Energy Corporation, an ACEN subsidiary.

Moreover, the Institute for Energy Economics and Financial Analysis recently published a report on Pakistan's coal transition (Isaad et al., 2025). The report pointed out that Pakistan's lack of carbon pricing systems hinders its ability to secure transition financing. The nation requires institutional frameworks to visualise, verify, and monitor carbon credits, which is a crucial step in establishing trust in global markets. If Pakistan's coal-fired power plants can align with the qualifying standards of these criteria, transition

⁵⁰ TRACTION's final report was released at COP30 in 2025 (<https://www.mas.gov.sg/-/media/mas-media-library/development/sustainable-finance/traction-final-report.pdf>).

credits may offer an extra revenue source to support plant owners.

In the case of our research, future studies should further explore the potential of transition credits.

Closing coal-fired power plants is economically and socially feasible only when their existing revenue streams are replaced through reinvestment and repurposing strategies, rather than simple shutdown. Coal power sites can be leveraged to develop renewable energy projects such as solar, wind, and battery storage facilities on former plant or mining sites, including ongoing examples where open-pit coalfields are being converted to solar power in Viet Nam. Although early plant retirement may lead to economic losses, particularly for newer and higher-capacity facilities, a managed transition backed by international financing and compensation schemes can mitigate these impacts and prevent investor disputes. Successful coal transition models must integrate worker reskilling, local economic diversification, and rehabilitation of land and environmental, as these social and environmental dimensions are necessary to ensure a just and politically viable transition process. Overall, coal transition should function not as a shutdown of mines and plants, but as a structured transformation in which coal assets are repurposed, refinanced, and reinvested to generate new and sustainable revenue streams.

References

- Agora Energiewende, Institute for Climate and Sustainable Cities (ICSC), and Institute for Essential Services Reform (IESR) (2023), *Transitioning Away from Coal in Indonesia, Vietnam and the Philippines. Overview of the Coal Sector with a Focus on Its Economic Relevance and Policy Framework*.
- Asian Development Bank (ADB) (2024), *Indonesia: Cirebon Energy Transition Mechanism Pilot Project*. <https://www.adb.org/sites/default/files/project-documents/56294/56294-001-dpta-en.pdf>
- Carrington, D. (2025), 'Norway Confirms \$900bn Sovereign Wealth Fund's Major Coal Divestment', *Guardian*, 5 June. <https://www.theguardian.com/environment/2015/jun/05/norways-pension-fund-to-divest-8bn-from-coal-a-new-analysis-shows>
- Center for WTO and International Trade, Vietnam Chamber of Commerce and Industry (2025), *Vietnam's Coal Imports from Malaysia in 2024 up 114 Times*, 6 January. <https://wtocenter.vn/chuyen-de/26849-vietnams-coal-imports-from-malaysia-in-2024-up-114-times>
- COBENEFITS (2019), *Future Skills and Job Creation through Renewable Energy in Vietnam: Assessing the Co-benefits of Decarbonising the Power Sector*. <https://www.cobenefits.info/wp-content/uploads/2020/08/COBENEFITS-Vietnam-Employment-Exec-Report.pdf>
- Cocks, T., F. Guarascio, and F. Nangoy (2025), 'Exclusive: US Withdraws from Plan to Help Major Global Polluters Move from Coal', *Reuters*, 7 March. <https://www.reuters.com/sustainability/climate-energy/us-withdrawing-plan-help-major-polluters-move-coal-sources-2025-03-05/>.
- Coleman, B. (2021), 'Assessment of a Social Discount Rate and Financial Hurdle Rates for Energy System Modelling in Viet Nam', *OECD Environment Working Papers*, No. 181. <https://dx.doi.org/10.1787/a4f9aff3-en>
- Do, L. (2025), 'Vietnam Spends \$1.8 Bln on Coal Imports in Q1, Mainly for Power Plants', *The Investor*, 5 May. <https://theinvestor.vn/vietnam-spends-18-bln-on-coal-imports-in-q1-mainly-for-power-plants-d15539.html>
- Do, T.N. and P.J. Burke (2023), 'Phasing Out Coal Power in a Developing Country Context: Insights from Vietnam', *Energy Policy*, 176, pp.1–11. <https://doi.org/10.1016/j.enpol.2023.113512>
- DTiNews (2025), *Quang Ninh Considers Coal Mine Tourism*, 14 February. <https://dtinews.dantri.com.vn/lifestyle/quang-ninh-considers-coal-mine->

[tourism-20250214142753284.htm](#)

Dương, K. (2024), 'Transition Away from Coal Poses Challenges for Miners', *Viet Nam News*, 12 December. <https://vietnamnews.vn/society/1688796/transition-away-from-coal-poses-challenges-for-miners.html>

Economic and Social Commission for Asia and the Pacific (ESCAP) (2023), *Socio-economic Opportunities from Phasing Out the Use of Coal in Viet Nam*. United Nations Publication.

Embassy of Denmark, Hanoi (2019), *Vietnamese Technology Catalogue 2019*. <https://www.ea-energianalyse.dk/en/publications/vietnam-technology-catalogue/>

Energy and Environment Consultancy Joint Stock Company (VNEEC) (2023), *Policy Brief: For Preparation of Just Energy Transition Partnership Implementation in Vietnam: Just and Equity Aspect*.

Erex Co., Ltd. (2025), *Notice of Commencement of Biomass Co-Firing Test at Coal-Fired Power Plant in Collaboration with Vinacom Power Holdings*, 26 September. <https://www.erex.co.jp/en/news/information/697/>

European Commission (2025), *EU Reinforces Support for Vietnam's Just Energy Transition with €430 Million Package*, 9 October. https://global-gateway-forum.ec.europa.eu/news/eu-reinforces-support-vietnams-just-energy-transition-eu430-million-package-2025-10-09_en

EVN (2025), *Operational Performance in First Half of 2025; Objectives and Tasks for July 2025*, 7 September. <https://en.evn.com.vn/d/en-US/news/Operational-performance-in-first-half-of-2025-objectives-and-tasks-for-july-2025-60-142-500845>

Fekete, H., M. Marquardt, and L. Hambrecht (2025), *Projection of Labour Force for Viet Nam's Energy Transition*. Clean, Affordable and Secure Energy for Southeast Asia (CASE).

GFANZ (2022), *GFANZ Establishes Working Group to Support Capital Mobilization for the Viet Nam Just Energy Transition Partnership*, 14 December. <https://www.gfanzero.com/press/gfanz-establishes-working-group-to-support-capital-mobilization-for-the-vietnam-just-energy-transition-partnership/>

Guarascio, F. and K. Vu (2025), 'Vietnam to Exempt Mitsubishi, Kepco, Other Coal Power Plant Operators from Global Tax, Document Shows', *Reuters*, 12 September. <https://www.reuters.com/sustainability/boards-policy-regulation/vietnam-exempt-mitsubishi-kepco-other-coal-power-plant-operators-global-tax-2025-09-12/>

- Halsey, R., N. Do, S. Goel, D. Sharma, A. Suharsono, C. Beaton, and P. Benoit (2025), *State of Transition: How State-owned Power Companies Can Drive Energy Transition in Emerging Economies*. International Institute for Sustainable Development.
- Hauber, G. (2024), *Vietnam's Direct Power Purchase Agreement (DPPA) Decree Could Catalyze a New Era for Renewable Energy*, 29 July. Institute for Energy Economics and Financial Analysis. <https://ieefa.org/resources/vietnams-direct-power-purchase-agreement-dppa-decree-could-catalyze-new-era-renewable>
- Hòa Phát (2023), *Hoa Phat Group Targets "Green Steel" Development*, 14 September. <https://www.hoaphat.com.vn/news/hoa-phat-group-targets--green-steel--development.html>
- Hưng, Đ. (2025), 'Digital Applications Enhance Quang Ninh Tourism Experiences', *Lao Dong*, 9 January. <https://news.laodong.vn/van-hoa-giai-tri/ung-dung-so-nang-tam-trai-nghiem-du-lich-quang-ninh-1447426.ldo>
- IASS/UfU/GreenID (2020), *Making the Paris Agreement a Success for the Planet and the People of Vietnam. Unlocking the Co-benefits of Decarbonising Vietnam's Power Sector*. COBENEFITS Policy Report. Potsdam/Hanoi. <https://www.cobenefits.info/wp-content/uploads/2020/10/COBENEFITS-Vietnam-Policy-Report-2020.pdf>
- International Energy Agency (IEA) (n.d.-a), *Viet Nam, Electricity*. <https://www.iea.org/countries/viet-nam/electricity> (accessed 26 October 2025).
- International Energy Agency (IEA) (n.d.-b), *Viet Nam, Efficiency & Demand*. <https://www.iea.org/countries/viet-nam/efficiency-demand> (accessed 26 October 2025).
- International Energy Agency (IEA) (2022), *Special Report on Solar PV Global Supply Chains*. <https://iea.blob.core.windows.net/assets/4eedd256-b3db-4bc6-b5aa-2711ddfc1f90/SpecialReportonSolarPVGlobalSupplyChains.pdf>
- International Energy Agency (IEA) (2024), *Coal 2024: Analysis and Forecast to 2027*. <https://www.iea.org/reports/coal-2024>
- International Energy Agency (IEA) (2025a), *Greenhouse Gas Emissions from Energy*. <https://www.iea.org/data-and-statistics/data-product/greenhouse-gas-emissions-from-energy>
- International Energy Agency (IEA) (2025b), *World Energy Balances*. <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>
- International Energy Agency (IEA) (2025c), *World Energy Statistics*. <https://www.iea.org/data-and-statistics/data-product/world-energy-statistics>

- International Labour Organization (ILO) (2015), *Guidelines for a Just Transition towards Environmentally Sustainable Economies and Societies for All*. Switzerland: International Labour Organization.
- International Union for Conservation of Nature (ICUN) (2022), *Unlocking International Finance for Vietnam's Renewable Energy Transition*, 23 May. <https://iucn.org/news/viet-nam/202205/unlocking-international-finance-vietnams-renewable-energy-transition>
- Isaad, H., M.H. Sayed, A. Ahmad, and U. Farooq (2025), *Repurposing Pakistan's Coal-based Assets: A Practical Case Study for the Early Retirement of Coal Assets in Pakistan*. Institute for Energy Economics and Financial Analysis. https://ieefa.org/sites/default/files/2025-10/IEEFA%20-%20Repurposing%20Pakistan%27s%20coal-based%20assets_0.pdf
- Jessop, S. and V. Furness (2025), 'Net-Zero Banking Alliance Folds After Mass Exodus by Members', *Reuters*, 3 October. <https://www.reuters.com/sustainability/cop/net-zero-banking-alliance-stop-operations-after-member-vote-2025-10-03/>
- Kimura, S., H. Phoumin, and A.J. Purwanto (2023), *Energy Outlook and Energy Saving Potential in East Asia 2023*. Jakarta: ERIA. <https://www.eria.org/publications/energy-outlook-and-energy-saving-potential-in-east-asia-2023>
- Kojima, M. (2022), *Japanese Coal Transition Reexamined: The Remains of Coal*, doctoral theses.
- Le, T.D. and X.-N. Bui (2020), 'Status and Prospects of Underground Coal Mining technology in Vietnam', *Inżynieria Mineralna*, 2(2), pp.104–10. <http://doi.org/10.29227/IM-2019-02-63>
- Ministry of Industry and Trade (2019), *Report on the Implementation Progress of Power Projects in the Revised Power Development Plan 7*. https://vepg.vn/wp-content/uploads/2019/06/MOIT_Report_58_BC_BCT.pdf
- Ministry of Industry and Trade of the Socialist Republic of Vietnam (2025), *MoIT and ADB Partner to Advance Green Energy*, 15 August. <https://moit.gov.vn/en/minister-s-newsletter/active-news/moit-and-adb-partner-to-advance-green-energy.html>.
- Monetary Authority of Singapore (2024), *Transition Credits Coalition (TRACTION): An Interim Report on the Application of Transition Credits for Accelerated Coal Retirement*. <https://www.mas.gov.sg/-/media/mas-media-library/development/sustainable-finance/traction---interim-report---final.pdf>
- Nguyễn, H. (2024), 'TKV tinh giản khoảng 27.000 lao động trong 10 năm' [in Vietnamese], *Lao Dong*, 27 December. <https://laodong.vn/cong-doan/tkv-tinh-gian-khoang->

27000-lao-dong-trong-10-nam-1441354.ldo

Nguyen, P. and G. Hauber (2025), *From Boom to Balance in Vietnam's Clean Energy Transition*, 17 June. Institute for Energy Economics and Financial Analysis. <https://ieefa.org/resources/boom-balance-vietnams-clean-energy-transition>

Norwegian Embassy in Hanoi and Innovation Norway (2023), *Offshore Wind Supply Chain for Fast-track Scenario in Vietnam*. https://www.norway.no/globalassets/2-world/vietnam/documents/034625-vietnam-supply-chain-study_eng.pdf

Phuong, N.T.B. and P.M. Quang (2020), *A Review of the Coal Power Sector in Vietnam*, conference paper.

Rathi, A., S. Stapczynski, and J. Saul (2025), 'The Gas Turbine Shortage Might Be a Climate Problem', *Bloomberg*, 2 October. <https://www.bloomberg.com/news/newsletters/2025-10-02/the-gas-turbine-shortage-might-be-a-climate-problem>

S&P Global (2025), *Vietnam to Start Pilot Emission Trading in 2025, Allow Offsetting 30% Emissions*, 11 June. <https://www.spglobal.com/commodity-insights/en/news-research/latest-news/energy-transition/061125-vietnam-to-start-pilot-emission-trading-in-2025-allow-offsetting-30-emissions>

Socialist Republic of Viet Nam (2022), *Nationally Determined Contribution*.

Socialist Republic of Viet Nam (2023), *Resource Mobilisation Plan: Implementing Viet Nam's Just Energy Transition Partnership (JETP)*.

Statistical Publishing House (2024), *Statistical Yearbook of Viet Nam*.

TheGlobalEconomy.com (n.d.), *Vietnam: Coal consumption*. https://www.theglobaleconomy.com/Vietnam/coal_consumption

Thompson, B. and M.B. Chow (2022), 'Vietnam's Direct PPA Pilot Scheme', *Mayer Brown*, 1 March. <https://www.mayerbrown.com/en/insights/publications/2022/03/vietnams-direct-ppa-pilot-scheme-energy-market-update-february-2022>.

UN Climate Change Conference UK 2021 (2021), *Global Coal to Clean Power Transition Statement*, 4 November. <https://webarchive.nationalarchives.gov.uk/ukgwa/20230313120149/https://ukcop26.org/global-coal-to-clean-power-transition-statement/>

United Nations Industrial Development Organization (n.d.), *Viet Nam. Employees. 05 Mining of Coal and Lignite*. <https://stat.unido.org/data/table?dataset=indstat&revision=4&country=704>.

U.S. Department of the Treasury (2018), *Treasury Sanctions Additional Individuals and Entities in Connection with the Conflict in Ukraine and Russia's Occupation of Crimea*,

- 26 January. <https://home.treasury.gov/news/press-releases/sm0266>.
- Vietnam+ (2025a), *Vietnam's Mining Giant Eyes Sale of 50 Million Tonnes of Coal in 2025*, 3 January. <https://en.vietnamplus.vn/vietnams-mining-giant-eyes-sale-of-50-million-tonnes-of-coal-in-2025-post307736.vnp>
- Vietnam+ (2025b, October 5), *Vietnam's Retail Electricity Price Climbs 4.8%*, 5 October. <https://en.vietnamplus.vn/vietnams-retail-electricity-price-climbs-48-post318980.vnp>
- Vietnam Energy Online (2020), *Coal Industry Takes Action to Ease Solution, Green the Environment*, 28 November. <https://vietnamenergy.vn/coal-industry-takes-action-to-ease-sollution-green-the-environment-25691.html>
- Vietnam Investment Review (2022), *PetroVietnam Seeks New EPC Contractor for 1,200MW Long Phu 1 Thermal Power Plant*, 23 December. <https://vir.com.vn/petrovietnam-seeks-new-epc-contractor-for-1200mw-long-phu-1-thermal-power-plant-98756.html&link=autochanger>
- Vietnamnet (2025), *Long Phu 1 thermal Plant Back on Track Following Sanctions Freeze*, 7 January. <https://vietnamnet.vn/en/long-phu-1-thermal-plant-back-on-track-following-sanctions-freeze-2360847.html>
- Viet Nam News (2022), *Quảng Ninh to Transition from Brown to Green*, 26 November. <https://vietnamnews.vn/economy/1398797/quang-ninh-to-transition-from-brown-to-green.html>
- Viet Nam News (2024), *Việt Nam's Steel Industry Strategy to Be Submitted in September*, 19 July. <https://vietnamnews.vn/economy/1659596/viet-nam-s-steel-industry-strategy-to-be-submitted-in-september.html>
- Viet Nam News (2025a, August 5), *Vinacomin Contributes Over \$635 Million to State Budget in 7 Months*, 5 August. <https://vietnamnews.vn/economy/1722703/vinacomin-contributes-over-635-million-to-state-budget-in-7-months.html>
- Viet Nam News (2025b), *Quảng Ninh Accelerates Progress on \$2.2 Billion LNG Power Project*, 7 August. <https://vietnamnews.vn/economy/1722860/quang-ninh-accelerates-progress-on-2-2-billion-lng-power-project.html>
- Viet Nam News (2025c), *Quảng Ninh's Coal Companies Digging Deep for a Future*, 5 September. <https://vietnamnews.vn/society/1724609/quang-ninh-s-coal-companies-digging-deep-for-a-future.html>
- Wischermann, J. (2024), *Vietnam: The Just Energy Transition Partnership (JETP) Has High Political Costs*, 10 March. <https://www.boell.de/en/2024/03/10/just-energy-transition-partnership-vietnam-jetp-has-high-political-costs>

- World Bank (2022a), *East Asia and Pacific Region Policy Note: Energy Sector Decarbonization in Vietnam*. Energy and Extractives Infrastructure Practice Group. <https://documents1.worldbank.org/curated/en/099516309052222817/pdf/IDU0c4a1d5c2054b004e670a7f3085330ecd829b.pdf>
- World Bank (2022b), *Energy Sector Decarbonization in Vietnam: Background Note to the Country Climate and Development Report (CCDR)*. Energy and Extractives, Infrastructure Practice Group.
- World Bank. (2022c). *Vietnam Country Climate and Development Report*. CCDR Series. <http://hdl.handle.net/10986/37618>
- World Bank (2024), *To Phase Down: A Renewed Approach to Coal Power in Developing Countries*. <https://openknowledge.worldbank.org/server/api/core/bitstreams/1f9c458d-af10-40e3-94fd-42224d6d0cab/content>
- Yamashita, T., T. Amari, Y. Urakata, K. Matsumoto, T. Mine, and A. Takayama (2023), 'Development of Ammonia Burner at Coal-fired Boilers for Decarbonized Society', *Mitsubishi Heavy Industries Technical Review*, 60(3), pp.1–4.

Appendix

The table below shows the data on coal-fired power plants (excluding unknown combustion technology) in Viet Nam used for the NPV analysis.

| Plant Name | Start Year | Capacity (MW) | Combustion Technology | NPV (40 Years) |
|----------------------------------|------------|---------------|-----------------------|----------------|
| Pha Lai Power Complex | 1983 | 110 | Subcritical | 0 |
| Pha Lai Power Complex | 1984 | 110 | Subcritical | 0 |
| Pha Lai Power Complex | 1985 | 110 | Subcritical | 0 |
| Pha Lai Power Complex | 1986 | 110 | Subcritical | 5,610,615 |
| Pha Lai Power Complex | 2002 | 300 | Subcritical | 270,045,834 |
| Pha Lai Power Complex | 2002 | 300 | Subcritical | 270,045,834 |
| Na Duong Power Station | 2004 | 50 | Subcritical | -74,474,390 |
| Na Duong Power Station | 2004 | 50 | Subcritical | -74,474,390 |
| Nhon Trach Formosa Power Station | 2004 | 150 | Subcritical | 64,996,818 |
| Cao Ngan Power Station | 2006 | 58 | Subcritical | 58,115,798 |
| Cao Ngan Power Station | 2006 | 58 | Subcritical | 58,115,798 |
| Uong Bi Power Station | 2007 | 300 | Subcritical | 387,067,828 |
| Quang Ninh Power Station | 2009 | 300 | Subcritical | 403,422,053 |
| Son Dong Power Station | 2009 | 110 | CFB | 108,389,299 |
| Son Dong Power Station | 2009 | 110 | CFB | 108,389,299 |
| Quang Ninh Power Station | 2010 | 300 | Subcritical | 410,911,624 |
| Cam Pha Power Station | 2011 | 340 | CFB | 440,980,008 |
| Cam Pha Power Station | 2011 | 340 | CFB | 440,980,008 |
| Hai Phong Thermal Power Station | 2011 | 300 | Subcritical | 417,977,256 |
| Hai Phong Thermal Power Station | 2011 | 300 | Subcritical | 417,977,256 |

| Plant Name | Start Year | Capacity (MW) | Combustion Technology | NPV (40 Years) |
|------------------------------------|------------|---------------|-----------------------|----------------|
| Nhon Trach Formosa Power Station | 2012 | 150 | Subcritical | 122,685,126 |
| Quang Ninh Power Station | 2012 | 300 | Subcritical | 424,642,947 |
| Hai Phong Thermal Power Station | 2013 | 300 | Subcritical | 430,931,335 |
| Mao Khe Power Station | 2013 | 220 | CFB | 231,560,693 |
| Mao Khe Power Station | 2013 | 220 | CFB | 231,560,693 |
| Nghi Son Power Station | 2013 | 300 | Subcritical | 430,931,335 |
| Hai Phong Thermal Power Station | 2014 | 300 | Subcritical | 436,863,776 |
| Nghi Son Power Station | 2014 | 300 | Subcritical | 436,863,776 |
| Nong Son Power Station | 2014 | 30 | Subcritical | 35,029,366 |
| Quang Ninh Power Station | 2014 | 300 | Subcritical | 436,863,776 |
| Uong Bi Power Station | 2014 | 330 | Subcritical | 480,550,154 |
| Vinh Tan Power Station | 2014 | 622 | Supercritical | 1,160,137,440 |
| Vinh Tan Power Station | 2014 | 622 | Supercritical | 1,160,137,440 |
| Vung Ang Power Station | 2014 | 600 | Subcritical | 1,046,867,794 |
| An Khanh Power Station | 2015 | 50 | CFB | 54,035,418 |
| An Khanh Power Station | 2015 | 50 | CFB | 54,035,418 |
| Duyen Hai Power Generation Complex | 2015 | 623 | Subcritical | 926,015,555 |
| Duyen Hai Power Generation Complex | 2015 | 623 | Subcritical | 926,015,555 |
| Mong Duong Power Station | 2015 | 540 | Subcritical | 954,251,254 |
| Mong Duong Power Station | 2015 | 540 | Subcritical | 954,251,254 |
| Mong Duong Power Station | 2015 | 620 | Subcritical | 1,095,621,810 |
| Mong Duong Power Station | 2015 | 620 | Subcritical | 1,095,621,810 |
| Vung Ang Power Station | 2015 | 600 | Subcritical | 1,060,279,171 |

| Plant Name | Start Year | Capacity (MW) | Combustion Technology | NPV (40 Years) |
|------------------------------------|------------|---------------|-----------------------|----------------|
| Nhon Trach Formosa Power Station | 2016 | 150 | Subcritical | 177,578,603 |
| Duyen Hai Power Generation Complex | 2017 | 623 | Supercritical | 1,226,678,422 |
| Duyen Hai Power Generation Complex | 2017 | 623 | Supercritical | 1,226,678,422 |
| Thai Binh Power Center | 2017 | 300 | Subcritical | 542,433,746 |
| Vinh Tan Power Station | 2017 | 600 | Supercritical | 1,182,340,648 |
| Thai Binh Power Center | 2018 | 300 | Subcritical | 548,063,972 |
| Thang Long Power Station | 2018 | 300 | CFB | 516,461,677 |
| Thang Long Power Station | 2018 | 300 | CFB | 516,461,677 |
| Vinh Tan Power Station | 2018 | 600 | Subcritical | 1,277,415,263 |
| Vinh Tan Power Station | 2018 | 600 | Supercritical | 1,194,612,828 |
| Vinh Tan Power Station | 2019 | 600 | Subcritical | 1,289,795,267 |
| Vinh Tan Power Station | 2019 | 600 | Ultra-supercritical | 915,132,926 |
| Duyen Hai Power Generation Complex | 2020 | 688 | Supercritical | 1,172,101,236 |
| Song Hau Thermal Power Plant | 2021 | 600 | Supercritical | 1,227,416,511 |
| Nghi Son Power Station | 2022 | 660 | Supercritical | 1,360,850,950 |
| Nghi Son Power Station | 2022 | 660 | Supercritical | 1,360,850,950 |
| Song Hau Thermal Power Plant | 2022 | 600 | Supercritical | 1,237,137,227 |
| Thai Binh Power Center | 2023 | 600 | Supercritical | 1,405,232,988 |
| Thai Binh Power Center | 2023 | 600 | Supercritical | 1,405,232,988 |
| Van Phong Power Station | 2023 | 716 | Supercritical | 1,487,260,539 |
| Van Phong Power Station | 2024 | 716 | Supercritical | 1,497,584,546 |
| Vung Ang Power Station | 2025 | 660 | Ultra-supercritical | 1,273,062,865 |
| Vung Ang Power Station | 2025 | 660 | Ultra-supercritical | 1,273,062,865 |

| Plant Name | Start Year | Capacity (MW) | Combustion Technology | NPV (40 Years) |
|--------------------------|------------|---------------|-----------------------|----------------|
| Na Duong Power Station | 2026 | 110 | CFB | 166,093,453 |
| Quang Trach Power Center | 2026 | 701 | Supercritical | 1,484,741,991 |
| Quang Trach Power Center | 2026 | 702 | Supercritical | 1,486,860,025 |
| Quang Tri Power Station | 2026 | 600 | Ultra-supercritical | 1,164,384,716 |
| Long Phu Power Centre | 2027 | 600 | Supercritical | 1,278,084,419 |
| Long Phu Power Centre | 2027 | 600 | Supercritical | 1,278,084,419 |
| Quang Tri Power Station | 2027 | 600 | Ultra-supercritical | 1,171,040,224 |