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7th INTERNATIONAL CONFERENCE ON ECONOMIC MANAGEMENT IN MINERAL ACTIVITIES AND TOPICAL ISSUES IN SUSTAINABLE DEVELOPMENT (EMMA+)

HANOI UNIVERSITY OF MINING AND GEOLOGY
Faculty of Economics and Business Administration

# 7th INTERNATIONAL CONFERENCE

# EMMA+

## ON ECONOMIC MANAGEMENT IN MINERAL ACTIVITIES AND TOPICAL ISSUES IN SUSTAINABLE DEVELOPMENT

October 23rd - 24th, 2024, Hanoi, Vietnam

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# FOREWORD

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We are pleased to welcome you to the 7th International Conference on Economic Management in Mineral Activities and Topical Issues on Sustainable Development (EMMA+), hosted at the Hanoi University of Mining and Geology on October 23, 2024. The Conference continues to foster dialogue among scientists, researchers, experts, and students dedicated to advancing the field of economic management in mineral activities and sustainable development.

The 7th EMMA+ is particularly special as it coincides with the 25th Anniversary of the Faculty of Economics and Business Administration. This milestone reflects our commitment to excellent education and research, and we are excited to celebrate this journey with all of you.

This year, the Conference received 70 submissions from Australia, Russia, Romania, China, Indonesia, Thailand, and Vietnam. After a rigorous peer-review process, we are proud to include 51 papers in this proceedings volume, alongside ten qualified articles selected for publication in the Journal of Indonesian Economy and Business and Gadjah Mada International Journal of Business. These works represent the latest advancements, insights, and innovative research in the field.

We would like to extend our heartfelt gratitude to all participants whose contributions and insights enrich our discussions and knowledge base. A special thanks goes to our diligent reviewers, whose expertise and commitment ensure the quality of the papers selected for publication. We would like to acknowledge the significant support from the University of Applied Sciences Georg Agricola Bochum, Germany, and colleagues at the Faculty of Economics and Business Administration. Your dedicated assistance has been crucial to the successful organization of the Conference and the preparation of the proceedings. We also appreciated the financial support from our sponsors, which has greatly facilitated our efforts.

We wish the 7th EMMA+ a great success and all participants an enjoyable and fruitful scientific gathering in Hanoi. We look forward to seeing you again at the 8th EMMA+ in 2026 at the same location.

**On behalf of the Organizing Committee**

**Prof. Tran Thanh Hai, PhD**

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# GREEN GROWTH

# ENERGY TRANSITION IN VIETNAM: THE LESSONS LEARNT FROM INTERNATIONAL EXPERIENCES

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**Abstract:** *As fossil fuel resources become depleted and environmental pollution issues arise from their utilization, transitioning to renewable energy is imperative for national sustainable development. Vietnam set an ambitious target: achieving net-zero emissions by 2050 through various strategies, including a commitment to cease the use of coal-fired power by 2050 (Vietnam's-Commitments-at-COP26, 2021). To achieve this goal, Vietnam will face numerous challenges during the transition, including energy security concerns, high costs, and impacts on the livelihoods of workers in the coal sector, especially as coal still accounts for over 33% of electricity generation capacity and more than 50% of power output (Kirin-Capital, 2024). If these challenges are not addressed, the transition process may stall, failing to meet commitments made at the COP26 conference or impacting energy security. This paper analyzes the experiences of countries that have significantly progressed in transitioning away from coal-fired energy, such as the UK, Germany, and China. It proposes policies that could apply to Vietnam. Recommendations are made to promote technological innovation, improve clean energy development models, and enhance community and business engagement toward a sustainable transition model.*

**Keywords:** *Energy transition, energy transition lessons, energy transition experiences.*

## 1. INTRODUCTION

In Resolution 55-NQ/TW dated February 11, 2020, the Political Bureau outlined the strategic orientation for the national energy development up to 2030 and vision to 2045, emphasizing to "exploit, use thoroughly and efficiently renewable energies, new energies, and clean energies; and to exploit and use fossil energy sources domestically in a rational manner" (Resolution-No-55/NQ-TW, 2020).

At COP26, Vietnam was among the nations that made strong commitments to achieving net-zero emissions by 2050, ceasing new coal-fired power construction from 2030 and gradually phasing out coal power from 2040; announcing initiatives on forests and land use; participating in the Global Adaptation Coalition; and reducing methane emissions by 30% by 2030 compared to 2020 levels. (Vietnam's-Commitments-at-COP26, 2021).

Power Plan VIII also states: "Orientation to 2050: No longer use coal for power generation, completely switch fuel to biomass and ammonia..." (Decision-No-500/QĐ-TTg, 2023).

Meanwhile, as of the end of 2023, the total capacity of coal-fired thermal power was 26,757 MW, accounting for 33.2% of the total power capacity, while coal-fired power constituted 46.1% of total electricity output [2]. In 2024, coal-fired thermal power is expected to contribute over 55% of the electricity consumption due to lower water inflow to hydroelectric reservoirs compared to previous years (Vietnam Electricity, 2024).

The transition away from coal-fired energy is an inevitable trend in Vietnam

due to its international commitments and because such a transition brings numerous benefits, such as climate change mitigation, minimizing environmental and health risks, enhancing national energy security, and improving the country's trade balance. However, the transition to non-coal energy has many challenges. Vietnam will face several hurdles during the process, including energy security issues, high costs, and impacts on workers' livelihoods in the coal sector and thermal power plants.

This report explores the experiences of countries transitioning away from coal-fired energy and enhancing renewable energy, such as the UK, the US, Germany, and China, which have made significant progress in this field, to consider proposals that could be applied to Vietnam.

## 2. GLOBAL ENERGY TRANSITION EXPERIENCES

Vietnam should learn from the experiences of countries that have previously undergone significant transitions in energy usage to implement its energy transition goals effectively.

The European Union, as a continent leading the energy shift, provides a valuable case study in energy transition experiences. Notably, Germany and the UK, selected for this study, transitioned from a fossil fuel-based power system, where coal power once had a substantial share in their electricity production. These countries have made concerted efforts to transition to renewable energy-based power systems. Another country included in this study is China, a global leader in renewable energy research and investment. Despite its continued use of coal power, China shares similar natural conditions and potential for renewable energy development with Vietnam.

### 2.1. Germany

#### *2.1.1. Current State of Electricity Production in Germany*

From 2000 to 2022, coal power consistently contributed significantly to Germany's total electricity output, although its share has declined. The proportion of coal-fired electricity decreased from 65% in 1999 to about 30% by 2022, with a point where it only constituted 25% of the nation's total electricity production. Alongside coal, nuclear power decreased from over 30% in 2000 to 10% in 2022. Conversely, electricity from renewable energy sources has significantly increased, rising from nearly 5% in 1999 to about 55% by 2022.

The German government has committed to phasing out coal-fired power plants by 2038.

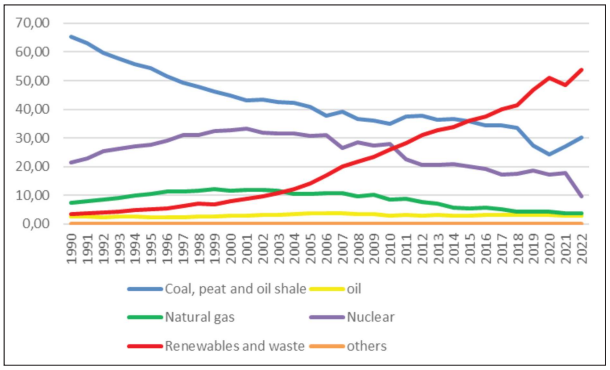


**Fig 1.** Proportion of Electricity Sources in Germany from 1990-2022

*Source IEA*

#### *2.1.2. Germany's Experience in Energy Transition*

Germany's approach to reducing coal emissions has been cautious and comprehensive, particularly during the discussion about coal reduction conducted after Germany shut down its last three

nuclear reactors in April 2023. The insights from the debate, policy formulation, and Germany's approach to reducing coal-fired power can be valuable lessons for other countries, including Vietnam.

*- Establishment of the Coal Commission with a comprehensive approach to a just energy transition:*

From 2015 to 2018, Germany conducted extensive research on various policy options with different approaches aimed at gradually reducing and eventually ceasing the operation of coal-fired power plants (Agora, 2019).

To facilitate this process, the German government established the Commission on Growth, Structural Change, and Employment (commonly known as the Coal Commission), which included representatives from the energy industry, trade, environmental sectors, coal industry regions, unions, etc., to research, discuss, and develop a roadmap for reducing coal-fired electricity generation. The purpose of the Commission was to create a coal reduction roadmap and promote a just transition, ensuring minimal negative impacts on the economy and society by considering the overall reduction of coal-fired power in the context of energy security, electricity pricing, economic development in coal mining regions, new employment opportunities, as well as social cohesion and environmental concerns. The Federal Ministry of Economics and Energy oversaw the Commission.

The final report of the Commission estimated the total cost necessary to completely stop coal-fired power plants in Germany by 2038 at approximately 69 - 93 billion EUR, including several critical elements (World resource institute, 2021): (1) direct and indirect support for workers (including retraining, early retirement support, and job loss compensation) with an estimated total cost of 5 - 7 billion EUR, (2) involvement of trade unions, employers, and the government in conducting collective labor agreements, as well as signing additional contents in employment contracts regarding compensation for job loss and workers' rights, (3) price compensation to limit electricity price increases, with an estimated budget of 16 - 32 billion EUR from 2023 to 2038 to ensure that the costs of ceasing coal-fired power generation are not passed on to electricity prices and consumers, (4) dialogue between local governments and communities regarding plans related to coal mines, (5) compensation for the owners of coal-fired power plants, estimated at 5 - 10 billion EUR for early plant closure.

*- Enactment of related laws on coal reduction:*

In 2020, Germany enacted two laws related to reducing coal-fired power: the Coal Reduction and Cessation Act and the Coal Regions Support Act.

The 2020 Coal Reduction and Cessation Act established a gradual reduction roadmap for coal-fired power plants, decreasing capacity to approximately 30 GW by 2022 (15 GW each for lignite and hard coal) and 17 GW by 2030.

The Act introduced a bidding policy to cease coal-fired power plants, where hard-coal plants would participate in voluntary bidding until 2027, and from 2031, coal plants must shut down gradually according to the law. The bidding policy was designed to ensure that plants closing earlier would receive more compensation, with a bidding cap of 165 EUR/kW in 2020 for the first round of bidding in September 2020, decreasing to 89 EUR/kW by 2027.

The Coal Reduction and Cessation Act set specific targets for the capacity of coal-fired

power plants (decreasing) for 2022, 2030, and 2038. In its coal reduction roadmap, Germany also specified the cessation of lignite power plants in the western regions first, followed by those in the eastern areas (due to the weaker economy of the eastern regions and their greater vulnerability due to the cessation of coal-fired power).

The German government also reached agreements with investors in lignite power plants to specify closure dates and compensate them with a total of 4.35 billion EUR.

The Coal Regions Support Act introduced regulations for financial support to change the economic structure in regions and states affected by the cessation of coal use.

The support law introduced financial support up to 40 billion EUR to support economic restructuring in regions affected by the cessation of coal-fired power, including compensation for job loss and support for sustainable economic development. The Federal Government will provide 26 billion EUR in support for the affected regions by developing infrastructure and establishing new research facilities. Additionally, 14 billion EUR is directly invested in coal mines and other affected states.

There is also 1.1 billion EUR in specific support for less developed regions of coal-fired power plants using hard coal in Germany.

As per regulation, some coal-fired power plants will close entirely, while others will switch to reserve capacity mode, which must be maintained to be ready to operate again. In emergencies requiring power generation, reserve plants must generate electricity onto the grid within ten days. Furthermore, plants identified as crucial for voltage stability on the power grid (and approved by the federal regulatory authority) will have their own plans. (Dũng, 2023)

*- Electricity pricing policy*

Germany pioneered the Feed-in Tariff (FiT) rates for each kWh of electricity fed onto the grid. FiTs for small rooftop systems commissioned in October 2018 could be as high as 11.84 cents-EUR/kWh and are guaranteed to the operator for the next 20 years.

The FiT mechanism in Germany was applied in 2000 and regulated under the Renewable Energy Act (EEG). In 2014, the EEG Act in Germany adjusted the fixed purchase price from renewable energy sources downwards; simultaneously, it began phasing out fixed-price purchases from solar power and moving to auction-based purchases. In 2016, the EEG Act was further adjusted by eliminating subsidy policies and moving to a government purchasing electricity through auction formats.

## 2.2. United Kingdom

### *2.2.1. Current State of Electricity Production in the UK*

Since the 1960s, the UK has developed oil and natural gas. Thus, the share of electricity generated from gas and oil has been relatively high. At one point, the proportion of electricity generated from oil and gas exceeded 65% of the total electricity generation. In 2022, the UK's share of electricity from oil and gas was still around 65%. Coal power in the UK decreased from over 30% in 1990 to about 10% in 2012; by 2020, the proportion of coal power was nearly zero. Renewable energy in the UK has gradually increased in share throughout this period. By 2022, the total electricity from renewable sources in the UK was about 20%.

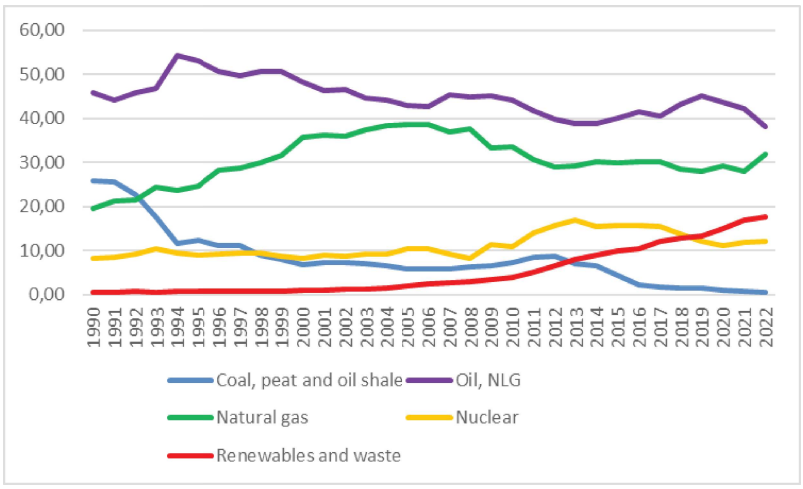


**Fig 2.** Proportion of Electricity Sources in the UK from 1990-2022

*Source: IEA*

The most noteworthy lesson for Vietnam from the UK is the effective elimination of coal power.

### *2.2.2. UK's Experience in Energy Transition (National Agency for Science and Technology Information, 2022)*

In 2015, the UK committed to eliminating coal power from the national grid by 2025. On April 21, 2017, the United Kingdom experienced its first coal-free day since the start of the Industrial Revolution.

By May 2019, the National Grid of the United Kingdom confirmed that it had gone 168 hours, equivalent to a week, without using coal-fired energy.

Unlike Germany, where solutions primarily came from government-enacted laws to reduce coal power, the UK utilized market mechanisms to decrease coal usage.

*- Renewable Energy Obligation*

The UK introduced the Utilities Act 2000, which was enacted in 2000. This act introduced the Renewables Obligation (RO) system, which requires electricity producers to source a certain percentage of their electricity from renewable energies. RO came into effect in April 2002, mandating that UK electricity suppliers contribute a mandatory renewable energy ratio within their total commercial electricity output. In 2015, this ratio was 15.4%. Companies that achieved the required renewable energy ratio were issued a Renewables Obligation Certificate (ROC). If they failed to meet the requirement, they had to pay a buy-out fee of £34.3 per MWh shortfall for 2007-2008. This money went into the buy-out fund managed by Ofgem, and annually, a portion of the fund supports units achieving ROC certification.

Initially, ROCs were granted for each MWh of renewable electricity generated, regardless of the technology used. However, projects utilizing advanced technologies such as biomass or anaerobic digestion received more support than waste gas projects.

Establishing the RO market and the buy-out fund made renewable energy production more financially attractive. Renewable energy producers profit from selling regular energy, receive support from the buy-out fund and sell excess ROCs above their quota.

*- Tax incentives policies*

In the UK, all electricity production is subject to a climate change levy, except for electricity generated from renewable sources, which is exempt from this tax (about EUR 6.3/MWh). As part of its policy to transition to new

energy sources and reduce the use of fossil fuels, the UK government has focused on implementing tax credits or tax exemptions for fuels produced by renewable sources to encourage renewable energy development, increase public investment income, and cut labor costs.

*- Pricing policies*

The UK has developed a FiT-CfD (Feed-in Tariff with Contract for Difference) framework, where low-carbon power plants sign different contracts with the CfD Counterparty backed by the government, which acts as an intermediary between power generators and suppliers.

Under the CfD contract, renewable energy generators receive the excess amount over the strike price compared to the reference price calculated by the average wholesale electricity price, or they get compensated for the difference if the reference price exceeds the strike price. This system allows power generators to hedge against local price volatility.

*- Other policies*

In April 2006, the UK government announced an action plan to develop renewable energy, notably a 5-year funding plan for biomass heating systems and combined heat and power biomass systems. In the same year, the UK government approved a program to assist with the installation costs of renewable energy supply stations such as hydrogen, electric, biofuel, natural gas/biomass stations... The deployment of biomass fuel projects in the UK was also supported by the Department of Energy and Climate Change and the National Lottery's New Opportunities Fund, which provided GBP 66 million in funding.

## 2.3. China

### *2.3.1. Current State of Electricity Production in China*

The structure of electricity production in China is depicted in Figure 3. Coal-fired power still plays a major role in China's electricity mix, accounting for nearly 70%. Despite being a global leader in renewable energy investment, with 546 million USD invested in 2022, China's share of renewable energy remains relatively low, just over 13%. However, from now until 2050, China has set directions to reduce the share of coal power to below 25% and increase the share of electricity from environmentally friendly sources, including wind, solar, and biomass power, as shown in Fig 4. This strategy is similar to Vietnam's future direction. Thus, China's policies are highly relevant to Vietnam, a country with conditions nearly identical to those of China.

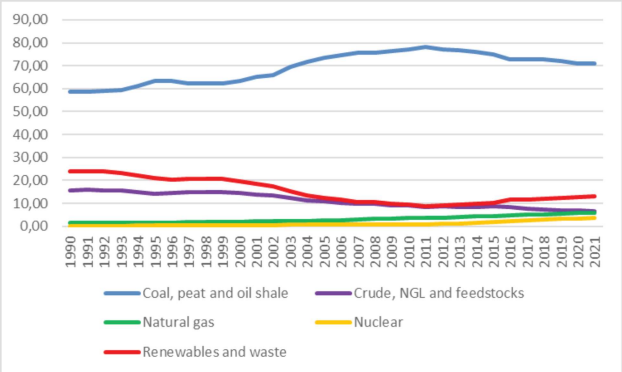


**Fig3. Electricity Sources in China from 1990-2022**

*Source: IEA*

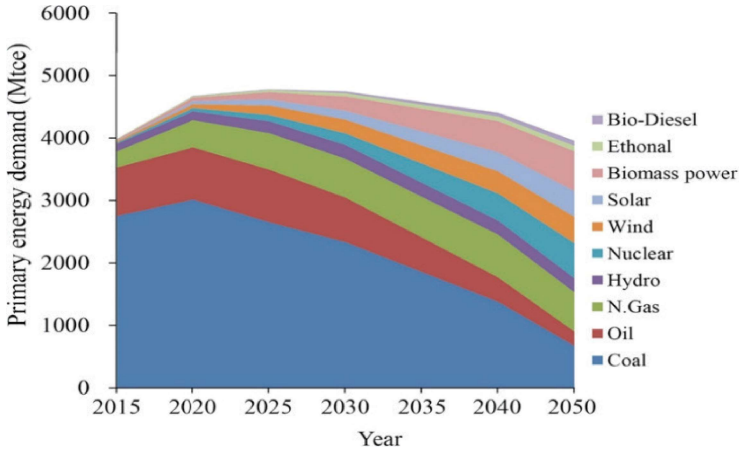


**Fig 4.** China's Energy Transition Scenario by 2050 (Xiang, 2022)

### *2.3.2. China's Experience in Renewable Energy Transition (National Agency for Science and Technology Information, 2022)*

*- Investment in Infrastructure for Renewable Energy*

In China, the government has given significant attention to the investment in infrastructure to develop renewable energy. They have heavily invested in the power transmission network to avoid congestion and potential damage to individual power grids in cases of large fluctuations in power supply.

*- Tax Incentives*

Tax incentives in China for the renewable energy sector include:

Corporate Income Tax (CIT) Policies: Certain enterprises within the renewable energy sector are eligible for CIT incentives, including up to a 50% reduction in corporate income tax.

+ Value-Added Tax (VAT) Policies: The Chinese government has implemented various tax incentives, including a 50% VAT refund for businesses selling wind-generated electricity, a 100% VAT refund for the sale of biodiesel produced from vegetable oil, VAT exemption for the sale of self-produced goods including recycled water, standard-compliant powdered rubber made from old tires, retreaded tires, and some building materials made from 30% or more waste, as well as VAT exemption for wastewater treatment, waste disposal, and sludge treatment services.

Besides incentives related to corporate income tax and VAT, China has also taxed and eliminated subsidies for fossil fuel sources (coal, oil, gas), as exemplified by Shanxi province's implementation of a coal tax.

*- Electricity Pricing Policy*

In China, the Feed-in Tariff (FiT) for renewable energy is a significant financial policy and has significantly contributed to the miraculous development of renewable energy in China. Specifically, the FiT requires the purchase of renewable energy at a fixed price. FiT is calculated based on factors such as the avoided cost in conventional power production, the cost of renewable energy plus a reasonable profit, and the average retail price. Thus, the renewable energy subsidy policy (FiT) is regularly adjusted.

*- Credit policy*

China established the Renewable Energy Development Fund to support the following activities: research, development of standards, implementation of pilot projects on the application of REIT; application of loan programs with preferential interest rates when investing in renewable energy projects or scientific and technological research in the field of renewable energy through funds dedicated to renewable energy development.

## 3. LESSONS FOR VIETNAM IN ENERGY TRANSITION

The author analyzes the current state and direction of Vietnam's energy transition until 2050 to draw lessons for achieving net-zero emissions as committed at COP 26.

### 3.1. Current State of Electricity Production in Vietnam

From the 1990s to 2010, Vietnam focused on exploiting hydroelectric power. During these 20 years, Vietnam only added five medium and large thermal power plants into commercial operation. As a result, the output from coal-fired power during this period only accounted for 10-16% of the total national electricity output.

However, from 2010 to the present, according to the adjusted National Power Development Plan for the period 2011-2020 with an outlook to 2030 (Power Development Plan VII adjusted) (Decision-No-1208/QĐ-TTg, 2011), by 2020, the total capacity of coal-fired power plants was about 26,000 MW (accounting for 42.7% of the total system capacity), producing about 131 billion kWh (accounting for 49.3% of electricity production).

**Table 1. Statistics of Electricity Production by Source for 2021-2023**

| TT | Power output, MW | | | Proportion (%) | | |
|---|---|---|---|---|---|---|
| | 2021 | 2022 | 2023 | 2021 | 2022 | 2023 |
| Hydro Power | 21.836 | 22.544 | 22.872 | 28,50 | 28,98 | 28,39 |
| Coal Power | 24.671 | 25.312 | 26.757 | 32,20 | 32,53 | 33,22 |
| Gas Power | 7.125 | 7.160 | 7.160 | 9,30 | 9,20 | 8,89 |
| Renewable Energy | 20.670 | 20.670 | 21.664 | 26,98 | 26,57 | 26,89 |
| Other Sources | 2.318 | 2.114 | 2.102 | 3,03 | 2,72 | 2,61 |
| Total Capacity | 76.620 | 77.800 | 80.555 | 100 | 100 | 100 |

*Source: (Kirin-Capital, 2024)*

By the end of 2023, the total capacity of the power system reached about 80,555 MW, an increase of more than 2,800 MW compared to 2022. Coal power accounted for the largest share at over 33.2% in 2023, a rise of 0.7% compared to 2022. Electricity from hydro and renewable sources also accounted for a significant proportion in 2023, at 28.4% and 26.9%, respectively, but the increase in proportion was relatively small.

### 3.2. Vietnam's Energy Transition Direction by 2050

According to Power Development Plan VIII, there is a significant change in the power capacity structure. Specifically, the capacity from coal power decreases from more than 33% in 2023 to 20% in 2030, and to 0% by 2050.

**Table 1. Statistics of Power Plant Capacity by Source for the Period 2030-2050**

| No. | Capacity (MW) | | | Proportion (%) | | |
|---|---|---|---|---|---|---|
| | 2030 | 2050 (kịch bản thấp) | 2050 (kịch bản cao) | 2030 | 2050 (kịch bản thấp) | 2050 (kịch bản cao) |
| Hydropower | 32.046 | 66.666 | 81.566 | 21,29 | 13,91 | 13,96 |
| Coal Power | 30.127 | 0 | 0 | 20,02 | 0,00 | 0,00 |
| Gas Power +NGL | 37.330 | 35.830 | 44.830 | 24,81 | 7,48 | 7,67 |
| Wind Power | 27.880 | 130.050 | 168.550 | 18,53 | 27,14 | 28,84 |
| Solar Power | 12.836 | 168.594 | 189.294 | 8,53 | 35,18 | 32,39 |
| Biomass Power + Cogeneration | 4.970 | 36.147 | 42.947 | 3,30 | 7,54 | 7,35 |
| Other Power Sources | 5.300 | 41.942 | 57.242 | 3,52 | 8,75 | 9,79 |
| Total Capacity | 150.489 | 479.229 | 584.429 | 100 | 100 | 100 |

*Source: (Decision-No-500/QĐ-TTg, 2023)*

The capacity of electricity from renewable energy sources significantly increases from more than 26% in 2023 to 28.5% in 2030 and over 60% by 2050 in both scenarios. Up to 2030, wind and gas power are prioritized for development, while solar power growth slows down, decreasing in proportion from more than 20% to 9% by 2030. However, from the 2030-2050 period, solar power will be prioritized for aggressive development, with its proportion increasing from nearly 9% in 2030 to over 35% by 2050. Wind power continues to be encouraged for development during the 2030-2050, but gas power decreases proportionally.

Although hydropower decreases in proportion during the 2030-2050 period, the electricity output from hydroelectric power still nearly doubles in 2050 compared to 2030.

Thus, Vietnam's electricity production structure is trending towards a substantial reduction in coal-fired power by 2050, while other fossil fuels, such as oil and gas, are still encouraged to be used along with other energy sources.

### 3.3. Vietnam's Policies on Energy Transition

In terms of policy and legal framework, since 2007, Vietnam has first adopted the national energy development strategy envisioning up to 2050 through Decision No. 1855/QD-TTg dated December 27, 2007, by the Prime Minister (Decision-No-1855/QĐ-TTg, 27/12/2007).

Based on this, various decrees and plans have been issued:

In 2011, the Government approved a 10-year development plan from 2011 to 2020 in the initial Power Development Plan VII under

Decision 1208/QD-TTg dated July 21, 2011, which, for the first time, identified the role and proportion of renewable energy sources (Decision-No-1208/QĐ-TTg, 2011).

In 2014, to strengthen the legal framework for the development of energy sources, the National Assembly amended the Electricity Law No. 28/2004/QH11 (2004), which was amended by Law No. 24/2012/QH13 at Article 29, laying the foundation for the development of renewable energy projects; a new Environmental Protection Law No. 55/2014/QH13 was enacted, which clearly defined the scope of application for renewable energy and emphasized government incentives for the exploitation and use of green and renewable energy.

To promote the objectives set out in Power Development Plan VII, in 2015, the Government announced Decision No. 2068/QD-TTg on Vietnam's first Renewable Energy Development Strategy, aiming for renewable energy to account for about 32% of total primary energy consumption and electricity production by 2030, and up to 44% by 2050 (Decision-No-2068/QĐ-TTg, 2015).

In 2016, the Government amended Power Development Plan VII to continue increasing these targets, raising the proportion of renewable energy to 10% according to Decision No. 428/QD-TTg on the National Power Development Plan for the period 2011 - 2020, with a vision to 2030 (Decision-No-428/QĐ-TTg, 2016).

Prime Minister's decisions on renewable energy development include:

- Decision No. 11/2017/QD-TTg dated April 11, 2017, and 13/2020/QD-TTg dated April 6, 2020, to encourage solar power development.

- Decision No. 37/2011/QD-TTg dated June 29, 2011, and Decision No. 39/2018/QD-TTg dated September 10, 2018, to promote wind power development.

- Decision No. 24/2014/QD-TTg dated March 24, 2014, and Decision No. 08/2020/QD-TTg dated March 5, 2020, amending and supplementing some provisions of Decision No. 24/2014/QD-TTg on biomass power.

- The most recent is Decision 500/QD-TTg dated May 15, 2023, by the Prime Minister approving the National Power Development Plan for the period 2021 - 2030, with a vision to 2050 (referred to as Power Development Plan VIII), continuing to adjust the policy frameworks related to renewable energy.

It is evident that, despite having a strategic framework since 2007 and multiple policy adjustments through decisions by the Prime Minister from 2014, 2015, 2016 to the most recent in 2023, policies and laws for renewable energy investment have not been specified in a single law but are scattered across various legal documents.

To meet the primary conditions of a project, renewable energy project developers must comply with several basic conditions:

- Comply with the power development planning;

- Meet the complex process of electricity purchasing and power purchase agreements, including grid connection, control system monitoring and data collection, and metering; approve environmental impact assessments; fire prevention and fighting plans; power operation licenses and power generation permits.

- In addition to meeting these requirements, renewable energy projects must comply with laws on investment, electricity, construction, environment, taxes, etc., not to mention the policy mechanisms of each locality.

### 3.4. Lessons for Vietnam

Given the current state, the direction of energy transition as previously outlined, and the government's energy transition policies, Vietnam has made significant efforts to transition towards low-emission energy. Recently, Vietnam has been recognized as one of the countries with rapid development and numerous incentives for renewable energy projects.

As of June 23, 2023, 70 of 85 renewable energy projects with a total capacity of 3,851.86 MW have submitted documents to the Vietnam Electricity Power Trading Company (EVNEPTC) to negotiate electricity prices and power purchase agreements. Furthermore, 11 wind and solar projects/ parts of projects with a total capacity of 545.72 MW have completed the Commercial Operation Date (COD) procedures and officially commenced commercial electricity generation. However, Vietnam needs to implement many more projects to achieve the goals set out in the Power Development Plan VIII.

From the actual activities of energy transition in countries like Germany, the UK, and China, we can observe the following: Germany has consistently implemented legislative measures carefully adjusted from the initial stages of developing systems to encourage renewable energy, adjusting feed-in tariffs (FiTs) and their decreasing rates according to the type of renewable energy, capacity range, and year of activation. Conversely, the UK has maximized market functions to encourage renewable energy efficiently. Meanwhile, China has introduced numerous tax incentives, credits, and pricing like the UK, focusing on infrastructure development.

Vietnam also has coal mines that need to be closed, just like Germany, and it needs to encourage investment in renewable energy. Therefore, we can draw the following lessons for energy transition:

#### *3.4.1. Policy Framework*

As analyzed, Vietnam's policies on energy transition are numerous but not focused, with various overlapping regulatory documents. Therefore, Vietnam needs a national master plan for renewable energy development, a clear and stable legal and policy framework, and sufficient incentives to attract investors. Policies are the main driver of growth, and a comprehensive legal system ensures the stability and security of investments in renewable energy.

To create a market for various technologies, encouraging policies, such as targets, quotas, mandatory obligations, standards, rules, and efficient tasks, and attractive policies, including pricing policies, public procurement, tradable certificates, and regulations on renewable energy, should be established.

#### *3.4.2. Infrastructure*

Renewable energy has the characteristic of rapid, uncontrollable changes in generation capacity, which will cause significant fluctuations in the power system whenever these sources generate intermittently and unstably.

Therefore, to develop these energy sources, investment in infrastructure and power systems is necessary. Expanding public investment in energy-efficient use will ensure the power system operates safely without voltage or frequency drops.

Investment in electrical storage systems for flexible use is also critical.

### *3.4.3. Investment Policy*

To transition from coal power by 2050, many renewable energy plants must be developed to replace coal power, ensuring energy security and economic growth. Therefore, many policies are needed to encourage investment in the renewable energy sector. Some suggestions for policies to enhance investment activities in renewable energy include:

- Implementing budgetary measures, cooperating with energy service companies, or using public-private partnerships (PPP) where risks are shared with the private sector.

- Establishing mega energy service companies to effectively pool and fund energy efficiency projects in the public sector.

- Supporting cost for activities: Research, establish standards, implement pilot projects applying renewable energy.

Dedicated funds for renewable energy development should be used to apply loan programs with preferential interest rates for investment in renewable energy projects or scientific research and technology (R&D) in the renewable energy sector.

### *3.4.4. Pricing Policy*

According to Decision 2068/QD-TTg, Vietnam had a supporting FiT policy (Decision-No-2068/QĐ-TTg, 2015), but this policy is no longer suitable because the uniform FiT applied nationwide leads to development concentration in areas with high economic potential (high solar radiation, considerable average wind speed), resulting in some regions experiencing grid overload or investments in low-demand areas requiring long-distance transmission. To remedy this, a regional and appropriate support pricing policy is needed.

### *3.4.5. Solutions related to closing coal power plants*

As Vietnam has committed to not using coal power by 2050, numerous coal power plants will gradually close until 2050. To facilitate this process, Vietnam should implement the following solutions:

- Developing a roadmap for reducing emissions from coal power and form a joint committee with representatives from all parties involved in the transition and plant closure (including representatives from the coal industry, coal mining localities, unions, and environmental and energy sectors) to ensure studies and evaluations consider the interests of all stakeholders, especially the rights of workers and local socio-economic development benefits.

- Identifying key coal power plants that directly affect the stability of the power system and plants that need to maintain a reserve mode.

- Building a detailed roadmap with specific evaluations of the necessary budget costs to choose appropriate policy options for each development stage, including fuel transition scenarios and cessation of coal power plant operations linked to the impact on the coal industry.

- Adjusting electricity prices to reasonable levels to generate revenue to support the closure of coal power plants.

- Cataloging and planning for retraining or compensating workers who lose their jobs during the energy transition process.

## 4. CONCLUSION

Transitioning to low-carbon energy and phasing out coal power is an inevitable trend that Vietnam must embrace due to its international commitments and substantial benefits such as environmental damage reduction, decreased health risks to the community, enhanced national energy security, and improved trade balance. Vietnam has already been transitioning from coal to increasing the use of renewable energy sources. Analyzing the experiences of countries currently undergoing energy transitions, such as the UK, Germany, and China, where significant progress has been made in this field, is crucial to formulating appropriate policies for Vietnam. The lessons drawn from the analysis of these countries' experiences, combined with Vietnam's current reality and energy transition direction, include lessons on policy frameworks, infrastructure, investment policies, pricing strategies, and solutions related to the closure of thermal power plants.

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