

Ha Noi, 15 May 2023

DECISION

On approving the National Power Development Plan for the 2021-2030 period, with a vision to 2050

THE PRIME MINISTER

- Pursuant to the Law on Government Organisation dated 19 June 2015; the Law on amending and supplementing a number of articles of the Law on Government Organisation and the Law on Organisation of Local Government dated 22 November 2019.
- Pursuant to the Law on Planning dated 24 November 2017;
- Pursuant to the Electricity Law dated 3 December 2004; the Law dated 20 November 2012 on revising the Electricity Law;
- Pursuant to Resolution 61/2022/QH15 dated 16 June 2022 of the National Assembly on continuing to strengthen the effectiveness and efficiency of the implementation of policies and laws on planning and a number of solutions to remove difficulties and obstacles, accelerating the formulation and improve the quality of planning for the period 2021 - 2030;
- Pursuant to the National Assembly's Resolution 81/2023/QH15 dated 9 January 2023 on the National Master Plan for the 2021-2030 period, with a vision to 2050;
- Pursuant to the Government's Decree 37/2019/ND-CP dated 7 May 2019 detailing the implementation of a number of articles in the Law on Planning;
- Pursuant to the Government's Decree 37/2013/ND-CP dated 21 October 2013 detailing the implementation of a number of articles in the Electricity Law and the Law on revising the Electricity Law;
- At the request of the Ministry of Industry and Trade mentioned in the Letter of Proposal 2842/TTr-BCT dated 14 May 2023 and the Official Dispatch 2851/BCT-DL dated 15 May 2023; the Appraisal Report 62/BC-HD TDQHD dated 13 May 2023 of the Appraisal Council for the National Power Development Plan for the 2021-2030 period, with a vision to 2050.

DECIDES:

Article 1. To approve the National Power Development Plan for the 2021-2030 period, with a vision to 2050 (hereafter referred to as PDP8) with the following key contents:

I. SCOPE OF PLANNING

Planning for the development of power sources and power transmission grids at the voltage level of 220 kV and above, new and renewable energy industries and services within the territory of Viet Nam in the 2021-2030 period, with a vision to 2050, including interconnection facilities with neighbouring countries.

II. DEVELOPMENT PERSPECTIVE AND OBJECTIVE

1. Development perspective

a) Electricity is an essential infrastructure sector, and the development of the power sector must take a proactive approach to create a foundation for rapid and sustainable national development, build an independent and self-reliant economy, improve the livelihoods of the people, and ensure national defence and security. Power development planning must have a long-term vision, be efficient, and sustainable, and prioritise the interests of the nation and the people above all else.

b) The development of the power sector follows the principle of optimising the overall factors related to power generation, transmission, distribution, and efficient electricity use. It includes a suitable roadmap that aligns with resource conservation, environmental protection, and economic transformation, ensuring national energy security at the lowest cost possible. This approach aims to achieve a comprehensive and

balanced development of the power sector, considering various aspects such as sustainability, cost-effectiveness, resource efficiency, and environmental preservation.

c) The development planning of the power sector must be based on scientific foundations and incorporate inheritance, dynamism, and openness while avoiding the legitimisation of any irregularities. It should ensure efficient exploitation and utilisation of domestic energy resources, combined with reasonable import and export activities, as well as promote energy savings and efficiency. The development of renewable energy and new energy sources should be seen as an opportunity to foster the comprehensive development of the energy industry ecosystem while considering the overall ecological system.

d) The state focuses on investing in and promoting economic entities to accelerate the electricity sector development based on the principles of healthy competition and implementing market mechanisms for electricity pricing. This ensures a harmonious balance of interests among the entities involved in investment, and electricity consumption, and meets the development requirements of different regions and areas.

e) The electricity sector development must closely follow the trends in scientific and technological advancements worldwide, particularly in renewable energy and new energy sources. It should be aligned with the process of transitioning the national economy towards a green economy, circular economy, and low-carbon economy. The energy transition should align with international trends and ensure sustainability, fairness, and justice.

2. Development objective

a) Overall objective

- Ensuring national energy security and meeting the requirements of economic and social development, as well as industrialisation and modernisation of the country.

- Successfully implementing a fair energy transition in conjunction with modernising production, establishing a smart grid, and managing advanced power system technologies that align with the green transition, emission reduction, and global scientific and technological advancements.

- Developing a comprehensive energy industrial ecosystem based on renewable energy and new energy sources.

b) Specific objectives

- Ensure national energy security:

+ Provide sufficient electricity to meet the goal of socio-economic development with an average GDP growth rate of about 7% per year during the period of 2021-2030, and about 6.5-7.5% per year during the period of 2031-2050.

• Sales electricity: around 335.0 billion kWh in 2025; around 505.2 billion kWh in 2030; and an estimated range of 1,114.1 - 1,254.6 billion kWh by 2050.

• Electricity production and imports: around 378.3 billion kWh in 2025; around 567.0 billion kWh in 2030; and an estimated range of 1,224.3 - 1,378.7 billion kWh by 2050.

• Pmax: around 59,318 MW in 2025; around 90,512 MW in 2030; and an estimated range of 185,187 – 208,555 MW by 2050.

+ Ensure safe and reliable electricity supply, meeting the N-1 criterion for important load areas and the N-2 criterion for extremely important load areas. By 2030, Viet Nam aims to be among the top 4 countries in terms of electricity supply reliability and among the top 3 countries in terms of electricity access in the ASEAN region.

+ The goal is to strive for 50% of office buildings and 50% of residential households to utilise rooftop solar panels for self-generation and self-consumption (serving on-site consumption without selling excess electricity back to the national grid) by 2030.

- Just energy transition:

+ Strong development of renewable energy (RE) sources for electricity production is targeted; the proportion of electricity production from RE sources will reach 30.9-39.2% in 2030. The target is to achieve a 47% share of RE if the Just Energy Transition Partnership (JETP) Political Declaration on establishing a just energy partnership with Viet Nam is fully complied. Looking towards 2050, the goal is to reach an RE share of 67.5 - 71.5%.

+ The greenhouse gas (GHG) emissions from electricity generation are expected to reach around 204-254 million tons in 2030 and around 27-31 million tons in 2050. The goal is to achieve a peak emissions level of no more than 170 million tons by 2030, with the condition that the JETP-based commitments are fully implemented by international partners.

+ Developing a smart grid system capable of integrating and efficiently operating large-scale renewable energy sources is essential.

- Developing the ecosystem of the RE industry and services:

+ By 2030, it is projected to establish two regional RE industry and service centres that encompass electricity production, transmission, and consumption. These centres will focus on manufacturing RE equipment, construction, installation, and related services, creating an ecosystem for the RE industry. The regions with high potentials, such as the Northern, Central, and Southern parts of Viet Nam, will be prioritised for the development of these centres, leveraging favourable conditions.

+ There will be a strong emphasis on developing electricity generation from RE sources for export purposes. The goal is to achieve an export capacity of approximately 5,000-10,000 MW by 2030.

III. NATIONAL POWER DEVELOPMENT PLAN

1. Power source development plan

a) Development Orientation

- Develop a synchronised and diversified range of power sources with a reasonable structure to ensure energy security, enhance self-reliance of the power sector, and reduce dependence on imported fuels.

- Continue to promote the development of RE (hydropower, onshore and offshore wind power, solar power, biomass power, among others), new energy, and clean energy (such as green hydrogen, ammonia, etc.) that are suitable for ensuring the safety of the system at a reasonable cost, especially self-generated and self-consumed electricity sources, rooftop solar (RTS).

- Efficiently exploit and use domestic fossil fuel sources in combination with imported sources: Gradually reduce the proportion of coal-fired power, prioritise the development of domestic gas-fired power, and develop imported LNG power sources on a suitable scale. Implement energy transition following global technology development trends and costs.

- Develop a balanced electricity supply by region and area to balance the internal supply and demand. Rationally allocate electricity sources in localities within the region to effectively exploit different power sources, ensure reliable on-site electricity supply, reduce technical losses, and decrease long-distance power transmission.

- Develop new power sources, using modern technology and technology innovation at the existing plants. End operations of the plants that do not meet environmental standards.

- Diversify investment forms for developing power sources to enhance competition and improve economic efficiency.

b) Development Plan

- Accelerate the development of RE sources (wind power, solar power, biomass power, among others), and continue to increase their proportion in the power generation mix and production output.

+ Promote the development of onshore and offshore wind power and solar power, fitting the system's hosting capacity, reasonable electricity prices and transmission costs in connection to operational security and the overall economic situation of the power system and making the most of the existing electricity grid

infrastructure. Prioritise and encourage the development of wind and solar power (including RTS on the rooftop of residential houses, commercial facilities, construction works, factories, industrial zones, manufacturing and business facilities, on-site consumption, those not connecting or selling electricity to the national power grid). Solar power development must be integrated with energy storage when the cost is reasonable.

- By 2030, the onshore wind power capacity will reach 21,880 MW (the total technical potential in Viet Nam is approximately 221,000 MW).

- Maximise the technical potential of offshore wind power (around 600,000 MW) for electricity and new energy production.

By 2030, offshore wind power capacity to serve domestic demand will reach around 6,000 MW, and the number can be higher in case of rapid technological advancements and changes with reasonable electricity costs and transmission costs. The target for 2050 is 70,000-91,500 MW.

The strong development orientation of offshore wind power in combination with other RE sources (solar, onshore wind, etc.) for new energy production (green hydrogen, ammonia, etc.) is aimed at serving domestic demand and exports. The development of RE capacity for new energy production is prioritised/not limited as long as their development can ensure national defence and energy security, result in high economic efficiency, and is considered a new economy of the country.

It is expected that offshore wind capacity serving new energy production will reach around 15,000 MW by 2035 and around 240,000 MW by 2050.

- + The solar power potential in Viet Nam is approximately 963,000 MW (837,400 MW land-based, 77,400 MW floating, and 48,200 MW RTS). By 2030, the solar power capacity is expected to increase by 4,100 MW. The 2050 development target aims to reach a capacity of 168,594 - 189,294 MW, producing 252.1 - 291.5 billion kWh. In which:

- Priority is given to RTS systems on residential houses and construction works, particularly in the areas facing the risk of power shortage like the Northern region and self-produced, self-consumed solar power. By 2030, the capacity of these power sources will increase by 2,600 MW. These power sources will be prioritised for development with no capacity limit, provided that the cost is reasonable, and the existing power grid is utilised without upgrades.

- + Priority is given to developing biomass power (with around 7,000 MW potential) and electricity production from waste and solid waste (with around 1,800 MW potential) to utilise agroforestry and wood processing by-products, promote forestation and environmental management in Viet Nam. In 2030, the capacity of these power sources is expected to reach 2,270 MW, with a target of 6,015 MW by 2050. They can be developed further on a larger scale if there is a sufficient source of raw materials and efficient land utilisation, driven by environmental processing needs, grid conditions, electricity prices, and reasonable transmission costs.

- Maximise hydropower's economic and technical potential (about 40,000 MW in total in Viet Nam) while ensuring environmental protection, forest protection, and water source security. Research and selectively expand hydropower plants to reserve capacity and exploit hydropower in reservoirs to utilise water resources. By 2030, the hydropower capacity, including small hydropower, will reach 29,346 MW, producing 101.7 billion kWh. They can be developed further if economic and technical conditions permit (see the potential projects in Appendix III). The goal for 2050 is to achieve a capacity of 36,016 MW and produce 114.8 billion kWh.

- Power storage:

- + By 2030, develop pumped storage hydropower plants with a capacity of about 2,400 MW for load regulation, reverse capacity and support large-scale RE integration.

+ Energy storage batteries will be developed when the cost is reasonable and deployed in a decentralised manner and close to the wind and solar sources or load centres. By 2030, it is expected to achieve a capacity of about 300 MW.

+ The 2050 target is to achieve a power capacity for pumped storage hydropower and energy storage batteries of 30,650 – 45,550 MW matching the high share of RE sources.

- Encourage the development of combined heat and power plants, power plants using waste heat, blast furnace gas, and by-products of production lines. The target is to achieve 2,700 MW by 2030 and around 4,500 MW by 2050. The scale can be even larger, suitable for the demand and potential of industrial facilities.

- Coal-fired power plants: Only continue implementing projects already included in the revised PDP7 and currently under construction until 2030. The direction is to convert fuel to biomass/ammonia with power plants that have been operating for 20 years when the cost is appropriate. Stop operating power plants that are over 40 years old if fuel conversion is not feasible.

+ By 2030, the total capacity of operating power plants and projects being constructed and expected to be completed and entering operation is about 30,127MW. Urgently complete 6 projects/6,125 MW which are currently under construction: Na Duong II, An Khanh – Bac Giang, Vung Ang II, Quang Trach I, Van Phong I, Long Phu I. 13,220 MW coal-fired power shall not be deployed: Quang Ninh III, Cam Pha III, Hai Phong III, Quynh Lap I and II, Vung Ang III, Quang Trach II, Long Phu II and III, Tan Phuoc I and II. Converting Quang Trach II power project into LNG before 2030.

+ The 2050 target aims to stop using coal for electricity generation and shift completely to biomass/ammonia with a total capacity of 25,632 - 32,432 MW, producing 72.5-80.9 billion kWh.

- Gas-fired power plants: Prioritise using domestic gas for power generation. If there is a domestic gas shortage, natural gas or LNG should be additionally imported. Synchronise the development of LNG projects and LNG import infrastructure, using modern technologies. Implementing the roadmap to switch to hydro energy when the technology becomes commercialised with the appropriate cost.

+ Domestic gas-fired power: Accelerate Lot B and Ca Voi Xanh gas exploitation projects, of which invest and install 6,900 MW of downstream gas-fired power plants: O Mon II, III and IV (3,150 MW), Mien Trung I and II, and Dung Quat I, II and III (3,750 MW); converting O Mon I (600MW) to using gas from Lot B source. Implementing the combined gas-turbine power plant Quang Tri (340MW) using gas from Bao Vang mine. Accelerate the exploration and appraisal of Ken Bau gas field to plan gas field development and add downstream power plants if applicable (expected in Hai Lang - Quang Tri, Chan May - Thua Thien Hue areas). Kien Giang 1 and 2 projects (2x750 MW) were not implemented as fuel sources are not identified.

Southeast region: Implementing solutions, focusing on infrastructure construction, and researching connecting domestic and regional systems for importing natural gas and LNG to ensure gas sources for Phu My, Ba Ria and Nhon Trach power plants.

Southwest region: Implementing solutions and investments in infrastructure construction, researching connecting domestic and regional systems for importing natural gas and LNG to ensure gas sources for power plants in Ca Mau.

In 2030, the total capacity of power plants using domestic gas shall reach 14,930 MW and produce 73 billion kWh. The 2050 target is to reach around 7,900 MW using domestic gas or through conversion into LNG, producing 55.9-56.9 billion kWh; 7,030 MW is expected to be completely converted to use hydrogen, producing 31.6-31.9 billion kWh.

+ LNG thermal power: Limit the development of power generation using LNG if there are substitutions to reduce the dependency on imported fuel, extending the Long Son LNG project (1,500 MW, approved in the revised PDP7) to the 2031-2035 period. By 2030, the total capacity of LNG power sources shall reach a

maximum of 22,400 MW and produce 83.5 billion kWh. The 2050 target is to gradually convert into hydrogen with a total capacity of 25,400 MW, producing 129.6-136.7 billion kWh.

Continue to implement LNG storage and import terminal projects at Thi Vai (supplying gas for Nhon Trach 3 and 4 and supplement gas for plants in the Southeast region), Son My (supplying gas for Son My I and II). Synchronously developing LNG storage and import terminals with power plants in the PDP.

- Flexible power sources (quick starting power source): Invest and develop flexible power sources for load regulation and maintain the power system's stability to absorb a large capacity of renewable sources. Flexible power sources are expected to reach 300 MW by 2030, and target 30,900 – 46,200 MW by 2050.

- Power import and export: Effectively connect and exchange electricity with countries in the region, ensuring the interests of the parties, enhancing the safety of the power system; boosting electricity imports from Southeast Asian countries (ASEAN) and the Greater Mekong Subregion (GMS) with hydropower potential. Focus on investing and exploiting electricity sources abroad to supply electricity to Vietnam. In 2030, around 5,000 MW will be imported from Laos following the two governments' agreement, producing 18.8 billion kWh. By 2050, around 11,000 MW will be imported, producing 37 billion kWh based on balancing with exporting to ensure overall optimal efficiency.

Prioritise the unlimited development of power sources from renewable energy for export and production of new energy (hydrogen, green ammonia...) to ensure energy security and bring high economic efficiency. Striving to 2030, the scale of electricity export capacity will reach about 5,000-10,000 MW.

Continue to implement projects on small hydropower, wind power, cogeneration power sources, power sources using residual heat, blast furnace gas, by-products of technological chains in industrial facilities, biomass power, biogas, electricity produced from waste, solid waste and connection plans approved but must ensure compliance with regulations of laws, criteria requirements, priority project arguments.

Coal, gas power projects and medium and large hydropower projects in the revised Power Plan VII that have not yet been put into operation shall be adjusted in this Plan.

For solar power projects that have been approved with investment policies approved by competent agencies and assigned to investors, specific progress will be considered in the PDP VIII's Implementation plan in accordance with the law on planning, the law on investment and other relevant provisions of law ensuring security, the balance of sources and loads, suitable with power grid infrastructure, ensuring economic efficiency, electricity prices and reasonable transmission costs. Solar power projects that have been planned in the period of 2021-2030 but have not yet been assigned to the investor are not allowed to be implemented and will be considered after 2030, except for the case of self-production and self-consumption on the basis of non-legalisation if there is a violation of the regulations on planning and land, and other provisions of law (Appendix IV).

c) Power generation mix

- By 2030

The total installed capacity of power plants to meet domestic demand is 150,489 MW (excluding export, existing RTS, and RE used for new energy production). The breakdown of the capacity is as follows:

- + Onshore wind power: 21,880 MW (14.5% of the total capacity);

- + Offshore wind power: 6,000 MW (4.0% of the total capacity). If there are rapid technological advancements, reasonable electricity prices, and efficient transmission costs, the development of offshore wind power can be scaled up to a higher capacity;

- + Solar power: 12,836 MW (8.5%, excluding existing RTS), including concentrated solar power sources of 10,236 MW and self-consumption solar power sources of approximately 2,600 MW. The development of self-consumption solar power sources is prioritised without capacity limitations;

- + Biomass power and electricity generated from waste: 2,270 MW (1.5%). In case of sufficient fuel

sources, efficient land use, environmental treatment requirements, suitable electricity grid infrastructure, reasonable electricity prices, and transmission costs, the scale of development can be larger;

+ Hydropower: 29,346 MW (19.5%), and can be further developed if economic and technical conditions allow;

+ Pumped hydropower storage: 2,400 MW (1.6%);

+ Energy storage batteries: 300 MW (0.2%);

+ Cogeneration, utilising waste heat, blast furnace gas, and by-products from industrial processes: 2,700 MW (1.8%). The scale can be increased according to the capacity of industrial facilities;

+ Coal-fired thermal power: 30,127 MW (20.0%), excluding the projects in table 3 of Appendix II;

+ Domestic gas-fired thermal power: 14,930 MW (9.9%);

+ LNG-based thermal power: 22,400 MW (14.9%);

+ Flexible power sources: 300 MW (0.2%);

+ Imported power: 5,000 MW (3.3%), and it can reach up to 8,000 MW.

For coal-fired power sources that are facing difficulties in deployment, updating the processing procedures to replace them with LNG or RE sources will be considered.

- Orientation towards 2050

The total capacity of power plants is 490,529-573,129 MW (excluding exports and RE for producing new energy), including:

+ Onshore wind power: 60,050-77,050 MW (12.2-13.4%);

+ Offshore wind power: 70,000-91,500 MW (14.3-16%);

+ Solar power: 168,594-189,294 MW (33.0-34.4%);

+ Biomass and waste-to-energy: 6,015 MW (1-1.2%);

+ Hydropower: 36,016 MW (6.3-7.3%);

+ Energy storage: 30,650-45,550 MW (6.2-7.9%);

+ Cogeneration power plants, utilizing waste heat, blast furnace gas, and by-products of industrial processes: 4,500 MW (0.8-0.9%);

+ Coal-fired thermal power: 0 MW (0%), no longer using coal for electricity generation;

+ Thermal power using biomass and ammonia: 25,632-32,432 MW (4.5-6.6%);

+ Domestic gas-fired and LNG-based thermal power: 7,900 MW (1.4-1.6%);

+ Domestic gas-fired thermal power plants completely converted to hydro: 7,030 MW (1.2-1.4%);

+ LNG-fired thermal power plants co-firing with hydrogen: 4,500-9,000 MW (0.8-1.8%);

+ LNG-fired thermal power plants completely converted to hydrogen: 16,400-20,900 MW (3.3-3.6%);

+ Flexible power sources: 30,900-46,200 MW (6.3-8.1%);

+ Imported power: 11,042 MW (1.9-2.3%).

2. Power grid development plan

a) Development Orientation

- Develop a synchronous power transmission system with the progress of power sources and the development needs of local load demand, using modern technology, ensuring compliance with international standards, and readiness for regional interconnections. Develop a smart grid to enable large-scale RE integration, meeting the requirements of safe, stable, and economical power system operation.

- Develop a 500 kV and 220 kV transmission grid to ensure the system's hosting capacity, improve the reliability of power supply, reduce power losses, and meet the N-1 criterion for important load areas and N-2 for very important load areas. Develop a long-term backup power transmission grid and increase the use of

multi-circuit and multi-voltage-level poles to reduce land use. Encourage the construction of transmission substations that also supply power to neighbouring loads.

- The 500 kV transmission grid plays a key role in connecting regional power systems and exchanging electricity with neighbouring countries. Cross-regional transmission is limited to a reasonable level, reducing long-distance transmission, and minimising the construction of new cross-regional transmission lines before 2030.

- Build a reliable 220 kV transmission grid, with substations in high-density load areas designed for flexible operation. Build 220 kV substations capable of automatic unmanned operation. Promote the construction of GIS substations, 220/22 kV substations, and underground substations in load centres.

- Study the application of Back-to-Back systems and flexible power transmission equipment to increase transmission capacity and minimise land use. Conduct research on both AC and DC voltage transmission technologies on 500 kV systems.

- Beyond 2030, the plan is to develop high-voltage direct current transmission lines connecting the Central Highlands, the Central Coast, and the North to exploit the potential of offshore wind power. Study cross-Asia-Pacific connections.

The transmission grid projects in the PDP7-revised that have not yet been put into operation will be adjusted in this Plan.

b) The volume of transmission grid construction

- *During the period of 2021-2030:* newly construct 49,350 MVA and renovate 38,168 MVA of 500 kV substations; newly construct 12,300 km and renovate 1,324 km of 500 kV lines; newly construct 78,525 MVA and renovate 34,997 MVA of 220 kV substations; newly construct 16,285 km and renovate 6,484 km of 220 kV lines.

- *Orientation towards the period of 2031-2050:* newly construct 40,000-60,000 MW of HVDC station capacity and 5,200-8,300 km of HVDC transmission lines; newly construct 90,900-105,400 MVA and renovate 117,900-120,150 MVA of 500 kV substations; newly construct 9,400-11,152 km and renovate 801 km of 500 kV transmission lines; newly construct 124,875-134,125 MVA and renovate 105,375-106,750 MVA of 220 kV substations; newly construct 11,395-11,703 km and renovate 504-654 km of 220 kV transmission lines. The exact volume of the power grid for the period 2031-2050 will be determined in the next power planning periods.

3. Grid interconnection with countries in the region

- Continue to research and cooperate on power grid interconnection with Mekong sub-region countries and ASEAN countries at voltage levels of 500 kV and 220 kV to enhance the system's connectivity, and power exchange, and take advantage of the countries' resource strengths.

- Establish power grid connections with Laos through 500 kV and 220 kV transmission lines to import electricity from power plants in Laos, according to the memorandum of understanding signed between the two governments.

- Maintain power grid connections with neighbouring countries through existing voltage levels of 220 kV, 110 kV, and medium voltage; research and implement solutions to synchronise power systems through AC-DC converter stations at the 220-500 kV voltage levels.

- Build connection facilities for high economic efficiency power export projects to ensure energy security and national defence and security.

4. Rural power development orientation

Develop a new program to provide electricity to rural, mountainous, and island areas, supplying households without electricity and renovating existing rural electricity grids. Implement electricity supply from the national grid, combined with RE supply for rural, mountainous, and island areas. By 2025, ensure that 100% of households in rural areas have access to electricity.

5. Orientation for developing an industrial and service ecosystem for renewable energy.

- By 2030, two cross-regional RE industrial and service centres are expected to be established in the areas with high potential such as the Northern, Central and Southern regions, when conditions permit.

- The cross-regional RE industrial and service centres are expected to include RE power plants with a capacity of 2,000-4,000MW (mostly offshore wind power plants); manufacturing facilities for RE equipment and new energy production; equipment and vehicles for transportation, construction, and installation of RE equipment; ancillary services; low-carbon emission green industrial parks; RE research centres, and RE training institutions.

6. Investment capital demand

- *In the 2021 – 2030 period:* The total investment capital for the development of power sources and transmission grid is equivalent to 134.7 billion USD, of which: around 119.8 billion USD (12.0 billion USD/year) for power sources; and 15.0 billion USD (1.5 billion USD/year) for the transmission grid.

- *Orientation towards the 2031-2050 period:* The total investment capital for the development of power sources and transmission grid is equivalent to 399.2-525.1 billion USD, of which: around 364.4-511.2 billion USD (18.2-24.2 billion USD/year on average) for power sources; and 34.8-38.6 billion USD (1.7-1.9 billion USD/year on average) for the transmission grid. The numbers will be determined accurately in the next power planning periods.

IV. THE ORIENTATION FOR LAND USE ALLOCATION FOR THE DEVELOPMENT OF POWER FACILITIES AND ENVIRONMENTAL PROTECTION ACTIVITIES, CLIMATE CHANGE ADAPTATION, AND CONSERVATION OF ECOSYSTEMS, LANDSCAPES AND MONUMENTS

1. Land use allocation for power development

The land use demand for the development of power infrastructure and structures is about 89.9-93.36 thousand hectares in the period of 2021-2030 and about 169.8-195.15 thousand hectares in the period of 2031-2050, in line with the land allocation target in Resolution 39/2021/QH15, to ensure the implementation of power development goals.

2. Environmental protection, climate change adaptation, and conservation of ecosystems, landscapes and monuments

- Implement a strong transition from fossil fuels to new and renewable energy to reduce air pollution and greenhouse gas emissions and meet the net-zero emissions target by 2050.

- Apply new and modern technologies towards a low-carbon economy transition, reducing energy consumption and emissions, aiming to comply with regulations on carbon emissions per unit of exported goods and carbon markets.

- Avoid and limit the development of energy infrastructure in locations that may affect forests, natural reserves, biodiversity, natural heritage, and cultural heritage sites that have been ranked.

- Take into account climate change mitigation and adaptation measures for extreme weather events such as droughts, floods, storms, landslides, heatwaves, precipitation, sea level rise, etc. during the implementation of power projects to ensure safe and stable operation and minimise risks and losses.

V. LIST OF IMPORTANT PROJECTS AND INVESTMENT PRIORITIES OF THE POWER SECTOR AND THEIR IMPLEMENTATION PRIORITY ORDER

1. Criteria and rationale for developing the list of important projects and investment priorities of the power sector

The list of important projects and investment priorities of the power sector is formulated based on the following criteria and rationale:

- Projects that play an important role in balancing the national power supply and demand, as well as those in regions, areas, and important load centres, to ensure power supply security and meet socio-economic development needs.
- Projects that ensure national defence and security and the combined economic benefits and national defence and security.
- Projects that need to be implemented to ensure consistency between the development planning of the power industry and other energy planning.
- Projects that enhance the power supply for areas at risk of power shortage.
- Projects that ensure the safety and security of the national power system between base-load power sources, RE sources, and loads (such as hydroelectric power, energy storage batteries, etc.).
- Projects that contribute to climate change adaptation, greenhouse gas emissions reduction, environmental protection (biomass, waste-to-energy, solid waste-to-energy, co-generation, utilisation of surplus gas...), and climate commitments fulfilment.
- Self-generation and self-consumption projects.
- Projects that contribute to creating an overall ecosystem for the renewable energy industry and service sectors.
- Projects that export electricity and newly produced energy from renewable sources.
- Projects that use land efficiently.
- 500 kV and 220 kV power grid projects.
- Feasibility in the implementation process.
- Application of advanced, environmentally friendly technologies.
- High socio-economic efficiency.

2. List of important projects and investment priorities

The list of important projects and investment priorities is presented in Appendices I and II.

VI. SOLUTIONS AND RESOURCES FOR THE IMPLEMENTATION OF THE PLAN

1. Solutions for ensuring power supply security

- Diversify fuel sources used for power generation, and harmoniously combine domestic and imported primary energy sources.
- Promote exploration in order to increase reserves and output of domestic coal and oil and gas mining for electricity production to reduce dependence on imported fuels.
- Invest in technical infrastructure for importing natural gas, LNG and imported coal, in line with the structure of thermal power sources and the energy transition trend.
- Strongly develop renewable energy sources to replace fossil energy sources. Promptly update scientific and technological advances in the world on new energy sources (hydrogen, ammonia ...) to use for power generation.
- Research and apply technology to convert coal-fired and gas-fired power plant fuel to biomass, ammonia, hydrogen fuel...

- Organize research and assessment of the potentials of non-traditional energy sources.

2. Solutions for creating capital sources and mobilising investment capital for power sector development

- Research and complete financial mechanisms and mobilise capital for investment in the development of the electricity sector.
- Diversify capital sources and forms of capital mobilisation, effectively attract domestic and foreign capital sources to electricity development, and ensure national defence, national security and competition in the electricity market. Strengthen calls for and effective use of international support commitments (JETP, AZEC...), green credit sources, climate credits, and green bonds...
- Diversify forms of investment (public, private, public-private partnership ...) for power projects. Promote the role of state-owned enterprises, and strongly attract the domestic and foreign private sectors to invest in electricity development. Continue to negotiate, effectively use funding sources, and support international partners' capital arrangements in implementing the energy transition and towards net zero emissions of Vietnam.
- Encourage people and businesses to invest in the development of rooftop solar power, self-produced and self-consuming power sources.
- Facilitate a favourable, transparent environment, attract and encourage private participation in investment and development of power projects.
- Gradually increase the financial mobilisation capacity of enterprises in the electricity sector at the request of domestic and international financial institutions.
- Implement flexible and effective credit policies, creating favourable conditions for enterprises to access capital sources for the development of power projects.

3. Solutions on law and policy

- Complete the policy and legal framework on electricity development, renewable energy development (including rooftop solar power, self-production and self-consumption solar power), economic and efficient use of electricity and other relevant regulations:
 - + Formulate the amended Electricity Law to complete policies on investment, planning and administration of electricity prices, develop competitive electricity markets, handle problems, institutionalise development mechanisms, create breakthroughs to encourage and promote the strong development of electricity sources using renewable energy; separate the role of state management from production and business of enterprises.
 - + Research and develop auction and bidding mechanisms to select investors with electricity prices in the process of amending the Electricity Law and completing the competitive electricity market model.
 - + Research and concretise policies on the socialisation of investment in power transmission grids.
 - + Promulgate the pilot mechanism and proceed to officially build the mechanism of direct power purchase agreements between renewable energy power producers and consumers in sync with amendments to the Electricity Law and the roadmap for the implementation of the competitive electricity market. Study and develop regulations on charging fees for direct power purchase agreements (DPPAs).
- Continue to perfect the electricity price management mechanism according to the State-regulated market mechanism, ensuring a harmonious combination between the State's political and socio-economic objectives, production and business objectives, and financial autonomy of electricity enterprises. Electricity prices must recover sufficient costs, have reasonable profits, attract investment in electricity development, encourage competition in the stages of production, transmission, distribution, retail, electricity use, and combat electricity waste. Continue to improve and finalise the current electricity tariff. Study the implementation of two-component electricity tariffs at the appropriate time. Continue to implement electricity price transparency.
 - + Research, formulate and promulgate the Law on renewable energy.

- + Amending the Law on Economical and Efficient Use of Energy to drastically reduce the energy intensity of the economy, promulgate sanctions and mandatory standards and regulations on energy efficiency.
- Develop mechanisms and policies to encourage domestic enterprises to participate in the development of renewable energy, the development of the renewable energy industry, new energy for domestic service and the export and the development of the electrical equipment manufacturing industry.
- Develop policies to raise the localisation rate in the electricity industry to improve independence and reduce costs.
- Develop mechanisms and policies to promote electricity imports, especially from Laos through agreements and memorandums of understanding between the two Governments.

4. Solutions for environment protection and fighting natural hazards

- Implement an energy transition, with a focus on transitioning from fossil fuels to renewables and new energy; increase the size of absorption tanks and promote the application of carbon capture technology.
- Research, application and development of waste treatment technology, especially from the renewable energy industry on the principle of reduction, recovery, reuse and recycling to minimise the amount of waste, and make use of discarded materials as raw materials for other economic sectors.
- Implement solutions to prevent and combat natural disasters and respond to climate change and extreme weather phenomena from the process of project site selection, design, and construction to production and operation.
- Minimise the development of electrical works and infrastructure in locations likely to affect natural forests, nature reserves and biodiversity, natural heritages, monuments and cultural heritages already classified, per the national environmental protection zoning.

5. Solutions for science and technology

- Invest in research and development (R&D) on electricity. Establish basic research centres and development centres on renewable energy, new energy, and carbon storage technologies in Viet Nam to improve the level, receive and transfer of technology and governance solutions in order to accelerate and scale up the deployment of renewable energy and clean power system management in Viet Nam and the region.
- Using modern technology for new electrical works; step-by-step upgrade, renovate and convert existing works.
- Renovate and upgrade power transmission and distribution systems, improve reliability, and reduce power losses. Accelerate the roadmap to build smart grids.
- Modernise data information systems, automation and control systems for the dispatch and operation of power systems and the electricity market. Access to new scientific and technological achievements, artificial intelligence, IoT, including digital transformation in the electricity industry.
- Gradually apply measures to encourage and compulsory innovation of technologies and equipment of electricity-intensive economic sectors.

6. Solutions for economical and efficient use of electricity

- Raising awareness of economical and efficient use of energy, and environmental protection is an important national policy and responsibility of the whole society as in the spirit of Resolution No. 55-NQ/TW dated February 11, 2020, of the Politburo.
- Encourage investment in and use of energy-saving technologies and equipment; strengthen energy audits; promote the implementation of the model of energy service companies.

- Apply mandatory standards and regulations together with sanctions on the efficient use of electricity to sectors and industries with high electricity consumption.
- Promote the implementation of electricity demand side management (DSM) programs, programs on economical and efficient use of energy.

7. Solutions for human resource development

- Develop high-quality human resources, especially in the fields of power generation, transmission, distribution, dispatch, electricity market, smart grid...
- Building a team of highly qualified experts and scientists in the field of electricity; building units with strong expertise in electricity science and technology.
- Organise training and retraining of technical staff and managers of the electricity industry at the same level as other countries in the region and the world.
- Renovate training programs and contents, diversify forms of human resource training, associate training with actual production, ensure sufficient staff capacity to operate large-scale power systems, integrate a high proportion of renewable energy sources, and apply smart grid technology.

8. Solutions for international cooperation

- Actively and effectively implement the contents of the Political Declaration establishing a Just Energy Transition Partnership with International Partners (JETP), making the most of international partners' support in technology transfer, governance and human resource training, financing support, considering JETP as an important solution for the energy transition in Viet Nam.
- Implement flexible, efficient, equitable and mutually beneficial energy and climate foreign policies. Expand and deepen energy cooperation with strategic and important partners.
- Promote cooperation in research and deployment of power grid connectivity with neighbouring countries, countries in Southeast Asia and countries in the Greater Mekong sub-region (GMS).
- Expand international cooperation in scientific research and development of electricity technology, take advantage of technology transfer and capital from foreign partners.

9. Solutions for enhancing domestic capabilities, localising the equipment in the electricity sector and developing the electrical mechanical industry

- Forming renewable energy industry centres, creating a complete renewable energy industrial ecosystem, associated with production and manufacturing, auxiliary services, and concentrated industrial parks.
- Focus on developing the manufacturing industry for renewable energy equipment, energy storage equipment, and technology for carbon recovery, absorption, storage and use... in the country to actively exploit the available potential of our country, increase independence and autonomy, reduce the cost of electricity production from renewable energy.
- Encourage domestic enterprises to implement complex and high-tech power projects. Improve the capacity of domestic enterprises to design, organise procurement, manage and operate projects, capable of taking on the role of the general contractor of large-scale power projects.
- Improve domestic equipment design and manufacture capacity to increase the proportion of domestic equipment in power source and grid projects; improve the capacity to repair, maintain and inspect domestic electrical equipment.

10. Solutions for managing and improving the efficiency of power operation

- Strongly innovate the management of the electricity sector in the direction of openness, transparency, competition, efficiency, increasing labour productivity, and reducing costs in all stages, in accordance with the socialist-oriented market economy institution.
- Reform the power sector in accordance with the approved roadmap for building a competitive electricity market.

- Innovate and improve the efficiency of state-owned enterprises in the electricity sector, applying advanced management models and practices, raising international credit ratings, and implementing openness and transparency in operation.

11. Solutions for implementing and monitoring the power development plan

- Urgently formulate and submit an implementation plan for the PDP VIII to the Prime Minister after the Power Plan VIII is approved. Select priority projects based on criteria and arguments mentioned in Clause 1, Section V, Article 1 of this Decision.
- Develop a database for the electricity sector, including data on the plan and its implementation to serve as a basis for monitoring the implementation of the plan. Regularly review the situation of load development of the whole country and localities, the implementation progress of power source and grid works to propose solutions to adjust the power mix and the progress of the plan if necessary, ensuring electricity supply and demand of the economy.
- Effectively manage the development of self-produced and self-consumed power sources, cogeneration power sources, power sources using residual heat, blast furnace gas, by-products of technological chains in industrial facilities, rooftop solar power sources and power sources directly negotiated and agreed between power generation and purchasing units.
- To further promote the role of the National Steering Committee for Electricity Development in inspecting and promoting key electricity projects, promptly removing difficulties and obstacles.
- Develop and apply institutions on discipline and compliance in the implementation of Power Plan VIII for investors, ministries, branches, State Capital Management Committees at enterprises and localities. Develop sanctions to handle and withdraw projects that are slow or not implemented according to the assigned schedule.

Article 2. Implementation arrangement

1. Ministry of Industry and Trade

a) Assume responsibility for the accuracy of data, documents, the system of diagraphs, maps and databases in the planning file compilation, and ensure their consistency with the content of this Decision.

b) Announce the issuance of PDP8 in accordance with the prevailing regulations and implement this Decision in association with directing the implementation of socio-economic development tasks as prescribed by law; develop a plan to implement PDP8 based on criteria and rationale stipulated in this Decision to implement the objectives and tasks set out in the plan; organise the evaluation of plan implementation in accordance with the provisions of the Law on Planning. Complete and submit the plan to implement PDP8 in June 2023 to the Prime Minister.

c) Take charge of and coordinate with ministries and localities to complete the drafting and submit to the National Assembly in 2024 the revised Electricity Law and the Law on Renewable Energy. Submit to the Government for issuance of policies on direct power purchase.

d) Take charge of and coordinate with ministries and the People's Committees of provinces and municipalities to continue working with investors, carefully reviewing the legal regulations, commitments, and agreements between parties to completely resolve the difficulties faced by the projects in Table 3 of Appendix II during implementation, and report to the Prime Minister on issues beyond their authority.

2. Ministries, the Commission for the Management of State Capital at Enterprises

Fulfil their functions, duties, and powers to implement the projects in PDP8 on schedule; propose mechanisms, policies, and solutions to remove obstacles for effectively achieving the objectives of the plan, ensuring consistency and coherence with the implementation of the 10-year Socio-Economic Development Strategy 2021-2030, as well as the socio-economic development plans of each sector and locality.

3. The People's Committees of provinces and municipalities

Organise the selection of investors for power projects; allocate land funds for power projects in accordance with legal regulations; take charge of and closely coordinate with the investors on land clearance, compensation, migration and resettlement for power source and power grid projects according to the prevailing regulations.

4. Vietnam Electricity (EVN)

- Play a leading role in ensuring stable and safe power supply for socio-economic development. Implement investment in power source and transmission power grid projects according to assigned tasks.

- Regularly review and assess power supply and demand balance, assess the operation of the national and regional power systems, and report to the relevant authorities.

- Thoroughly implement innovative corporate governance solutions, improve production and business efficiency, increase labour productivity, reduce power losses, save costs, and reduce prices.

5. Vietnam Oil and Gas Group (PVN)

- Enhance the exploration, survey, and exploitation of domestic gas sources to supply power generation, fitting power load demand. Implement efficiently and promptly the approved schedules for gas fields such as Lot B, Ca Voi Xanh, Ken Bau, etc.

- Implement solutions for building infrastructure facilities such as warehouses, and ports, connecting domestic and regional gas systems serving natural gas and LNG imports to ensure gas supply for power plants.

- Carry out power source projects assigned on schedule.

6. Vietnam National Coal and Mineral Industries Group (Vinacomin), Dong Bac Corporation

- Play a leading role in ensuring the supply of coal for power production in accordance with the energy transition roadmap. In the short term, enhance domestic coal production capacity and coal imports to supply fuel for power plants.

- Invest in power source projects according to their assigned tasks.

Article 3. This Decision shall take effect from the date of issuance.

Article 4. The Ministers, Heads of Governmental Agencies, Heads of Departments under the Government; Chairpersons of People's Committees of provinces and municipalities; Chairpersons of Councils of Members, General Directors of EVN, PVN, Vinacomin; Chairpersons and General Directors of Dong Bac Corporation and relevant agencies shall be responsible for the implementation of this Decision./.

Recipients:

- The Central Party Committee Secretariat;
- The Prime Minister and Deputy Prime Ministers;
- Ministries, Government agencies, and organisations under the Government;
- The People's Councils and People's Committees of provinces and centrally-controlled cities;
- Central Party Committees and their subordinate units;
- Office of the General Secretary of the Party;
- Office of the President;
- The Council for Ethnic Affairs and other Committees of the National Assembly;
- Office of the National Assembly;
- The Supreme People's Court;
- The Supreme People's Procuracy;
- The State Audit Office;
- The National Financial Supervisory Commission;
- The Social Policy Bank;
- The Development Bank of Viet Nam;

**P.P PRIME MINISTER
DEPUTY PRIME MINISTER**

Tran Hong Ha

- The Central Committee of the Vietnam Fatherland Front;
- Central agencies of various organisations;
- EVN, PVN, Vinacomin;
- Dong Bac Corporation;
- Office of the Government: Minister and Chairperson, Vice Chairpersons, Assistant to the Prime Minister, Director General of the Government Portal, Departments, Bureaus, and Government Gazette;
- Archived at Administration Department, Industry (3).

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