

DECISION

**APPROVING THE NATIONAL POWER DEVELOPMENT PLAN IN THE 2021-2030
PERIOD, WITH VISION TO 2045**

THE PRIME MINISTER

Pursuant to the Law on Organization of the Government dated June 19th, 2015; Law on Amending and Supplementing a number of articles of the Law on Organization of the Government and Law on Organization of Local Administration dated November 22nd, 2019;

Pursuant to the Law on Planning dated November 24th, 2017;

Pursuant to the Electricity Law dated December 3rd, 2004; Law on Amending and Supplementing a number of articles of the Electricity Law dated November 20th, 2012;

Pursuant to Decree No 137/2013/ND-CP dated 21 October 2013 on detailing implementation of a number of the Electricity Law and the Law on amending and Supplementing a number of articles of the Electricity Law;

Pursuant to the Decree No. 37/2019/ND-CP dated May 07th, 2019 detailing the implementation of a number of articles in the Law on Planning;

Considering Report No. /TTr-BCT dated 2021 of the Ministry of Industry and Trade, Official dispatch No. 1236/BTNMT-TCMT dated 17 March 2021 of the Ministry of Natural Resources and Environment reporting on the appraisal result of the Report on Strategic Environmental Assessment of the National Power Development Plan in the 2021-2030 period, with vision to 2045 and opinions of various ministries and sectors on the national power development plan in the 2021- 2030 period, with vision to 2045,

DECIDES:

Article 1. To approve the National power development plan in the 2021-2030 period, with vision to 2045 (Power Development Plan VIII), with the following principal contents:

1. Development viewpoints:

a/ To develop the electricity sector one step ahead in conformity with the national socioeconomic development strategy, ensuring adequate supply of electricity for the national economy and social life.

b/ To prioritize developing power sources using renewable energy, developing conventional power sources with modern technologies, creating breakthrough in ensuring national power security, contributing to the preservation of energy resources, minimizing negative impact on the environment in energy generation. Special importance shall be put on developing small, decentralized power sources in order to provide local power supply.

c/ To effectively utilize domestic primary energy resources and prioritize development of domestic power source using gas, in combination with the rational import of electricity from neighbouring countries and import of fuel (coal, LNG) to diversify primary energy sources for electricity generation.

d/ To synchronously develop power source and grid; to implement balanced investment on power development among regions, areas on the basis of rational and effective use of local primary power resources.

e) To create interconnected power grids with neighbouring countries and in the region to utilize the power potential of each country, optimizing the operation of interconnected power system.

f) To step by step establishing smart power grid; enhancing power quality and reliability in power supply to provide increasing quality. To implement market-based power prices to encourage investment on power development; promoting energy efficiency and conservation program.

g) To develop competitive power market at all levels according to the roadmap in order to diversify power investment and business methods.

h) Power development must be adapting to climate change, ensuring sustainable development and compliant with the National Strategy on Green Growth.

2. Objectives:

a/ General objectives:

To mobilize all domestic and international resources for power development in order to ensure sufficient, stable, with increasing quality power supply at rational prices for rapid and sustainable socio-economic development; to effectively utilize diversified domestic primary power sources and in combination with importing fuel for power generation; promoting exploitation and maximizing use of renewable energy sources for power generation, step by step increasing the proportion of renewable energy in power sources for generation to decrease the dependence of power sources for generation from imported fuel, contributing to ensure power security, climate change adaptation and environment protection; effective and conservative use of power; establishing and developing smart power system, with the ability to integrate with high proportion of renewable energy sources; upgrading and building advanced and modern power transmission grid and distribution system.

b/ Specific objectives:

- To supply adequate electricity for the domestic demand, meeting the national's socio-economic development goals with Vietnamese average GDP growth of approximately 6.6%/year during 2021-2030 period and around 5.7% during 2031-2045 period, of which:

+ Commercial power: reaching 335.3-346.6 billion kWh by 2025; 491.2-530.5 billion kWh by 2030; 651.3-736.9 billion kWh by 2035; 779.7-938.3 billion kWh by 2040 and 886.9-1,101.2 billion kWh by 2045.

+ Generated and imported power: reaching 378.6-391.7 billion kWh by 2025; 554.9-598.4 billion kWh by 2030; 728.9-824.6 billion kWh by 2035; 867.3-1,043.7 billion kWh by 2040 and 980.9 – 1,220.7 billion kWh by 2045

+ Electricity elasticity coefficient of commercial power/GDP reach 1.31-1.34 times in the 2021-2025 period; 1.24-1.25 times in the 2026-2030 period; 0.97-1.03 times in the 2031-2035 period; 0.64-0.82 times in the 2036-2040 period; and decrease to 0.47-0.52 times during 2041-2045 period.

- To prioritize radical and efficient exploitation and usage of renewable sources in energy generation; increase the proportion of power generated from renewable source to 11.9-13.4% by 2030 and 26.5-28.4% by 2045.

- Building power grid system integrated and synchronized with power source with the ability to operate flexibly and highly automatically from transmission phase to distribution phase; to ensure safety in power supply, meeting N-1 standard for important load regions and N-2 standard for special important load regions; to ensure all 220kV transformers are remotely controlled and unmanned operated after 2025 to improved labour productivity of the power sector.

- Continuing to accelerate the program on power supply for rural, mountainous and island areas for the 2021-2030 period to reach the target of supplying power for 100% household. Continuing to invest on improvement, extension and enhancement of rural power distribution grid to ensure quality power supply for socio-economic development.

- Promoting the implementation of the National program on economical and efficient use of energy to reach the target of saving 8-10% national total energy consumption in the 2021-2030 period.

3. The national master plan on electricity development:

a/ Development plan for power sources:

- Development orientations:

+ To develop a balanced capacity of power sources in each region: Northern region, North Central region, Mid Central region, South Central region, Central Highlands and Southern region, toward ensuring balance of local source-load; enhancing the reliability of electricity supply to reduce transmission losses and the efficiently exploitation of power sources.

+ To synchronously and rationally develop and diversify power source models. Prioritizing development of renewable energy sources. Considering to increase proportion of renewable energy sources comparing to targets under current policies.

+ To promote the development of power centers using LNG with appropriate scale to ensure the economic efficiency of the projects, prioritizing development in the high-demand region with favourable conditions to invest on infrastructure, terminals and with extension opportunity in the future.

+ To increase electricity importing and grid interconnection with neighbouring countries and other countries in the region with potential, on the basis of ensuring power security, safety operation of power system.

+ To develop flexible-operating power source models (pumped storage hydropower plant, power storage system...) suitable with the scale and proportion of renewable energy source in the power system.

+ To diversify forms of investment and investment funds in power development.

+ To diversify the fuel sources used for power generation to ensure national power security, harmoniously balancing between domestic and imported fuel.

- Development plan for power sources:

+ To prioritize the development of renewable and new energy sources (wind power, solar power, biomass power, waste-to-energy power...), continuing to increase the proportion of power generated from renewable energy sources suitable with the operational capacity of the national and regional power systems:

• To raise the total capacity of onshore and nearshore wind power to 11,320-11,820 MW by 2025, 11,820-13,820 MW by 2030 and 27,110-32,720 MW by 2045. To raise the

total capacity of offshore wind power to 2,000 MW or higher when favourable conditions are available by 2030 and 21,000-36,000MW by 2045. Total capacity from all type of wind power is estimated to reach the proportion of 7.8% by 2025, 5.6-6.5% by 2030 and 15.7-15.9% by 2045.

- To develop the power sources using solar energy, including the ground and lake's surface installed concentrated solar power sources and rooftop-installed distributed sources. Total capacity of solar power shall reach 17,240-18,540 MW by 2025, 18,640-22,040 MW by 2030 and around 51,540-63,540 MW by 2045. Power generated from solar sources is estimated to reach the proportion of 7.3-7.6% by 2025, 5.4-5.9% by 2030 and 8.4% by 2045.

- To maximize the exploitation of current hydropower sources, especially the multipurpose hydropower projects; to implement selective development of potential small and medium hydropower project nation-wide. Power generated from large, medium, small and pumped storage hydropower sources shall reach 23.2-24% by 2025, 15.4-16.8% by 2030 and 8.2-9.8% by 2045.

- To promote the development of projects utilizing solid waste, biomass and other renewable energies, biogas, tidal power, ocean waves and geothermal energy when the technical and economical conditions are enabled. Striving toward 2030, the proportion of power capacity from these sources shall reach 0.9-1% and 2.2-2.5% by 2045.

- To continue the implementation of renewable energy projects (wind power, solar power, biomass power, solid waste power...) approved in the revised Power Development Plan VII (PDP VII) and other specialized plans in the energy sector.

- + To stop the consideration of the plan for a number of coal-fired thermal power projects approved in the revised PDP VII but does not received support from the local or does not meet sufficient conditions for development.

- + To develop thermal power plants with rational proportion in the total power source structure, suitable with the supplying and importing capacity of fuel, having rational power generation price and balanced among regions and areas:

- Thermal power using domestically exploited gas (including thermal power using oil-fired gas turbines) and LNG (not including the flexible gas turbine power sources using LNG: by 2030, total capacity reaches 27,471-32,071 MW, generating 127-142 billion kWh, accounting for 23-23.8% total generated power; by 2045, total capacity reaches 53,833-69,783 MW (61,900-88,700 MW if including flexible gas turbine power sources using LNG), generating 279.8-402.6 billion kWh, accounting for 28.6-33.2% of total generated power.

- The Southwest Region: continue to promote the progress of bringing gas from Lot B to shore to supply for power plants at Ô Môn Power Centre.

- The Central Region: continue to promote the exploitation progress of Ca Voi Xanh, Bao Vang and Ken Bau gas field and other potential fields in lot L13-L19 to ensure the gas supply sources for gas power plants in the region. Speeding up the researching progress of Ken Bau gas field to define exploitation scale and time.

- To develop the terminal systems and infrastructures importing LNG in the regions to supply fuel for power project using LNG and other needs of the economic. Developing importing terminals in the Northern region to supply gas for power projects in Hai Phong, Quang Ninh and Thai Binh...; in North Central region to supply LNG for thermal power centres in Thanh Hoa...; in South Central region to supply gas for Ca Na and Son My power projects...; in Southeast region to supply LNG for gas power projects in Ba Ria – Vung Tau, Dong Nai and Long An. Developing some floating storages for LNG and terminals importing

LNG in the Southwest Region to supply gas for gas power projects in Bac Lieu, Ca Mau and Kien Giang.

+ To continue maximizing exploitation of domestic coal sources to supply for existing coal-fired power plants and promoting the use of domestic-imported mixed coal to supply for coal-fired power plants.

+ To continue the implementation of hydropower projects in hydropower plans, power plans and other relevant plans approved by jurisdictional authorities; to continue the optimizing exploitation of hydropower sources nation-wide.

+ To promote the interconnection of power systems and effective power exchange with countries in the region with reasonable scale, ensuring national power security and safety operation of the power system. Prioritizing the import of regulating-enabled power source; importing of power sources following a roadmap suitable with the scale of Vietnam power system. Continuing to import power from Laos to reach the capacity of 3,853-4,728 MW by 2025 and 3,937-5,742 MW by 2030 or more according to agreements signed between two Governments.

+ Total capacity of all power sources shall be review continuously during the process of building Implementation plan for the Power Development Plan VIII to be in line with the hosting capacity of the power grid and the ability of the power system to operate safely.

- Structure of power sources:

+ By 2025:

The total capacity of power plants will reach approximate 102,656-105,265 MW, of which large, medium and pumped hydropower will account for 24.06-24.73%; coal-fired thermo-power, 27.96-28.67%; gas-fired thermo-power (including LNG and flexible sources using LNG), 13.54-13.89%; renewable energy sources (including solar power, wind power, biomass power...), 28.96-29.95%; and imported power, 3.75-4.49%.

Produced and imported electricity will reach approximate 378.3-391.3 billion kWh, of which large, medium and pumped hydropower will account for 23.2-24%; coal-fired thermo-power, 40.4-42.3%; gas-fired thermo-power (including LNG), 13.1-15.4%; renewable energy sources (including small hydropower, solar power, wind power, biomass power...), 16.4-17%; and imported power, 4.1-4.5%.

+ By 2030:

The total capacity of power plants will reach approximate 130,371-143,839 MW, of which large, medium and pumped hydropower will account for 19.5-17.73%; coal-fired thermo-power, 28.3-31.2%; gas-fired thermo-power (including LNG), 21.1-22.3%; renewable energy sources (including solar power, wind power, biomass power...), 24.3-25.7%; and imported power, 3-4%.

Produced and imported electricity will reach approximate 551.3-595.5 billion kWh, of which large, medium and pumped hydropower will account for 15.4-16.8%; coal-fired thermo-power, 44-45.5%; gas-fired thermo-power (including LNG), 8.4-9%; renewable energy sources (including small hydropower, solar power, wind power, biomass power...), 11.9-13.4%; and imported power, 2.9-3.6%.

+ By 2045:

The total capacity of power plants will reach approximate 261,951-329,610 MW, of which large, medium and pumped hydropower will account for 9.1-11.1%; coal-fired thermo-power, 15.4-19.4%; gas-fired thermo-power (including LNG), 20.6-21.2%; renewable energy

sources (including solar power, wind power, biomass power...), 40.1-40.7%; and imported power, 3.4%.

Produced and imported electricity will reach approximate 977-1,213 billion kWh, of which large, medium and pumped hydropower will account for 9.8-8.2%; coal-fired thermo-power, 27.3-32.2%; gas-fired thermo-power (including LNG), 28.6-33.2%; renewable energy sources (including small hydropower, solar power, wind power, biomass power...), 26.5-28.4%; and imported power, 3.1%.

The detailed list of thermo power projects is provided in Table 1 of Appendix 1.

b/ Development plan for the power grid:

- Development orientations:

+ The power transmission grids are built to ensure that it meets the requirements of the national power system to operate safely, stably and with the ability to integrate high proportion of renewable energy sources; to overcome overloads, congestions, low quality power and other technical issues of the power grid's operation.

+ 500kV or higher transmission grids are built for power transmission from large power centres to load centres, connecting area and regional power systems.

+ Applying technological and scientific achievements in investments developing power grid to enhance transmission capability, minimize land use. Step by step establishing smart power transmission grid.

+ To build and upgrade 500kV and 220kV power transmission grid, basically ensuring the main power transmission grid to meet N1 standard, power transmission grid at some big cities with high load density (such as Ha Noi, Ho Chi Minh city) to meet N2 standard. Power transmission grid with hosting capacity of conventional power sources shall meet N1 standard.

+ To study and build direct and alternating current power transmission system for voltage higher than 500kV, Back-to-back system, flexible alternating current transmission system (FACTS) at an appropriate time after 2030.

Volume of transmission grid to be build in each period:

#	Item	Unit	Period				Total volume 2021-2030	Total volume 2031-2045
			2021-2025	2026-2030	2031-2035	2036-2045		
Basic load scenario								
1	500kV station							
	New	MVA	35,850	13,200	28,500	12,900	49,050	41,400
	Renovate	MVA	13,500	20,700	26,250	58,800	34,200	85,050
2	500kV line							
	New	km	8,267	3,721	4,854	1,838	11,988	6,692
	Renovate	km	-	248	756		248	756
3	220kV station							
	New	MVA	48,138	19,375	26,625	19,125	67,513	45,750
	Renovate	MVA	11,935	20,812	27,188	49,374	32,747	76,562
4	220kV line							
	New	km	11,948	3,695	4,754	2,257	15,643	7,011

Renovate	km	5,406	1,006	32	80	6,412	112
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List and progress of investment prioritized power transmission grid projects are presented in Appendix 2 attached to this Decision.

c/ Connection to power grids of regional countries:

+ To continue studying the model of power interconnected system to regional countries and Great Mekong Sub-Region (GMS) countries at 500kV and 220kV voltage level in new situation, to be in line with power supply infrastructures of Vietnam in order to increase the ability to integrate renewable energy and to utilize the benefits of power grid interconnection.

+ To implement power grid connection with Laos by 500kV and 200kV line to import power from hydropower plants in Lao according to minutes of understanding and cooperation signed between two Government until 2030.

+ To maintain power grid connection with Cambodia via existing 220kV line, to study the opportunity to enhance power grid connection between Vietnam and Cambodia via bilateral and multilateral cooperating programs.

d/ Supply of electricity to rural mountainous areas and islands:

To continue the implementation of the Program on power supply for rural, mountainous and island areas according to Approval decision of the Prime Minister, to combine supplying power from the national grid and from local and renewable sources for rural, mountainous and island areas; to implement the target of 100% household has power with ensure quality at the latest by 2030.

e/ Total investment capital:

The total investment capital needed for the implementation of the power selective development program in the 2021-2030 period is estimated at 99.32-115.96 billion USD, of which: investment capital for developing power sources is about 85.70-101.55 billion USD (8.57-10.15 billion USD annually), for power grid is about 13.58-14.41 billion USD (1.36-1.44 billion USD annually).

The total investment capital needed for the implementation of the power selective development program in the 2031-2045 period is estimated at 180.1-227.38 billion USD, of which: investment capital for developing power sources is about 163.14-208.89 billion USD (10.88-13.93 billion USD annually), for power grid is about 16.93-18.49 billion USD (1.13-1.23 billion USD annually).

4. Solutions for implementation of the master plan

a/ Solutions for governing the Power development plan

- To definitely complete the establishment of the institution on the discipline and compliance for implementing the National Power development plan, applying for investors, Ministries, sectors, Commission for the management of State Capital at Enterprises and provinces. Any obstruction at any phase without close monitoring and timely steering to resolve will lead to disruption of the plan, resulting in power shortage for the country, reduce the efficiency in project investment, even losses and waste as seen during recent times in some large projects.

- To promote further the role of National Steering Committee on Power Development. The National Steering Committee on Power Development shall convene at least once per

month, regularly supervise and speed up the main projects, coordinate and manage Ministries, sectors and provinces, power project investors to ensure progress, timely resolve obstacles, difficulties, reporting to the Prime Minister and the Government on issues beyond its authority.

- After the National Power Development Plan is approved, it is proposed that the Prime Minister assigns the Ministry of Industry and Trade (MOIT) with the following responsibilities:

+ From 01 January 2022, every six month, MOIT will conduct review of power sources constructions approved in PDP VII, revised PDP VII and PDP VIII and other relevant valid relevant plans.

+ If the projects under those approved plans mentioned above have been delayed for over 24 months in the first review duing 2022, MOIT will be enabled to revise and postpone the generation time of the project to the next 5 year cycle.

+ In the second review in the year 2022, if the projects mentioned above do not progress practically, MOIT shall report to the Prime Minister to consider withdrawing the project to handover to a new investor with ability to deploy, all material losses (if any) will be beared by previous investor.

+ For delayed projects but not over 24 months: the generation time shall be postponed to the next 5 year circle during the first review. In the second review, if the projects are still delayed, generation time shall be postponed further to the next 5 year cicle. If there is no practical progress made in the third review, MOIT shall report to the Prime Minister to consider withdrawing the project. Material losses (if any) during the previous deployment shall be beared by the previous investor. MOIT shall be enabled to revise by replacing the delayed project with new project from the list of approved projects in the PDP.

- For projects does not have investor or have not been handed over to investor:

+ Within 12 months from approval date of the plan, Provincial People's Committee where the project is approved must conduct the procedures of fomulation, approval of the investment policy or report to competen authorities to approve investment policy, to organize investor selection to implement the project following provisions of the Law on Investment and Law on Bidding.

+ In case the province does not take action within 12 months, MOIT shall report to the Prime Minister to revise and replace the delayed project from the list of approved projects in the PDP.

- For projects to be implemented following public-private partnership procedure (if any), MOIT will conduct the procedures of formulation, approval of the investment policy, feasibility study report, investor selection following provisions of the Law on Public-private partnership investment (PPP Law) and Law on Bidding, but the maximum time to select investor is 18 months (as current provisions require investor must be selected after the approval of feasibility study report) from the date of project approval in the plan. Exceeding this time limit, MOIT, as a competent authority for these projects, is responsible to report to the Prime Minister to revise and replace the delayed project from the list of approved project in the PDP.

- It is proposed that the Government to assign and enable MOIT to revise the generation time, revise capacity of the power source projects every 12 months to closely follow the practical implementation and ensuring power supply security.

b/ Solutions for ensuring fuel supply for power generation

- To diversify the fuel sources used for power generation, harmoniously combine the domestic and imported primary sources in order to ensure power security; actively seeking supplemental sources for the decreasing gas and coal sources.

- To build infrastructure systems for terminals importing LNG and gas distribution pipe line system for the next period, suitable with the selected power structure.

- To study and invest on construction of coal transshipment terminals in areas and regions to serve the coal importing activities to optimize the coal importing fee; foremostly investors of thermal power projects using imported coal shall have temporary coal terminal plan for the power plant when the centralized coal transshipment terminal is not available.

- To extend international cooperation in order to enhance the search and exploration activities to increase the reserve and the coal and gas exploitation capacity, ensuring fuel supply for power generation.

c/ Solutions for creating investment capital for development of the power sector:

- To incrementally raise the capability for mobilization of finance from enterprises in the power sector through such solutions as improving the operational efficiency and efficacy of enterprises in the power sector, ensuring healthy financial standing and reasonable benefits, ensuring ratio of own capital for development investment as required by domestic and international financial institutions.

- To diversify the funding sources, mode of financing (bank credit fund, development assistance fund, stock market,...), to effectively attract domestic and international funds in power development.

- To encourage all economic actors to participate in investment on power generation, power wholesale and retail following the roadmap of building the power market.

d/ Solutions on laws and policies

- To finalize the policy mechanism on state management in the power sector. To study, form and finalize mechanism on developing renewable energy.

- To form implementing policies after the approval of the PDP VIII in compliance with provisions of laws.

e/ Solutions on environment protection and natural disaster prevention

- Strictly compliant with provisions of laws regarding environment protection in development investment, operation of power sources and power grid.

- To use and select advanced technologies, with high reliability and efficiency level, minimizing environmental impact from power constructions.

- To fully implement the process of supervising, monitoring, measuring, observing environmental parameters following provisions of laws; examining and inspecting the compliance of environmental protection regulations for enterprises in the power sector.

- To develop the environmental industry coupling with energy development.

- To continue the formulation of supporting mechanisms, policies to develop energy sources with little impact and contribute to improve the environment: using wastes of agriculture and forestry; municipal waste to generate power,...

f/ Solutions on science and technology

- New energy facilities must be built with modern technologies suitable to Vietnam's economic conditions; to incrementally upgrade and renovate existing facilities to ensure

technical, economic and environmental standards. To combine modern, new technologies and completing, renovating existing technologies to increase efficiency and saving energy.

- To renovate and upgrade electricity transmission and distribution grids in order to reduce losses and ensure safety and reliability. Step by step applying smart grid technology. To develop and applying 4.0 technologies in the power system.

- To modernize regulation, operation, communication, control and automation systems to serve the regulation of domestic electricity grids and regional connection;

- To step by step apply recommended and compulsory measures to renew technologies and equipment of power-intensive industries; to limit and eventually ban the import of used and low-efficient equipments in electricity production and use.

g/ Solutions for energy efficiency and conservation:

- To enhance the communication, dissemination and implementation of the Law on Energy Efficiency and Conservation in order to raise energy use efficiency.

- To promote the implementation of Demand side management programs (DSM), Energy efficiency and conservation programs to contribute to reduce energy consumption needs, reduce investment pressure, increasing energy use efficiency and enhancing awareness of electricity consumers.

- To synchronously finalize the political mechanisms and financial mechanisms to encourage electricity consumers, electricity units to participate in the Demand side management programs, energy conservation programs.

h/ Solutions on human resource development

- To develop training plan for human resource development in the fields of power sources, transmission, distribution, power market,... To increase the application of modern technologies to enhance labour productivity of enterprises in the power sector.

- To form groups of specialists, scientists, highly trained and qualified human resources in the power sector; establishing strong science and technology group to resolve important missions of the sector.

- To enhance cooperation and connection with domestic and international reputed training facilities to train human resources on technical contents to ensure sufficient capacity level to operate large scale power system and applying smart grid technology.

i/ Solutions on international cooperation

- To quickly implement power grid interconnection with regional countries and ASEAN countries to increase the integration capacity of renewable energy sources and achieve benefits from regional interconnected power grid.

- To extend international cooperation on scientific researches and technologies development, diversifying cooperating methods to make use of technologies transfer and funding sources from foreign partners for power sector's development.

j/ Solutions on localization of power sector's equipments and develop electricity mechanical industry.

- To study the solutions to develop domestic manufacturing, production and supplying industry for electrical equipment, serving domestic needs and developing toward exportation.

- To increase investment in, and diversify sources of capital, attract foreign countries' participation in the research, design and manufacture of equipment and parts for the electricity sector. To prioritize the usage of locally produced electrical equipments with suitable quality and competitive price.

k/ Solutions on renovating management, enhancing efficiency of power activities

- To finalize the legal framework for regulating and managing activities of the competitive power market, in order to ensure the efficient, fair, transparent, non-discriminate operation of the power market and with the state's management; striving forward the target of ensuring power supply security, enhancing efficiency in power production and business activities, presenting public and transparent price signal to attract sustainable investment and development of the power sector.

- To implement efficient reformation of the power sector to develop competitive power market, of which focuses on capitalization of power generation, speeding up the establishment of the operation unit of the power system and independent power market, separating power distribution phase (with monolytic nature) and business, retail phase in the distribution and retail units.

l/ Solutions on electricity prices

- To preserve in the implementation of the principle of the market-based electricity price, ensuring the sufficient calculation of cost and reasonable profit to encourage investments on the power sector. To continue finalize the mechanism on managing electricity price, adjustment of retail price toward no cross compensation among consumer groups, among regions, areas. To promote transparencization of power price and power distribution cost.

- To quickly finalize the formulation and operation of fully competitive power market.

- To study and improve the electricity tariffs, two-component electricity price to apply on appropriate time.

Article 2. Responsibilities of relevant ministries, sectors, localities and units

1. The Ministry of Industry and Trade

a/ To be in charge of formulating implementation and monitoring plan for the deployment of PDP VIII suitable with socio-economic development status in each period. Timely review and revise, supplement when required and submit to the Prime Minister for approval for contents beyond its authority.

b/ To carry out the review tasks according to the Solutions on governing the implementation of PDP VIII with provisions at Article 1, Clause 4, Point a.

c/ To study and propose implementation mechanisms, policies for PDP VIII suitable with its authority following the Government regulation.

d/ To be in charge and cooperate with relevant Ministries, sectors and localities to continue the formulation and finalization of mechanisms and policies on encouraging development investments on renewable energy projects.

e/ To be in charge and cooperate with Ministries and sectors to negotiate and signing power cooperation and exchange with neighbouring countries and the participation of Vietnam in the interconnected power system of regional countries.

f/ To be in charge and cooperate with relevant Ministries, sectors to develop and implement national programs on energy efficiency and conservation; to study, formulate and promulgate management programs on power supply-demand, load adjustment to reach the approved targets, contents and plans.

g/ To decide the amendment of power sources projects approved in power plans and Implementation plan of the PDP VIII: (i) capacity scale of power source projects (except

national importance projects) within $\pm 15\%$ total approved capacity scale; (ii) operating progress within five (5) years; (iii) technical parameters and solutions.

h/ To decide the amendment of power grid projects approved in power plans and Implementation plan of the PDP VIII: (i) capacity scale of 220kV substation; (ii) increasing load capacity, adjusting cross section, number of circuits and length of 220kV line; (iii) 110kV power grid after 220kV substation and power grid connecting power sources.

i/ To study and renovate electricity price mechanism at phases in accordance with growing level of competitive power market; to study and supplement regulations on electricity distribution price in accordance with the development orientation of the competitive retail market to finalize the provisions of the Law on Electricity and relevant legal documents on electricity price.

j/ To decide the amendment of the projects' progress in approved plan based on the annual implementation status of the plan; to carry out review and report to the Prime Minister every two years to consider supplement plan for new project, or eliminate unnecessary projects out of the plan to be in line with practical demands in socio-economic development in each period.

k/ To cooperate with the National Steering Committee on power development and the localities to carry out unplanned and periodical inspections to ensure investors and relevant units to timely and effectively implement the project approved in PDP VIII.

2. The Ministry of Planning and Investment

a/ To be in charge of formulating public and transparent bidding mechanism to select investors to implement power projects, provide guidelines for implementation in provinces.

b/ To formulate mechanisms and policies to attract foreign investment, ODA capital and private investment capital for synchronous, balanced and sustainable development of the electricity sector;

3. Ministry of Finance

a/ To be in charge and cooperate with relevant Ministries, sectors on developing financial mechanism and capital mobilization mechanism for development investment in the power sector following approved plan to timely and fully meet the electricity demand of the whole society according to the PDP VIII.

b/ To cooperate with MOIT to develop policies on market-based electricity price.

c/ To cooperate with MOIT to study, develop and promulgate or submit to competent authorities to promulgate financial mechanism, electricity price mechanism and encouraging mechanism for implementation.

d/ To be in charge of review normative and legal documents and regulations of tax, finance, accounting to adjust, revise when required, ensuring the implementation of financial mechanisms, encouraging supports to implement demand side management program, load adjustment program, energy efficiency and conservation program.

4. State bank of Vietnam: steering credit agencies to synchronously implement the solutions to create favourable conditions for customers and enterprises investing in power project in PDP VIII to conveniently approach bank's credit fund in accordance with provisions of laws.

5. The National Steering Committee on power development

a/ To steer, inspect, supervise and speed up, monitoring the implementation of development investment of power source and power grid construction, timely reporting to the

Prime Minister on obstacles and inaquedacies impacting the progress of development investment of power projects.

b/ To steer, inspect and cooperate with relevant sectors, localities to resolve issues regarding obstructions in carry out compensation, support, immigration, resettlement, land clearance for power projects.

6. Vietnam Electricity

a/ To play the main role in ensuring stable and safe power supply for the cause of socio-economic development. To carry out investment in power source projects according to assigned tasks; to carry out development investment of synchronous power grid constructions. Be responsible of investment on power transmission grid construction in accordance with provisions in the Law on Electricity and other relevant regulations.

b/ To implement solutions to continuously reduce electricity loss; applying energy conservation program in production and consumption.

c/ To continuously enhance labour productivity, applying advanced and modern technologies, reducing environmental pollution in the power generation, transmission, distribution, business and selling phases.

d/ To promote the implementation of raising awareness program for the society and electricity customers to reach energy efficiency and conservation.

e/ To continuously implement the power grid projects approved in revised PDP VII and supplemently approved in relevant specialized power plans.

7. Vietnam Oil and Gas Group

a/ To cooperate with joint venture bidders to have optimum exploitation plan for gas resources from gas field Lo B, Ca Voi Xanh, Ken Bau... in accordance with approved progress. To carry out investment in power source projects and a number of infrastructure importing LNG in accordance with assigned tasks.

b/ To increase searching, exploring and exploiting activities for domestic gas sources supplying for power generation.

8. The Vietnam National Coal- Mineral Industries Holding Corporation

a/ To keep the main role in ensuring coal supply for power generation from domestic coal sources. To carry out investment in power source according to assigned tasks.

b/ To implement the tasks of exploiting, processing, supplying coal following the orientation in the plans and contracts with coal-using units, of which prioritizing ensuring coal supply for power generation according to signed coal supply contracts.

c/ To increase searching for domestic and imported coal sources to supply coal for the country. To implement studies, explorations and reserve assessments and establish exploitation plan for domestic coal resources to supply fuel for power plant and the economy.

9. People's Committee of provinces and municipalities

a/ To steer and closely cooperate with investors in the implementation of land clearance, compensation, immigration, resettlement for power source and power grid projects following provisions of law.

b/ To arrange land fund for approve power constructions; enhancing land management activities prioritizing land fund arrangement for development of power constructions.

c/ To develop plans to attract investment and develop approved power projects in the provinces, cities.

d/ To identify the list of power source projects suitable with the planned total capacity to serve the formulation of the Implementation plan of the PDP VIII.

e/ To carry out selections of investors for power project according to the provisions of the Law on Investment and provisions of selecting investors in the Law on Bidding and other relevant regulations.

Article 3. This Decision shall take effect from the date of signature and replace the Prime Minister's Decision No. 428/QĐ-TTg dated 18 March 2016 approving the revised National Power Development Plan for the 2011-2020 period with visions to 2030.

Article 4. Ministers, Heads of Minister-level agencies, Heads of Government-dependent agencies; Chairpersons of the People's Committees of provinces and municipalities; Chairpersons of Board Members/Presidents of the Electricity of Vietnam, Vietnam Oil and Gas and Vietnam Coal - Mineral Corporation; and relevant agencies shall be responsible for executing this Decision./

Recipients:

- Central Communist Party Secretariat;
- Prime Minister, Deputy Prime Ministers;
- Ministries, Ministerial-level agencies, Government-dependent agencies;
- People's Councils and Committees of provinces and municipalities;
- Central Office and Committees of the Communist Party;
- Party General Secretary Office
- State President Office;
- Ethnic Minority Council and National Assembly Committees;
- National Assembly Office;
- People's Supreme Court;
- People's Supreme Procuracy;
- State Audit;
- Central Committee of Vietnam Fatherland Front;
- Central Agencies of Mass Organizations;
- Electricity and Renewable Energy Authority – Ministry of Industry and Trade;
- Electricity of Vietnam; Vietnam Oil and Gas and Vietnam Coal -Mineral Corporation
- National Power Transmission Corporation
- Government Office: Minister-Chairperson, Vice Chairpersons, Prime Minister's Assistant, E-Portal Director, dependent Departments, Official Gazette;
- For filing: Clerical section, KTN (3 copies).

PRIME MINISTER

Pham Minh Chinh

Appendix 1: List of key national and investment-prioritized power projects by development scenarios

(enclosed with the Prime Minister's Decision No./QD-TTg dated [day] [month] 2021)

Table 1. List of thermal power projects

No.	Project	Installed capacity* (MW)	Assigned project owner/ Remark	Input fuel
	The period 2021-2025			
1	Nhon Trach 3&4 gas turbine combined cycle (GTCC) power plants	1500	PVPower	LNG
2	Hiep Phuoc GTCC power plant	1200		LNG
3	Bac Lieu 1 GTCC power plant	800	Delta Offshore Energy PTE LTD	LNG
4	O Mon III GTCC power plant (Gas Lot B)	1050		Domestically extracted gas
5	O Mon IV GTCC power plant (Gas Lot B)	1050	EVN	Domestically extracted gas
6	Na Duong II thermal power plant	110	TKV	Coal
7	An Khanh – Bac Giang thermal power plant	650	An Khanh – Bac Giang Thermal Power JSC	Coal
8	Thai Binh II thermal power plant	1200	PVN	Coal
9	Nghi Son II thermal power plant	1200	Marubeni	Coal
10	Cong Thanh thermal power plant	660	Cong Thanh Thermal Power JSC	Coal
11	Quang Trach I thermal power plant	1200	EVN	Coal
12	Van Phong thermal power plant	1432	Sumitomo	Coal
13	Duyen Hai II thermal power plant	1200	Janakuasa SDN BHD	Coal
14	Song Hau I thermal power plant	1200	PVN	Coal
	The period 2026-2030			
1	Quang Ninh 1 (Cam Pha) GTCC power plant	1500		LNG

No.	Project	Installed capacity* (MW)	Assigned project owner/ Remark	Input fuel
2	Hai Phong No.I 1&2 (Tien Lang) GTCC power plant	1500		LNG
3	Thai Binh 1 GTCC power plant	750		LNG
4	Nghi Son 1,2 GTCC power plant	1600		LNG
5	Ca Na GTCC power plant	1500		LNG
6	Son My I GTCC power plant	2250	EDF, Kyushu, Sojitz, Pacific Ocean Group JSC	LNG
7	Son My II GTCC power plant	2250	AES Group (US)	LNG
8	Bac Lieu 2, 3, 4 GTCC power plant	2400	Delta Offshore Energy PTE LTD	LNG
9	Long An I GTCC power plant	1500		LNG
10	Dung Quat I GTCC power plant (using CVX gas)	750	EVN	Domestically extracted gas
11	Dung Quat II GTCC power plant (using CVX gas)	750	Sembcorp Utilities Pte., Ltd.	Domestically extracted gas
12	Dung Quat III GTCC power plant (using CVX gas)	750	EVN	Domestically extracted gas
13	Central Region I GTCC power plant (using CVX gas)	750	PVN	Domestically extracted gas
14	Dung Quat II GTCC power plant (using CVX gas)	750	PVN	Domestically extracted gas
15	Quang Tri GTCC power plant (Bao Vang gas field)	340	Gazprom International	Domestically extracted gas
16	O Mon II GTCC power plant (Gas Lot B)	1050		Domestically extracted gas
17	Hai Ha combined heat and power (CHP) power station	600	Cogeneration in the industrial park	Coal
18	Pha Lai 3 *** thermal power plant	220		Coal
19	Nam Dinh I thermal power plant	1200	Taekwang Power Holdings – ACWA Power	Coal
20	Quynh Lap I thermal power plant	1200		Coal
21	Quynh Lap II thermal power plant	1200		Coal
22	Vung Ang II thermal power plant	1200		Coal

No.	Project	Installed capacity* (MW)	Assigned project owner/ Remark	Input fuel
23	Formosa Ha Tinh #6-10** CHP power plant	750	Cogeneration in the industrial park	Coal
24	Quang Trach II thermal power plant	1200	EVN	Coal
25	Vinh Tan III thermal power plant	1800	VTEC	Coal
26	Long Phu I thermal power plant	1200		Coal
27	Song Hau II thermal power plant	2000	TOYO Ink Group	Coal
28	Quang Tri I thermal power plant	1200	EGATI	Coal
	The period 2031-2035			
1	Hai Phong I #3, 4 (Tien Lang) GTCC power plant	1500		LNG
2	Hai Phong II (Cai Trap) GTCC power plant	1600		LNG
3	Quang Ninh II (Cam Pha) GTCC power plant	1500		LNG
4	Thai Binh #2,3,4 GTCC power plant	2250		LNG
5	Nghi Son #3,4 GTCC power plant	1600		LNG
6	Thanh Hoa #1,2 GTCC power plant	1600		LNG
7	Tan Phuoc #1 GTCC power plant	800		LNG
8	Long Son GTCC power plant	1500		LNG
9	Long An II GTCC power plant	1500		LNG
10	Hai Ha CHP plant (phase 2) **	1500		Coal
11	Bao Dai coal-fired power plant (Bac Giang)	600	In line with the coal extraction of Bao Bai coal mine	Coal
12	Duc Giang CHP plant **	100		Coal
13	Vung Ang III thermal power plant	2400	Under proposal to change input fuel to LNG	Coal
14	Long Phu II thermal power	1320		Coal

No.	Project	Installed capacity* (MW)	Assigned project owner/ Remark	Input fuel
	plant			
15	Long Phu III thermal power plant	2000		Coal
	The period 2036-2040			
1	Hai Phong I#5,6 (Tien Lang) GTCC power plant	1500		LNG
2	Thai Binh#5,6 GTCC power plant	1500		LNG
3	Nghi Son#5,6 GTCC power plant	1600		LNG
4	Thanh Hoa#3,4,5,6 GTCC power plant	3200		LNG
5	Northern Region GTCC power plant	4500		LNG
6	Hai Lang GTCC power plant****	1500		LNG
7	Tan Phuoc 1 #2 GTCC power plant	750		LNG
8	Phu My 3.1 GTCC power plant	850		LNG
	The period 2041-2045			
1	Northern Region GTCC power plant	8500		LNG
2	Hai Lang GTCC power plant	1500		LNG
3	Chan May GTCC power plant ****	1500		LNG

(*) The installed capacity of thermal power projects may range within $\pm 10\%$ and will be corrected in the investment project formulation stage. Name of the projects sticks to the localities' proposal. The selection of power project investors shall adhere to regulations specified in the Law on Investment, Law on Bidding and other relevant stipulations. Other projects proposed by the localities shall subject to consideration in the PDP8 Implementation Plan.

(**) Thermal cogeneration in industrial parks

(***) Incremental installed capacity (deconstruct old plants and build a new plant on the same location)

(****) To be constructed in case of incapability to develop more LNG-fired power plants in the North after 2035

Table 2. List of gas turbine combined cycle (GTCC) power projects using LNG as backup gas to 2030 in the scenario of delay in GTCC power projects using gas extracted from Ca Voi Xanh (Blue Whale) field and Bao Vang field, Long An GTCC and Bac Lieu GTCC power projects

Project	Installed capacity in 2030 (MW)	Note
Grand total	8450	
Total of the Northern Region	3950	
Hai Phong II (Cai Trap) GTCC power plant	1600	
Thai Binh GTCC power plant	750	
Thanh Hoa GTCC power plant	1600	
Total of the Southern Region	4500	
Tan Phuoc 1 GTCC power plant	1500	
Tan Phuoc 2 GTCC power plant	1500	
Long Son GTCC power plant	1500	

Table 3. Solar PV capacity by region (unit: MW)

No.	Region/ Year	2025	2030	2035	2040	2045
1	Northern	860	860	3560	6560	9560
2	North-Central	950	950	950	950	950
3	Mid-Central	730	730	930	950	930
4	Highland	2500	3800	4000	4000	4000
5	South-Central	6300	6800	7500	7500	7500
6	Southern	7200	8900	18800	30600	40700
	Total	18540	22040	35740	50540	63640

Table 4. Onshore and nearshore wind power capacity by region (unit: MW)

No.	Region/ Year	2025	2030	2035	2040	2045
1	Northern	420	420	1020	1520	2020
2	North-Central	400	400	400	500	1500

No.	Region/ Year	2025	2030	2035	2040	2045
3	Mid-Central	800	800	1300	1800	2000
4	Highland	2500	2500	3600	5000	5200
5	South-Central	2500	2500	2500	2500	2500
6	Southern	5200	5200	12900	16700	19500
	Total	11820	11820	21720	28020	32720

Table 5. Total installed capacity of expected offshore wind power projects to be additionally developed by 2030 (*)

No.	Region	Offshore wind power (MW)	
		Period 2021-2025	Period 2026-2030
1	Northern		2,000 MW
2	North-Central		
3	Mid-Central		
5	South-Central		
6	Southern		
	Total		

(*) Region, location and capacity of specific projects shall be determined based on the detailed assessments of technical potential, construction conditions and absorption capacity of the connected grids. The selection of power project investors shall adhere to regulations in the Law on Investment, Law on Bidding and other relevant stipulations.

Table 6. List of hydropower projects

No.	Project	Installed capacity (MW)	Investor/ Owner
	Period 2021-2025		
1	Hoa Binh hydropower plant expansion	480	EVN
2	Long Tao hydropower plant	42	IPP
3	Yen Son hydropower plant	90	Binh Minh Construction and Tourism Group JSC

No.	Project	Installed capacity (MW)	Investor/ Owner
4	Song Lo 6 hydropower plant	60	Xuan Thien Ha Giang Co., Ltd.
5	Pac Ma hydropower plant	140	Pac Ma Hydropower JSC
6	Nam Cum 1, 4, 5 hydropower plants	94	IPP
7	Nam Cum 2, 3, 6 hydropower plants	66	IPP
8	Hoi Xuan hydropower plant	102	IPP
9	Song Hieu (Ban Mong) hydropower plant	45	IPP
10	Nam Pan 5 hydropower plant	28	IPP
11	Yaly hydropower plant expansion	360	EVN
12	Tra Khuc 1 hydropower plant	36	IPP
13	Dak Mi 1 hydropower plant	84	IPP
14	Dak Mi 2 hydropower plant	147	IPP
15	Song Tranh 4 hydropower plant	48	IPP
16	Upper Kon Tum hydropower plant	220	EVN
17	Tri An hydropower plant expansion	200	EVN
18	La Ngau hydropower plant	36	La Ngau Hydropower JSC
19	Northern Region mini hydropower	2311	
20	Central Region mini hydropower	68	
	Period 2026-2030		
1	Nam Mo (Viet Nam) hydropower plant	95	IPP
2	Da Nhim 2 hydropower plant expansion	80	EVN
3	Sesan 3 hydropower plant expansion	130	EVN
4	Sesan 4 hydropower plant expansion	120	EVN
5	Bac Ai pumped storage hydropower plant	1200	EVN
6	Phuoc Hoa pumped storage hydropower	1200	IPP

No.	Project	Installed capacity (MW)	Investor/ Owner
	plant		
	Period 2031-2035		
1	Thai An hydropower plant expansion	41	IPP
2	Tuyen Quang hydropower plant expansion	120	EVN
3	Huoi Quang hydropower plant expansion	260	EVN
4	Son La hydropower plant expansion (phase 1)	400	EVN
5	Trung Son hydropower plant expansion	130	EVN
6	Ban Ve hydropower plant expansion	120	EVN
7	Quang Tri hydropower plant expansion	48	EVN
8	Song Tranh 2 hydropower plant expansion	95	EVN
9	Buon Kop hydropower plant expansion	140	EVN
10	Srepok 3 hydropower plant expansion	110	EVN
11	Lower Song Ba hydropower plant expansion	60	EVN
12	Northern Region mini hydropower	198	
13	Central Region mini hydropower	607	
14	Southern Region mini hydropower	750	
	Period 2036-2040		
1	Son La hydropower plant expansion (phase 2)	400	EVN
2	Ban Chat hydropower plant expansion	110	EVN
3	My Ly hydropower plant	250	IPP
4	Northern Region mini hydropower	40	
	Period 2041-2045		
1	Lai Chau hydropower plant expansion	400	EVN

No.	Project	Installed capacity (MW)	Investor/ Owner
2	Northern Region mini hydropower	110	EVN

Table 7. List of new (energy) X-to-power projects (waste to power, biomass power, cogeneration projects) expected to be developed by 2030 (*)

No.	Project	Capacity (MW)	Location
I	Biomass and cogeneration power projects		
1	Nui To I biomass power plant	30	An Giang
2	Nui To II biomass power plant	30	An Giang
3	Cam Lo biomass power plant	20	Quang Tri
4	Quang Tri biomass power plant	60	Quang Tri
5	PIR-1 Quang Binh biomass power plant	50	Quang Binh
6	Soc Trang rice husk powered plant	25	Soc Trang
7	Bac Kan biomass power plant	30	Bac Kan
8	Biomass cogeneration from steam-power and brewer's spent grains drying project of Heineken Vung Tau	12.6	Ba Ria – Vung Tau
9	Phu Thuan steam cogeneration plant (phase 1)	30	Ben Tre
10	S.P.V An Giang biomass power plant	30	An Giang
11	DIVI Binh Phuoc biomass power plant	10	Binh Phuoc
12	Lang Son biomass power plant	30	Lang Son
13	Biomass cogeneration plant	15	Da Nang
14	Yen Binh biomass power plant	50	Yen Bai
15	Nhu Thanh biomass power plant	10	Thanh Hoa
II	Waste to power projects		
1	Hon Dat W2P plant	10	Kien Giang
2	Tay Ninh W2P plant	10	Tay Ninh
3	Soc Trang solid waste powered plant	15	Soc Trang
4	Quang Trung W2P plant, in Thong Nhat	3.42	Dong Nai

	district, Dong Nai province		
5	Thai Nguyen municipal waste powered plant	10	Thai Nguyen
6	Soc Son W2P plant (capacity adjustment)	90	Ha Noi
7	Greenity Nam Dinh W2P plant	12	Nam Dinh
8	Ha Noi W2P plant	37	Ha Noi
9	Bac Giang waste treatment and power generation plant	8	Bac Giang
10	Hai Phong W2P plant	20MW in the first phase (2021-2025) and 20MW in the second phase (2026-2030)	Hai Phong
11	Tam Sinh Nghia (Cu Chi) waste-to-energy power plant	40	Ho Chi Minh City
12	Tam Sinh Nghia (Long An) waste-to-energy power plant	10	Long an
13	Tho Xuan Thanh Hoa W2P plant	12	Thanh Hoa

(*) Name of the projects sticks to the localities' proposal. The selection of power project investors shall adhere to regulations specified in the Law on Investment, Law on Bidding and other relevant stipulations. Other projects proposed by the localities shall subject to consideration in the PDP8 Implementation Plan. The total capacity of waste-to-power and biomass power projects in the localities shall be kept reviewed and added (if necessary) during the implementation of PDP8.

Table 8. List of investment-prioritized transmission grid projects

A. Northern Region

Table a.1. List of newly built and improved 500kV transformer substations in the North by 2045

No.	Substation	Total capacity (MVA)	Note
Period up to 2025			
1	West Hanoi	1800	Improvement, capacity upgrade
2	Long Bien	900	New construction
3	Hai Phong	900	New construction
4	Nam Dinh thermal power plant	900	New construction, connection of the 500kV distribution yard of Nam Dinh 1 thermal power plant

No.	Substation	Total capacity (MVA)	Note
5	Thai Binh	600	New construction
6	Nho Quan	1800	Improvement, capacity upgrade, already energized
7	Lao Cai	2700	New construction, consideration of installing transformer unit 3 in line with the mini hydropower development and power purchase from China
8	Thai Nguyen	900	New construction
9	Viet Tri	1800	Improvement, capacity upgrade
10	Bac Giang	900	New construction, ensuring of the power supply for Bac Giang province in case the An Khanh Thermal Power Plant is delayed
11	Vinh Yen	1800	New construction
12	Bac Ninh	1800	New construction
13	Quang Ninh	1200	Improvement, capacity upgrade
14	Lai Chau	1800	Improvement, capacity upgrade
15	Hoa Binh	1800	Improvement, capacity upgrade
16	Nghi Son	900	Improvement, capacity upgrade
17	Thanh Hoa	1200	New construction
18	Quynh Luu	900	New construction
19	Reserve capacity of 500kV substation for load growth and power source development in the period	1800	New construction, or Improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection

No.	Substation	Total capacity (MVA)	Note
			devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2026-2030			
1	Dong Anh	2700	Improvement, capacity upgrade
2	Long Bien	1800	Improvement, capacity upgrade
3	Son Tay	900	New construction
4	Dan Phuong	900	New construction
5	South Ha Noi	900	New construction
6	Hai Phong 2	900	New construction
7	Gia Loc	900	New construction
8	Hung Yen	900	New construction
9	Thai Binh	1200	Improvement, capacity upgrade
10	Nam Dinh thermal power plant	1800	Improvement, capacity upgrade
11	Ninh Binh	Switching station	New construction of switching station, connection to the Laos' power sources
12	Thai Nguyen	1800	Improvement, capacity upgrade
13	Yen The	900	New construction
14	Lai Chau	2700	Improvement, capacity upgrade
15	Son La	2700	Improvement, capacity upgrade to host the hydropower capacity
16	Thanh Hoa	1800	Improvement, capacity upgrade
17	Vung Ang	1800	Improvement, capacity upgrade
18	Reserve capacity of the substation for load growth and power source development in the North	2100	New construction, or improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			

No.	Substation	Total capacity (MVA)	Note
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2031-2035			
1	Long Bien	2700	Improvement, capacity upgrade
2	Son Tay	1800	Improvement, capacity upgrade
3	Dan Phuong	1800	Improvement, capacity upgrade
4	South Ha Noi	1800	Improvement, capacity upgrade
5	Hai Phong	1800	Improvement, capacity upgrade. Consideration of setting the schedule of the project in the period 2026-2030 in case the Hai Phong I LNG power plant is delayed,
6	Gia Loc	1800	Improvement, capacity upgrade
7	Hung Yen	1800	Improvement, capacity upgrade
8	Vinh Yen	2700	Improvement, capacity upgrade
9	Lang Son (*)	900	New construction, connection and electrification of 220kV Dong Mo substation, project progress subject to the development of RE sources
10	Bac Ninh	2700	Improvement, capacity upgrade
11	Yen The	1800	Improvement, capacity upgrade
12	Quang Ninh	1800	Improvement, capacity upgrade
13	Hai Ha	900	New construction, electrification for Hai Ha industrial park and reservation of land fund for the

No.	Substation	Total capacity (MVA)	Note
			distribution yard of Hai Ha thermal power plant in case the power plant injects more capacity to the grid
14	Dien Bien (*)	900	New construction, RE source synchronized
15	Thanh Hoa	2700	Improvement, capacity upgrade
16	Nam Cam	900	New construction
17	Tinh Gia	900	New construction
18	Ha Tinh	1800	Improvement, capacity upgrade
19	Reserve capacity of the substation for load growth and power source development in the North	2100	New construction, or improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2036-2040			
1	Dan Phuong	2700	Improvement, capacity upgrade
2	Son Tay	2700	Improvement, capacity upgrade
3	South Ha Noi	2700	Improvement, capacity upgrade
4	Hai Phong 2	1800	Improvement, capacity upgrade
5	Hung Yen	2700	Improvement, capacity upgrade
6	Ha Nam	900	New construction
7	Nam Dinh 2	900	New construction

No.	Substation	Total capacity (MVA)	Note
8	Thai Binh	1800	Improvement, capacity upgrade
9	Ninh Binh	900	Installation of transformer in the switching station
10	Cao Bang	900	New construction
11	Tuyen Quang	900	New construction
12	Thai Nguyen	2700	Improvement, capacity upgrade
13	Viet Tri	2700	Improvement, capacity upgrade
14	Bac Giang	1800	Improvement, capacity upgrade
15	Bac Ninh 2	900	New construction
16	Quang Ninh 2	900	New construction
17	Tinh Gia	1800	Improvement, capacity upgrade
18	Nam Cam	1800	Improvement, capacity upgrade
19	Reserve capacity of substation for load growth and power source development in the North	3600	New construction, or improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2041-2045			
1	Thuong Tin	2400	Improvement, capacity upgrade
2	West Ha Noi	2400	Improvement, capacity upgrade
3	Hai Phong 2	2700	Improvement, capacity upgrade

No.	Substation	Total capacity (MVA)	Note
4	Gia Loc	2700	Improvement, capacity upgrade
5	Ha Nam	1800	Improvement, capacity upgrade
6	Nam Dinh 2	1800	Improvement, capacity upgrade
7	Bac Ninh 2	1800	Improvement, capacity upgrade
8	Quang Ninh 2	1800	Improvement, capacity upgrade
9	Hai Ha	1800	Improvement, capacity upgrade
10	Dien Bien (*)	1800	Improvement, capacity upgrade
11	Tinh Gia	2700	Improvement, capacity upgrade
12	Quynh Luu	1800	Improvement, capacity upgrade
13	Reserve capacity of substation for load growth and power source development in the North	4200	New construction, or improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors

Note: The capacity figures in the above table refer to the substations' installed capacity. The option of new construction, improvement to upscale the capacity or installation of addition transformers (transformer unit 2 or unit 3, etc.) will be clarified when carrying out each specific project.

(*) The capacity of wind/PV collector substations is estimated. The accurate volume and progress depend on actual connection progress and options applicable to RE projects.

Table a.2. List of newly built and improved 500kV transmission lines in the North by 2045

No.	Transmission line	Nos. of circuit x km	Note
Projects to be put into operation by 2025			

1	West Ha Noi – Vinh Yen	2x44	New construction
2	Long Bien – Branch Pho Noi – Thuong Tin	2x5	New construction, connection of 500kV Long Bien substation
3	West Ha Noi – Thuong Tin	2x40	New construction
4	Circuit-2 Nho Quan – Thuong Tin	1x75	New construction, upgrade of one circuit to two circuits
5	Hai Phong – Thai Binh	2x35	New construction
6	Nam Dinh I thermal power plant – Pho Noi	2x133	New construction
7	Nam Dinh I thermal power plant – thanh Hoa	2x73	New construction
8	Thai Binh – Branch Nam Dinh thermal power plant – Pho Noi	4x2	New construction, connection of 500kV Thai Binh substation
9	Lao Cai – Vinh Yen	2x210	New construction, connection of 500kV Lao Cai substation, absorption of mini hydropower capacity and power purchase from China
10	Hiep Hoa – Thai Nguyen	2x35	New construction
11	Vinh Yen – Branch Son La – Hiep Hoa and Viet Tri – Hiep Hoa	4x5	New construction, connection of 500kV Vinh Yen substation
12	Bac Giang – Branch Quang Ninh – Hiep Hoa	4x5	New construction, connection of 500kV Bac Giang substation, ensuring of power supply for Bac Giang province in case the An Khanh thermal power plant is delayed
13	Bac Ninh – Branch Dong Anh – Pho Noi	2x3	New construction, connection of 500kV Bac Ninh substation
14	Connection of expanded Hoa Binh hydropower plant	2x2	New construction, synchronization of the expanded Hoa Binh hydropower plant, transited to Hoa Binh – Nho Quan
15	Thanh Hoa – Branch Nho Quan – Ha Tinh	2x5	New construction, temporary connection of 500kV Thanh Hoa substation

16	Nghi Son – Branch Nho Quan – Ha Tinh	4x40	New construction, connection of 500kV Nghi Son substation
17	Cong Thanh thermal power plant – Branch Nghi Son – Nho Quan	2x5	New construction, connection of Cong Thanh thermal power plant
18	Quynh Luu – Thanh Hoa	2x80	New construction, improvement of transmission capacity for the North-North Central region
19	Quang Trach – Quynh Luu	2x222	New construction, improvement of transmission capacity for the North-North Central region
20	Vung Ang – Branch Ha Tinh – Da Nang (circuit 3, 4)	2x18	New construction, transited to the circuit 2 500kV Ha Tinh – Da Nang line
21	Vung Ang – Quang Trach	2x32.6	New construction
22	Quang Trach – Doc Soi	2x500	New construction
23	Improvement of loadability of the North – North Central interface		Improvement, replacement of series capacitors
24	Backup plan: new construction and upgradation of the North region 500kV transmission line in the period to 2025	68	Estimated volume
Projects to be put into operation in the period 2026-2030			
1	South Ha Noi – Branch Nho Quan – Thuong Tin	4x5	New construction, connection of 500kV South Ha Noi substation
2	Dan Phuong - Branch West Ha Noi – Vinh Yen	4x5	New construction, connection of 500kV Dan Phuong substation
3	Son Tay – Dan Phuong	2x20	New construction, connection of 500kV Son Tay substation. Temporarily transition to the 500kV West Hanoi – Vinh Yen line in case the 500kV Son Tay substation has yet to operate
4	Hai Phong 2 – Gia Loc	2x48	New construction, connection of Hai Phong 2

5	Gia Loc – Branch Thai Binh – Pho Noi	4x13	New construction, connection of 500kV Gia Loc substation
6	Hung Yen – Branch Quynh Lap thermal power plant – Long Bien	4x5	New construction, connection of 500kV Hung Yen substation
7	500kV Ninh Binh switching station – Branch Ha Tinh – Nho Quan	2x5	Connection of 500kV Ninh Binh switching substation, branching of circuit 2 of the existing 500kV line
8	Sam Nuea – 500kV Ninh Binh switching station	2x90	New construction, interconnection with the power source from Laos, with whole route of 186km long
9	500kV Ninh Binh switching station – West Ha Noi	2x100	New construction, hosting the hydropower capacity from Laos
10	Yen The – Branch Hai Ha thermal power plant – Thai Nguyen	4x10	New construction, connection of 500kV Yen The substation. Construction of Yen The – Thai Nguyen line of 73km in advance to ensure the power supply in case Hai Ha thermal power plant does not increase the power sold.
11	Nghi Son LNG – Branch Quynh Lap thermal power plant – Hung Yen (**)	4x5	New construction, synchronization of LNG sources in the North region in high scenario
12	Quang Ninh LNG (Cam Pha) – Quang Ninh	2x30	New construction, synchronization of Quang Ninh (Cam Pha) LNG power plant
13	Hai Ha thermal power plant – Thai Nguyen	2x250	New construction, synchronization of Hai Ha thermal power plant
14	Quynh Lap thermal power plant – Long Bien	2x212	New construction, synchronization of Quynh Lap thermal power plant to increase the North-North Central transmission capacity
15	Quynh Lap thermal power plant – Quynh Luu	2x20	New construction, connection of Quynh Lap thermal power plant
16	Improvement of loadability of the North Central – Mid Central		Improvement, replacement of

	interface		series capacitors
17	Backup plan: new construction and upgradation of the North region 500kV transmission line in the period 2026-2030	186	Estimated volume
Projects to be put into operation in the period 2031-2035			
1	Hai Phong 1 (Tien Lang) LNG – Hai Phong	4x10	New construction, connection of Hai Phong I (Tien Lang) LNG power plant
2	Hai Phong 2 (Cat Hai – Cai Trap) LNG – Branch Hai Phong 1 LNG – Hai Phong 2	4x5	New construction, synchronization of Hai Phong 2 LNG power plant
3	Hai Phong 1 (Tien Lang) LNG – Hai Phong 2	2x54	New construction, synchronization, capacity absorption for Hai Phong 1 & 2 LNG power plants
4	Connection of the Northern offshore wind power (*)	2x25	New construction, connection of the Northern offshore wind power
5	Thai Binh LNG – Thai Binh	2x41	New construction, capacity hosting for Thai Binh LNG power plant
6	Circuit-2 Hiep Hoa – Bac Ninh	1x66	New construction, upgrade of one circuit to two circuits
7	Circuit-2 Bac Ninh – Pho Noi	1x15	New construction, upgrade of one circuit to two circuits, consideration of changing connection to Gia Loc – Pho Noi – Bac Ninh line
8	Dien Bien – Northern pumped hydropower plant	2x250	New construction, connection of 500kV Dien Bien substation
9	Northern pumped hydropower plant – Branch Son La – Viet Tri and Son La – Vinh yen	4x35	New construction, connection of pumped hydropower in the North
10	Norther pumped hydropower plant – Son Tay	2x70	New construction
11	Lang Son – Branch Hai Ha thermal power plant – Yen The	4x5	New construction, connection of 500kV Lang Son substation, absorption of RE capacity

12	Connection of expanded Son La hydropower plant	2x5	Synchronization of the expanded Son La hydropower plant
13	Tinh Gia – Branch Quynh Luu – Thanh Hoa	4x4	New construction, connection of 500kV Tinh Gia substation
14	Thanh Hoa LNG – Branch Nghi Son LNG – Quynh Lap	4x5	New construction, connection of Thanh Hoa LNG power plant
15	Upgrade of Vung Ang – Nho Quan (circuit 1)	2x378	Upgrade of the current circuit-1 500kV into two-circuit 500kV line. Consideration to change the connection to Vung Ang III – Vung Ang – Nho Quan and Ninh Binh – Nho Quan – Thuong Tin lines in case of impossibility to expand the Vung Ang and Nho Quan 500kV substations
16	Upgrade of Vung Ang – Nho Quan (circuit 2)	2x357	Upgrade of the current circuit-2 500kV into two-circuit 500kV line. Consideration to change the connection to Vung Ang III – Vung Ang – Nho Quan and Ninh Binh – Nho Quan – Thuong Tin lines in case of impossibility to expand the Vung Ang and Nho Quan 500kV substations
17	Vung Ang III thermal power plant – changed connection to Vung Ang – Nho Quan (new circuit)	2x7	New construction, synchronization of Vung Ang III thermal power plant
18	Vung Ang III thermal power plant – Branch Quang Trach – Vung Ang	4x2	New construction, synchronization of Vung Ang III thermal power plant
19	Nam Cam – Branch Vung Ang – Nho Quan (new circuit)	4x12	New construction, transition on the new-circuit Vung Ang – Nho Quan line
20	Backup plan: new construction and upgradation of the North region 500kV transmission line in the period 2031-2035	168	Estimated volume
Projects to be put into operation in the period 2036-2040			
1	Gia Loc – Pho Noi (circuit 3, 4)	2x38	New construction,

			improvement the hosting of capacity of LNG power plant in the Northeastern region, consideration of changing connection of two circuits to Bac Ninh
2	Ha Nam – Branch Thanh Hoa LNG – South Ha Noi	4x5	New construction, connection of 500kV Ha Nam substation
3	Nam Dinh 2 – Branch Nam Dinh thermal power plant – Thai Binh	2x12	New construction
7	Thai Binh LNG – Hung Yen	2x70	New construction, synchronization of Thai Binh LNG power plant
6	Thai Nguyen – Cao Bang	2x150	New construction, connection of 500kV Cao Bang substation
7	Tuyen Quang – Branch Lao Cai – Vinh yen	2x30	New construction, connection of 500kV Tuyen Quang substation
8	Bac Ninh 2 – Branch Hiep Hoa – Bac Ninh	2x8	New construction, connection of 500kV Bac Ninh 2 substation
9	Thanh Hoa LNG – South Ha Noi	2x220	New construction, connection of Thanh Hoa LNG power plant in case the thermal power plants in the North are delayed
10	Connection of the Northern LNG power plant (1) (**)	2x10	New construction, synchronization of Northern LNG power plant in the high scenario
11	Backup plan: new construction and upgradation of the North region 500kV transmission line in the period 2036-2040	144	Estimated volume
Projects to be put into operation in the period 2041-2045			
1	Connection of expanded Lai Chau hydropower plant	2x5	Synchronization of expanded Lai Chau hydropower plant
2	Boulapha – Ha Tinh (**)	2x90	New construction, connection of the power source from Laos in the high scenario
3	Connection of the Northern LGN	4x10	New construction,

	power plant (2) (**)		synchronization of LNG power plants in the North in the high scenario
4	Backup plan: new construction and upgradation of the North region 500kV transmission line in the period 2041-2045	67	Estimated volume

Note: (*) The volume of RE connection lines in the above table is estimated. The accurate volume depends on the actual progress and applicable connection option of wind and solar power projects.

Table a.3. List of newly built and improved 220kV transmission transformer substations in the North by 2045

No.	Substation	Total capacity (MVA)	Note
Period to 2025			
1	Xuan Mai	500	Improvement, capacity increase
2	Van Tri	750	Improvement, capacity increase
3	Long Bien	750	Improvement, capacity increase
4	Me Linh	500	New construction
5	Van Dien	500	New construction
6	Thanh Xuan	750	New construction
7	Dai Mo (My Dinh)	750	New construction
8	Hoa Lac	500	New construction
9	Long Bien 2 (Gia Lam)	500	New construction
10	Ung Hoa	500	New construction
11	Vat Cach	500	Improvement, capacity increase
12	Hai Phong thermal power plant	500	Improvement, capacity increase
13	Thuy Nguyen	500	Improvement, capacity increase
14	An Lao	500	New construction
15	Duong Kinh	250	New construction

No.	Substation	Total capacity (MVA)	Note
16	Cat hai	250	New construction
17	Gia Loc	500	New construction
18	Thanh Ha	250	New construction
19	Tan Viet	250	New construction
20	Yen My	500	New construction
21	500kV Pho Noi connecting substation	250	New construction
22	Pho Cao	500	New construction
23	Bai Say	250	New construction
24	Phu Ly	500	Improvement, capacity increase
25	Thanh Nghi	500	Improvement, capacity increase
26	Ly Nhan	250	New construction
27	Dong Van	500	New construction
28	Hai Hau	250	New construction
29	Thai Thuy	500	Improvement, capacity increase
30	Vu Thu	250	New construction
31	500kV Nho Quang connecting substation	500	Improvement, capacity increase
32	Ninh Binh 2	250	New construction
33	Tam Diep	250	New construction
34	Gia Vien	250	New construction
35	Bac Quang	500	New construction
36	500kV Lao Cai connecting substation	250	New construction
37	Bat Xat	500	New construction
38	Bac Kan	250	Improvement, capacity increase
39	Lang Son	375	New construction

No.	Substation	Total capacity (MVA)	Note
40	Tuyen Quang	375	Improvement, capacity increase
41	Nghia Lo	250	New construction
42	Luc Yen	125	New construction
43	Luu Xa	500	Improvement, capacity increase
44	Phu Binh 2	500	New construction
45	Song Cong	250	New construction
46	Phu Tho 2	250	New construction
47	500kV Viet Tri connecting substation	250	New construction
48	Vinh Tuong	500	Improvement, capacity increase
49	Ba Thien	500	New construction
50	Tam Duong	250	New construction
51	Son Dong	250	New construction
52	Lang Giang	250	New construction
53	Yen Dung	250	New construction
54	Bac Ninh 4	500	New construction
55	Bac Ninh 5	500	New construction
56	500kV Bac Ninh connecting substation	250	New construction
57	Trang Bach	500	Improvement, capacity increase
58	Hoanh Bo	500	Improvement, capacity increase
59	500kV Quang Ninh connecting substation	500	Improvement, capacity increase
60	Cam Pha	375	Improvement, capacity increase
61	Khe Than	63	New construction
62	Yen Hung	250	New construction
63	Cong Hoa	250	New construction

No.	Substation	Total capacity (MVA)	Note
64	Nam Hoa	250	New construction
65	Muong Te	750	Improvement, capacity increase
66	Pac Ma	500	New construction
67	Phong Tho	500	New construction
68	Dien Bien	250	New construction
69	Muong La	500	Improvement, capacity increase
70	Suoi Sap 2A (*)	200	New construction, hydropower capacity releasing in accordance with the letter ref. 136/TTg-CN dated 29 Jan 2021
71	Hoa Binh	375	Improvement, capacity increase
72	Yen Thuy	250	New construction
73	Bim Son	500	Improvement, capacity increase
74	Nghi Son Economic Zone	500	New construction
75	Nghi Son Steel Complex	500	New construction
76	Sam Son	250	New construction
77	Hau Loc	250	New construction
78	Vinh (Hung Dong)	500	Improvement, capacity increase
79	Do Luong	375	Improvement, capacity increase
80	Tuong Duong	250	New construction
81	Nam Cam	500	New construction
82	Quy Hop	250	New construction, connection of mini hydropower stations
83	Ha Tinh	500	Improvement, capacity increase
84	Vung Ang	250	New construction
85	Reserve capacity of 220kV substation for load growth and power source development in the North	1250	New construction, or improvement and capacity upgrade

No.	Substation	Total capacity (MVA)	Note
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2026-2030			
1	Soc Son 2	500	New construction
2	Phu Xuyen	500	New construction
3	Van Dien	750	Improvement, capacity increase
4	Long Bien 2 (Gia Lam)	750	Improvement, capacity increase
5	Hoa Lac 2	500	New construction
6	Dan Phuong	500	New construction
7	Chuong My	250	New construction
8	Cau Giay	500	New construction, consideration of underground station
9	Hai Ba Trung	500	New construction, consideration of underground station
10	Duong Kinh	500	Improvement, capacity increase
11	Cat Hai	500	Improvement, capacity increase
12	Dai Ban	250	New construction
13	Do Son	250	New construction
14	Tien Lang	250	New construction
15	500kV Hai Phong 2 connecting substation	250	New construction
16	Pha Lai thermal power plant	750	Improvement, capacity increase

No.	Substation	Total capacity (MVA)	Note
17	Thanh Ha	500	Improvement, capacity increase
18	Tu Ky	250	New construction
19	Hai Duong thermal power plant	500	Improvement, capacity increase
20	Nhi Chieu	250	New construction
21	500kV Pho Noi connecting substation	500	Improvement, capacity increase
22	Hung Yen connecting substation (Hung Yen city)	250	New construction
23	Van Giang	250	New construction
24	Ly Nhan	500	Improvement, capacity increase
25	Hai Hau	500	Improvement, capacity increase
26	Nam Dinh 2	250	New construction
27	Nghia Hung	250	New construction
28	Vu Thu	500	Improvement, capacity increase
29	Quynh Phu	250	New construction
30	500kV Thai Binh connecting substation	250	New construction
31	Gia Vien	500	Improvement, capacity increase
32	Ha Giang	375	Improvement, capacity increase
33	Bac Quang	750	Improvement, capacity upgrade, absorption of mini hydropower capacity
34	Cao Bang	500	Improvement, capacity increase
35	500kV Lao Cai connecting substation	500	Improvement, capacity increase
36	Van Ban	250	New construction
37	Bac Ha	250	New construction
38	Dong Mo	250	New construction

No.	Substation	Total capacity (MVA)	Note
39	Lang Son	500	Improvement, capacity increase
40	Tuyen Quang	500	Improvement, capacity increase
41	Luc Yen	375	Improvement, capacity increase
42	Phu Binh 2	750	Improvement, capacity increase
43	Dai Tu	250	New construction
44	Phu Tho 2	500	Improvement, capacity increase
45	Phu Tho 3	250	New construction
46	Phuc Yen	250	New construction
47	Tam Duong	500	Improvement, capacity increase
48	Chan Hung	250	New construction
49	Hiep Hoa 2	250	New construction
50	500kV Bac Giang connecting substation	250	New construction
51	Lang Giang	500	Improvement, capacity increase
52	Tan yen	250	New construction
53	Viet Yen	250	New construction
54	Yen Dung	500	Improvement, capacity increase
55	Bac Ninh 4	750	Improvement, capacity increase
56	500kV Bac Ninh connecting substation	500	Improvement, capacity increase
57	Bac Ninh 2	750	Improvement, capacity increase
58	Bac Ninh 3	750	Improvement, capacity increase
59	Bac Ninh 6	500	New construction
60	Bac Ninh 7	250	New construction
61	Hai Ha industrial park	250	New construction
62	Mong Cai	125	New construction

No.	Substation	Total capacity (MVA)	Note
63	Cam Pha	500	Improvement, capacity increase
64	Yen Hung	500	Improvement, capacity increase
65	Dien Bien	500	Improvement, capacity increase
66	Moc Chau	250	New construction
67	Song Ma (*)	250	New construction
68	Hoa Binh	500	Improvement, capacity increase
69	Tan Lac	250	New construction
70	Nghi Son Economic Zone	750	Improvement, capacity increase
71	Tinh Gia	250	New construction
72	Sam Son	500	Improvement, capacity increase
73	Thieu Hoa	250	New construction
74	Hau Loc	500	Improvement, capacity increase
75	Ba Thuoc	250	New construction
76	Do Luong	500	Improvement, capacity increase
77	Can Loc	250	New construction
78	Vung Ang	500	Improvement, capacity increase
79	Reserve capacity of 220kV substation for load growth and power source development in the North	2250	New construction, or improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors

No.	Substation	Total capacity (MVA)	Note
Period 2031-2035			
1	Ung Hoa	750	Improvement, capacity increase
2	West Ha Noi	750	Improvement, capacity increase
3	Dan Phuong	750	Improvement, capacity increase
4	Dong Anh 2	500	New construction
5	Dong Anh 3	500	New construction
6	Phuc Tho	500	New construction
7	Chuong My	500	Improvement, capacity increase
8	Dinh Vu	750	Improvement, capacity increase
9	Thuy Nguyen	750	Improvement, capacity increase
10	500kV Hai Phong 2 connecting substation	500	Improvement, capacity increase
11	Nhi Chieu	500	Improvement, capacity increase
12	Gia Loc	750	Improvement, capacity increase
13	Tu Ky	500	Improvement, capacity increase
14	Tan Viet	500	Improvement, capacity increase
15	Nam Sach	250	New construction
16	Bai Say	500	Improvement, capacity increase
17	Van Giang	500	Improvement, capacity increase
18	Dong Van	750	Improvement, capacity increase
19	Kim Bang	250	New construction
20	Giao Thuy	250	New construction
21	Nam Dinh 2	500	Improvement, capacity increase
22	Nghia Hung	500	Improvement, capacity increase
23	500kV Thai Binh connecting substation	500	Improvement, capacity increase

No.	Substation	Total capacity (MVA)	Note
24	Quynh Phu	500	Improvement, capacity increase
25	Tien Hai	250	New construction
26	Ninh Binh 2	500	Improvement, capacity increase
27	Tam Diep	500	Improvement, capacity increase
28	Ha Giang	500	Improvement, capacity increase
29	Quang Uyen	250	New construction
30	Lao Cai 2	250	New construction
31	Van Ban	500	Improvement, capacity increase
32	Bac Kan	375	Improvement, capacity increase
33	Lang Son RE collector station (*)	250	New construction
34	Lang Son	500	Improvement, capacity increase
35	Dong Mo	500	Improvement, capacity increase
36	Son Duong	250	New construction
37	Yen Bai	375	Improvement, capacity increase
38	Nghia Lo	500	Improvement, capacity increase
39	Yen Bai RE collector station (*)	250	New construction
40	Song Cong	500	Improvement, capacity increase
41	Dai Tu	500	Improvement, capacity increase
42	Phuc Xuan	250	New construction
43	Viet Tri 2 (Lam Thao)	250	New construction
44	500kV Viet Tri connecting substation	500	Improvement, capacity increase
45	Phuc Yen	500	Improvement, capacity increase
46	Ba Thien	750	Improvement, capacity increase
47	Chan Hung	500	Improvement, capacity increase

No.	Substation	Total capacity (MVA)	Note
48	Viet Yen	500	Improvement, capacity increase
49	Chu	250	New construction
50	500kV Bac Giang connecting substation	500	Improvement, capacity increase
51	Hiep Hoa 2	500	Improvement, capacity increase
52	Bac Ninh 7	750	Improvement, capacity increase
53	Bac Ninh 8 (Thuan Thanh)	500	New construction
54	Khe Than	126	Improvement, capacity increase
55	Nam Hoa	500	Improvement, capacity increase
56	500kV Quang Ninh connecting substation	750	Improvement, capacity increase
57	Hai Ha	500	Improvement, capacity increase
58	Uong Bi thermal power plant	375	Improvement, capacity increase
59	Cong Hoa	500	Improvement, capacity increase
60	Mong Cai	375	Improvement, capacity increase
61	Hai Ha industrial park	500	Improvement, capacity increase
62	Sin Ho	250	New construction
63	Dien Bien 1 RE collector station (*)	250	New construction
64	Son La RE collector station (*)	250	New construction
65	Son La 1 RE collector station (*)	250	New construction
66	Luong Son	250	New construction
67	Hoa Binh RE collector station (*)	250	New construction
68	Nong Cong	750	Improvement, capacity increase
69	Sam Son	750	Improvement, capacity increase

No.	Substation	Total capacity (MVA)	Note
70	Tinh Gia	500	Improvement, capacity increase
71	Thieu Hoa	500	Improvement, capacity increase
72	Ba Thuoc	500	Improvement, capacity increase
73	Ngoc Lac	500	New construction
74	500kV Tinh Gia connecting substation	250	New construction
75	Hoang Mai	250	New construction
76	Can Loc	500	Improvement, capacity increase
77	Vung Ang	750	Improvement, capacity increase
78	Loc Ha	250	New construction
79	Ha Tinh 1 RE collector station (*)	250	New construction
80	Reserve capacity of 220kV substation for load growth and power source development in the North	3000	New construction, or improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2036-2040			
1	Hoa Lac	750	Improvement, capacity increase
2	Soc Son	750	Improvement, capacity increase
3	Thuong Tin	750	Improvement, capacity increase
4	Thanh Cong	750	Improvement, capacity increase

No.	Substation	Total capacity (MVA)	Note
5	Tay Ho	750	Improvement, capacity increase
6	Son Tay	750	Improvement, capacity increase
7	Hoa Lac 2	750	Improvement, capacity increase
8	Phu Xuyen	750	Improvement, capacity increase
9	Dong Anh 3	750	Improvement, capacity increase
10	Cau Giay	750	Improvement, capacity increase
11	Thanh Tri	750	New construction
12	Dong Hoa	750	Improvement, capacity increase
13	Duong Kinh	750	Improvement, capacity increase
14	Dai Ban	500	Improvement, capacity increase
15	Tien Lang	500	Improvement, capacity increase
16	Thanh Mien	500	New construction
17	Nam Sach	500	Improvement, capacity increase
18	Hung Yen connecting substation (Hung Yen city)	500	Improvement, capacity increase
19	Kim Bang	500	Improvement, capacity increase
20	Nam Dinh 2	750	Improvement, capacity increase
21	Giao Thuy	500	Improvement, capacity increase
22	Tien Hai	500	Improvement, capacity increase
23	Gia Vien	750	Improvement, capacity increase
24	Lao Cai 2	500	Improvement, capacity increase
25	Bao Thang	750	Improvement, capacity increase
26	Loc Binh RE collector station (*)	500	Improvement, capacity increase
27	Lang Son RE collector station (*)	500	Improvement, capacity increase
28	Son Duong	500	Improvement, capacity increase

No.	Substation	Total capacity (MVA)	Note
29	Yen Bai	500	Improvement, capacity increase
30	Phu Luong	250	New construction
31	Phuc Xuan	500	Improvement, capacity increase
32	Viet Tri 2 (Lam Thao)	500	Improvement, capacity increase
33	Phu Tho 3	500	Improvement, capacity increase
34	Tam Duong	750	Improvement, capacity increase
35	Lap Thach	250	New construction
36	500kV Bac Ninh connecting substation	750	Improvement, capacity increase
37	Bac Ninh 5	750	Improvement, capacity increase
38	500kV Bac Ninh 2 connecting substation	250	New construction
39	Bac Ninh 9 (Khac Niem)	500	New construction
40	Hai Ha	750	Improvement, capacity increase
41	Yen Hung	750	Improvement, capacity increase
42	Mong Cai	500	Improvement, capacity increase
43	500kV Quang Ninh 2 connecting substation	250	New construction
44	Sin ho	500	Improvement, capacity increase
45	Dien Bien 2 RE collector station (*)	250	New construction
46	Dien Bien 1 RE collector station (*)	500	Improvement, capacity increase
47	Moc Chau	500	Improvement, capacity increase
48	Son La RE collector station (*)	500	Improvement, capacity increase
49	Yen Thuy	500	Improvement, capacity increase
50	Luong Son	500	Improvement, capacity increase

No.	Substation	Total capacity (MVA)	Note
51	Hoa Binh RE collector station (*)	500	Improvement, capacity increase
52	Nghi Son	750	Improvement, capacity increase
53	Ba Che	750	Improvement, capacity increase
54	Hau Loc	750	Improvement, capacity increase
55	Thieu Hoa	750	Improvement, capacity increase
56	Hoang Hoa	500	New construction
57	Nga Son	250	New construction
58	500kV Tinh Gia connecting substation	500	Improvement, capacity increase
59	Nam Cam	750	Improvement, capacity increase
60	Hoang Mai	500	Improvement, capacity increase
61	Tan Ky	250	New construction
62	Cua Lo	250	New construction
63	Loc Ha	500	Improvement, capacity increase
64	Huong Son	250	New construction
65	Ha Tinh 1 RE collector station (*)	500	Improvement, capacity increase
66	Reserve capacity of 220kV substation for load growth and power source development in the North	5000	New construction, or improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors

No.	Substation	Total capacity (MVA)	Note
Period 2041-2045			
1	Xuan Mai	750	Improvement, capacity increase
2	Dong Anh	750	Improvement, capacity increase
3	Me Linh	750	Improvement, capacity increase
4	Soc Son 2	750	Improvement, capacity increase
5	Dong Anh 2	750	Improvement, capacity increase
6	Phuc Tho	750	Improvement, capacity increase
7	Thanh Oai	500	New construction
8	Chuong My	750	Improvement, capacity increase
9	Cat Hai	750	Improvement, capacity increase
10	Do Son	500	Improvement, capacity increase
11	Thanh Ha	750	Improvement, capacity increase
12	Tu Ky	750	Improvement, capacity increase
13	Tan Viet	750	Improvement, capacity increase
14	Nam Sach	750	Improvement, capacity increase
15	Yen My	750	Improvement, capacity increase
16	Van Giang	7560	Improvement, capacity increase
17	Ly Nhan	750	Improvement, capacity increase
18	Nghia Hung	750	Improvement, capacity increase
19	500kV Thai Binh connecting substation	750	Improvement, capacity increase
20	Quynh Phu	750	Improvement, capacity increase
21	Tam Diep	750	Improvement, capacity increase
22	Quang Uyen	500	Improvement, capacity increase
23	500kV Lao Cai connecting substation	750	Improvement, capacity increase

No.	Substation	Total capacity (MVA)	Note
24	Dong Hy	250	New construction
25	Phu Tho 2	750	Improvement, capacity increase
26	Lap Thach	500	Improvement, capacity increase
27	Tan Yen	500	Improvement, capacity increase
28	Son Dong	500	Improvement, capacity increase
29	500kV Bac Ninh 2 connecting substation	500	Improvement, capacity increase
30	Bac Ninh 9 (Khac Niem)	750	Improvement, capacity increase
31	Khe Than	250	Improvement, capacity increase
32	Cong Hoa	750	Improvement, capacity increase
33	Mong Cai	750	Improvement, capacity increase
34	Nam Hoa	750	Improvement, capacity increase
35	500kV Quang Ninh 2 connecting substation	500	Improvement, capacity increase
36	Dien Bien 1 RE collector station (*)	750	Improvement, capacity increase
37	Dien Bien 2 RE collector station (*)	500	Improvement, capacity increase
38	Son La RE collector station (*)	750	Improvement, capacity increase
39	Hoa Binh RE collector station (*)	750	Improvement, capacity increase
40	Tinh Gia	750	Improvement, capacity increase
41	Nga Son	500	Improvement, capacity increase
42	Hoang Mai	750	Improvement, capacity increase
43	Dien Chau	250	New construction
44	Huong Son	500	Improvement, capacity increase
45	Reserve capacity of 220kV substation for load growth and power source development in	6625	New construction, or improvement & capacity upgrade

No.	Substation	Total capacity (MVA)	Note
	the North		
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors

Note: The capacity figures in the above table refer to the substations' installed capacity. The option of new construction, improvement to upscale the capacity or installation of addition transformers will be clarified when carrying out each specific project.

(*) The volume of RE connection lines in the above table is estimated. The accurate volume depends on the actual progress and applicable connection option of wind and solar power projects.

Table a.4. List of newly built and improved 220kV transmission lines in the North by 2045

No.	Project	Nos. of circuit x km	Note
Projects to be put into operation by 2025			
1	Van Dien – Branch Ha Dong – Thuong Tin	4x4	New construction, connection of 220kV Van Dien substation including change of connection of Van Dien substation to Van Dien – Hoa Binh, Van Dien – Xuan Mai
2	West Ha Noi – Thanh Xuan	4x16	New construction
3	500kV Dong Anh – Van Tri	2x13	New construction
4	Improvement of loadability of Hoa Binh – Chem line	1x74	Upgrade, loadability improvement to ensure the power supply for Ha Noi
5	Improvement of loadability of Ha Dong – Chem line	1x16.3	Upgrade, loadability improvement to ensure the power supply for Ha Noi
6	Dai Mo (My Dinh) – Branch West Ha Noi – Thanh Xuan	4x2	New construction, connection of 220kV Dai Mo substation
7	Me Linh – Branch Soc Son – Van Tri	4x2	New construction, connection of 220kV Me Linh substation
8	500kV West Ha Noi – Hoa Lac	2x14	New construction
9	Ung Hoa – Branch Ha Dong – Phu Ly	2x4	New construction, connection of 220kV Ung Hoa substation
10	Improvement of loadability of Ha Dong – Thuong Tin line	2x16	Upgrade, loadability improvement
11	Circuit 2 of Son Tay – Vinh Yen line	2x30	New construction, upgrade of one circuit to two circuits, and improvement of the loadability of the current Son Tay – Vinh Tuong and Viet Tri – Vinh Yen transmission lines
12	Long Bien – Mai Dong	2x16	New construction, underground cabling
13	Long Bien 2 – Branch Mai Dong – Long Bien	4x3	New construction, connection of 220kV Long Bien 2 substation

14	Improvement of loadability of Thuong Tin – Pho Noi line	2x33	Upgrade, loadability improvement of one-circuit Thuong Tin – 220kV Pho Noi 1 substation and one-circuit Thuong Tin – 500kV Pho Noi substation lines
15	Improvement of loadability of Son Tay – Hoa Binh line	1x49	Upgrade, loadability improvement
16	Improvement of loadability of Xuan Mai – Ha Dong line	1x25	Upgrade, loadability improvement
17	Improvement of loadability of Van Tri – Tay Ho – Chem line	2x20	Upgrade, loadability improvement to ensure the power supply for Ha Noi
18	Long Bien 500kV – Branch Long Bien – Long Bien 2	4x10	New construction, connection on the 220kV side of 500kV Long Bien substation
19	An Lao – Branch Dong Hoa – Thai Binh	4x2	New construction, connection of 220kV An Lao substation
20	Dinh Vu – Cat Hai	2x8	New construction, phasing lines
21	Duong Kinh – Branch Dong Hoa – Dinh Vu	4x3	New construction, connection of 220kV Duong Kinh substation, change connection of Hai Duong 2 – Dong hoa and dong Hoa – Dinh Vu to Hai Duong 2 – Dinh Vu
22	Nam Hoa – Cat Hai	2x12	New construction
23	Hai Phong 500kV – Branch An Lao – Dong Hoa	4x5	New construction, connection on the 220kV side of 500kV Hai Phong substation, in case of failing to arrange land fund in An Lao to connect and supply power for the 500kV Hai Phong substation
24	Hai Duong thermal power plant – Pho Noi 500kV	2x60	New construction
25	Gia Loc – Branch Hai Duong thermal power plant – Pho Noi	4x2	New construction, connection of 220kV Gia Loc substation
26	Bai Say – Kim Dong	2x11.5	New construction, connection of 220kV Bai Say substation

27	Gia Loc – 500kV Hai Phong	2x35	New construction
28	Thanh Ha – Branch Gia Loc – 500kV Hai Phong	2x6.5	New construction, connection of 220kV Thanh Ha substation
29	Tan Viet (Binh Giang) – Branch Gia Loc – Pho Noi	4x3	New construction, connection of 220kV Tan Viet substation
30	Improvement of loadability of 220kV Pha Lai – Bac Ninh line	1x24	Upgrade, replacement of super thermal-resistant conductors
31	Improvement of loadability of 220kV Pha Lai – Hiep Hoa line	1x25	Upgrade, replacement of super thermal-resistant conductors
32	Improvement of loadability of Pha Lai – Branch Hai Duong thermal power plant line	2x17	Upgrade, loadability improvement, capacity absorption for Hai Duong thermal power plant energized in April 2021
33	Yen My – Branch Pho Noi 500kV – Thuong Tin 500kV	2x2	New construction, connection of 220kV Yen My substation
34	Pho Cao – Branch Thai Binh – Kim Dong	4x2	New construction, connection of 220kV Pho Cao substation
35	Circuit 2 of Nho Quan – Phu Ly line	2x27	New construction, upgrade of one circuit to two circuits
36	Ly Nhan – Branch Thanh Nghi – Thai Binh	4x2	New construction, connection of 220kV Ly Nhan substation
37	Dong Van – Phu Ly	2x15	New construction, connection of 220kV Dong Van substation, consideration of changing connection to transit to Ha Dong – Phu Ly line in case of impossibility to expand the bay
38	Nam Dinh 1 500kV thermal power plant – Ninh Binh 2	2x25	New construction, large cross-section phasing conductors
39	Hai Hau – Truc Ninh	2x16	New construction
40	Nam Dinh 1 500kV thermal power plant – Hai Hau	2x10	New construction, synchronization of 500kV Nam Dinh substation, large cross-section phasing conductors
41	Nam Dinh 1 500kV thermal power plant – Hau Loc	2x35	New construction, synchronization of 500kV Nam Dinh substation, large cross-

			section phasing conductors
42	Vu Thu – Branch Thai Binh – Nam Dinh and Thai Binh – Ninh Binh	4x5	New construction, connection of 220kV Vu Thu substation
43	Improvement of loadability of Dong Hoa – Thai Binh line	2x53	Upgrade, loadability improvement
44	Thai Binh 500kV – Thanh Nghi	2x60	New construction
45	Thai Binh 500kV – Branch Thai Binh – Kim Dong	4x5	New construction, connection on the 220kV side of 500kV Thai Binh substation
46	Tam Diep – Branch Bim Son – Ninh Binh	2x5	New construction, connection of 220kV Tam Diep substation
47	Gia Vien – Branch Nho Quan 500kV – Ninh Binh	2x6.7	New construction, connection of 220kV Gia Vien substation
48	Gia Vien – Nam Dinh	2x6.7	New construction, change of connection to Gia Vien – Nam Dinh line in case of relocating the 220kV Ninh Binh substation
49	Circuit 2 of Gia Vien – Tam Diep – Bim Son line	2x25.7	Upgrade of one-circuit line to two-circuit line in case of acquiring 220kV Ninh Binh substation to replace the circuit-2 220kV Ninh Binh – Tam Diep – Bim Son line, expansion of 2 bays in the 220kV Gia Vien substation
50	Ninh Binh 2 – Branch Ninh Binh – Thai Binh	2x19	New construction, connection of 220kV Ninh Binh 2 substation
51	Bac Quang – Branch Bao Thang – Yen Bai (Bac Quang – Luc Yen)	2x43	New construction, connection of 220kV Bac Quang substation, increase of power purchase from China
52	Installation of cables for circuit 2 of Ha Giang – Viet Nam and China boundary	1x30	
53	Bac Quang – Viet Nam and China boundary (of Ha Giang province)	2x55	New construction, increase of power purchase from China
54	Improvement of loadability of Ha	1x118	Upgrade, loadability

	Giang – Bac Me hydropower plant – Thai Nguyen		improvement, increase of power purchase from China
55	Installation of cables for circuit 2 of Cao Bang – Bac Kan line	1x71	Installation of circuit-2 Cao Bang – Bac Kan line
56	Cao Bang – Lang Son	2x120	New construction
57	Bao Lam – Bac Me	2x30	New construction, capacity absorption for Ha Giang mini hydropower
58	Lao Cai – Bao Thang	2x18	New construction
59	Connection of 500kV Lao Cai	4x4	New construction, connection of 220kV Bao Thang substation, capacity absorption for mini hydropower
60	Bat Xat – 500kV Lao Cai	2x40	New construction, connection of 500kV Lao Cai, branching to Bao Thang – Yen Bai
61	Than Uyen – 500kV Lao Cai	2x70	New construction, absorption of mini hydropower capacity
62	500kV Lao Cai substation – boundary of Viet Nam and China	2x40	New construction, increase of power purchase from China
63	Bac Ha power plant – changed connection to 500kV Lao Cai	1x5	Reinstatement of the 220kV Bao Thang – Yen Bai line, synchronization of 500kV Lao Cai substation
64	Bac Giang – Lang Son	2x101.6	New construction, connection of 220kV Lang Son substation
65	Yen Son hydropower plant – Branch Tuyen Quang hydropower plant – Tuyen Quang	2x8	New construction, synchronization of Yen Son hydropower plant
66	Improvement of loadability of Yen Bai – Viet Tri line	2x67	Upgrade, loadability improvement
67	Huoi Quang – Nghia Lo	2x103	New construction, absorption of mini hydropower capacity
68	Nghia Lo – Viet Tri (500kV Viet Tri)	2x92.6	New construction, absorption of mini hydropower capacity
69	Luc Yen – Branch Lao Cai – Yen Bai	4x2	New construction, connection of 220kV Luc Yen substation

70	Improvement of loadability of Yen Bai – Tuyen Quang line	2x36	Upgrade, loadability improvement, increase of power purchase from China
71	Improvement of loadability of Luc Yen – Yen Bai line	2x58	Upgrade, loadability improvement, increase of power purchase from China
72	500kV Hiep Hoa – Phu Binh 2	2x14	New construction
73	Song Cong – Branch Tuyen Quang – Phu Binh	2x2	New construction, connection of 220kV Song Cong substation
74	Phu Binh 2 – Branch Thai Nguyen – Bac Giang	2x13	New construction, connection of 220kV Phu Binh 2 substation
75	Improvement of loadability of Thai Nguyen – Bac Giang line	1x63	Upgrade, loadability improvement
76	Improvement of loadability of Hiep Hoa – Phu Binh line	1x10	Upgrade, loadability improvement of ACSR410 circuit
77	Improvement of loadability of Thai Nguyen – Luu Xa – Phu Binh	1x30	Upgrade, loadability improvement
78	500kV Thai Nguyen – Branch Malungtang – Thai Nguyen	2x20	New construction, connection on the 220kV side of 500kV Thai Nguyen substation
79	500kV Thai Nguyen – Branch Tuyen Quang (substation) – Phu Binh	2x20	New construction, connection on the 220kV side of 500kV Thai Nguyen substation
80	500kV Thai Nguyen – Branch Luu Xa – Phu Binh	2x15	New construction, connection on the 220kV side of 500kV Thai Nguyen substation
81	Improvement of loadability of Vinh Yen – Soc Son line	1x27	Upgrade, loadability improvement, consideration of combining with the Work: Circuit-2 Vinh Yen 500kV – Vinh Yen
82	500kV Viet Tri – Viet Tri	2x10	Upgrade, loadability improvement
83	Improvement of loadability of 500kV Viet Tri – Vinh Tuong line	1x27	Upgrade, loadability improvement

84	Improvement of loadability of 500kV Viet Tri – Vinh yen line	1x36	Upgrade, loadability improvement
85	500kV Viet Tri – Ba Thien (500kV Vinh yen)	2x43	New construction
86	Phu Tho 2 – Branch Son La – Viet Tri	2x5	New construction, connection of 220kV Phu Tho 2 substation
87	Vinh Yen 500kV – Branch Vinh Yen – Soc Son	2x13	New construction, connection of 220kV Ba Thien substation
88	Tam Duong – Branch 500kV Viet Tri – Ba Thien (500kV Vinh Yen)	4x2	New construction, connection of 220kV Tam Duong substation
89	Vinh Yen 500kV – Me Linh	2x25	New construction
90	Vinh Yen 500kV – Vinh yen	1x16	New construction, upgrade of one circuit to two circuits, 4 phasing conductors, consideration of combining with the Work of loadability improvement for the Vinh Yen – Soc Son line
91	Vinh Tuong – Branch 500kV Viet Tri – Vinh yen	2x4.5	New construction, transition of circuit 2. Only transitioned one circuit of 500kV Viet Tri substation – Son Tay line at the moment
92	Improvement of loadability of Son Tay – Vinh Tuong line	1x21	Upgrade, loadability improvement
93	Circuit 2 of Pha Lai – Bac Giang line	1x27	Upgrade of one circuit to two circuits
94	Connection of An Khanh thermal power plant	4x20	New construction, synchronization of An Khanh thermal power plant, connection on the 220kV Bac Giang – Lang Son line
95	Son Dong – Branch Son Dong – Trang Bach	2x2	New construction, connection of 220kV Son Dong substation
96	Lang Giang – Branch Bac Giang – Thai Nguyen	2x2	New construction, connection of 220kV Lang Giang substation
97	Bac Giang 500kV – Branch An Khanh thermal power plant –	4x8	New construction, connection on the 220kV side of 500kV

	Lang Son		Bac Giang substation
98	Yen Dung – Branch Pha Lai thermal power plant – Bac Giang	2x10	New construction, connection of 220kV Yen Dung substation
99	Bac Ninh 4 – Dong Anh	2x18	New construction, connection of 220kV Bac Ninh 4 substation
100	Bac Ninh 5 – Branch Bac Ninh 500kV – Pho Noi	2x4	New construction, connection of 220kV Bac Ninh 5 substation
101	Bac Ninh 500kV – Branch Bac Ninh 2 – Pho Noi	4x3	New construction, connection of 220kV Bac Ninh 500kV
102	Bac Ninh 500kV – Bac Ninh 4	2x15	New construction
103	Bac Ninh 500kV – Bac Ninh	2x10	New construction
104	Khe Than – Branch Son Dong thermal power plant – Trang Bach	2x2	New construction, connection of 220kV Khe Than substation
105	Cong Hoa – Branch Cam Pha – Hai Ha	4x2	New construction, connection of 220kV Cong Hoa substation
106	Yen Hung – Branch Uong Bi thermal power plant – Trang Bach	2x20	New construction, connection of 220kV Yen Hung substation
107	Yen Hung – Nam Hoa	2x30	New construction, connection of 220kV Nam Hoa substation
108	Lai Chau 500kV – Phong Tho	2x60	New construction, absorption of hydropower capacity, reduction of load for 500kV Lai Chau substation, large cross-section phasing conductors
109	Phong Tho – Than Uyen	2x76.4	New construction, absorption of mini hydropower capacity
110	Pac Ma – Muong Te	2x36	New construction, absorption of hydropower capacity
111	500kV Son La – Dien Bien	2x126	New construction
112	Improvement of loadability of Son La – Viet Tri line	1x167	Upgrade, loadability improvement
113	Improvement of loadability of 500kV Son La – Son La line	1x40.5	Upgrade, loadability improvement, subject to the development of mini hydropower and RE projects

114	Improvement of loadability of 500kV Son La – Muong La line	1x21.5	Upgrade, loadability improvement, subject to the development of mini hydropower and RE projects
115	Improvement of loadability of Muong La – Son La line	1x31.7	Upgrade, loadability improvement, subject to the development of mini hydropower and RE projects
116	Suoi Sap 2A – Branch Son La – Viet Tri	2x5	New construction, absorption of hydropower capacity in accordance with the letter ref. 136/TTg-CN dated 29 Jan 2021
117	Yen Thuy – Branch Hoa Binh – Nho Quan	2x2	New construction, connection of 220kV Yen Thuy substation
118	Nghi Son Economic Zone – Branch Nghi Son – Nghi Son thermal power plant	4x2	New construction, connection of 220kV Nghi Son Economic Zone substation
119	Nghi Son thermal power plant – Nghi Son Steel Complex	2x2	New construction, connection of 220kV Nghi Son Steel Complex Zone substation
120	Sam Son – Thanh Hoa 500kV	2x2.5	New construction, connection of 220kV Sam Son substation
121	500kV Thanh Hoa – Branch Nong Cong – Thanh Hoa	4x7	New construction, connection on the 220kV side of 500kV Thanh Hoa substation
122	500kV Thanh Hoa – Hau Loc	2x35	New construction
123	Circuit 2 of Thanh Hoa (Ba Che) – Bim Son line	2x36	New construction, upgrade of one circuit to two circuits for the 220kV Ba Che – Bim Son line
124	Nam Sum (Laos) hydropower plant – Nong Cong	2x139	New construction, synchronization of Nam Sum Laos hydropower plant
125	Circuit 3 of Thanh Hoa – Nghi Son – Quynh Luu line	1x83	Installation of cables of the circuit 2
126	Nghi Son thermal power plant – Branch Nong Cong – Nghi Son	2x9.6	New construction, change of connection to Nong Cong – Nghi Son to replace the Nghi Son thermal power plant – Branch Nghi Son – Vinh line

127	My Ly – Ban Ve	1x72	New construction
128	Nam Mo 1 hydropower plant – Branch My Ly – Ban Ve	1x18	New construction, synchronization of Nam Mo 1 (Viet Nam) hydropower plant
129	Nam Cam – Branch Quynh Luu – Hung Dong	4x3	New construction, connection of 220kV Nam Cam substation
130	Quy Hop – Branch Quynh Luu – Hung Dong	2x57	New construction, connection of 220kV Quy Hop substation, connection to 220kV busbar of 500kV Quynh Luu substation in case the 500kV Quynh Luu substation comes to operate
131	Quynh Luu 500kV – Branch Nghi Son – Nong Cong	4x5	New construction, connection on the 220kV side of 500kV Quynh Luu
132	Quynh Luu 500kV – changed connection to Quy Hop	2x5	New construction
133	Do Luong – Nam Cam	2x32	Capacity absorption for the Laos' hydropower plants and the hydropower plants in Western Nghe An
134	Improvement of loadability of Hung Dong – Quynh Luu – Nghi Son line	2x100	Upgrade, loadability improvement of 2 circuits, capacity absorption for Laos' hydropower plant and the hydropower plants in Western Nghe An
135	Nam Mo 2 (Laos) – Tuong Duong	2x77	New construction, synchronization of Nam Mo (Laos) hydropower cluster
136	Tuong Duong – Do Luong	2x118	New construction, synchronization of Nam Mo (Laos) hydropower cluster
137	Tuong Duong – Branch Ban Ve hydropower plant – Do Luong	2x3	New construction, connection of 220kV Tuong Duong substation
138	Vung Ang – 500kV Vung Ang thermal power plant	2x13.4	New construction, connection of 220kV Vung Ang substation
139	Improvement of loadability of Ha Tinh – Hung Dong line	2x66	Upgrade, loadability improvement, prevention of

			overload in dry season
140	Backup plan: new construction and improvement of the North region 220kV line in the period 2021-2025	261	Estimated volume
Projects to be put into operation in the period 2026-2030			
1	500kV Dan Phuong – Me Linh	2x15	New construction
2	Connection of 500kV Dan Phuong	4x11	Branch Van Tri – Tay Ho and Tay Ho – Chem
3	Soc Son 2 – Branch Hiep Hoa – Dong Anh	2x3	New construction, connection of 220kV Soc Son substation
4	500kV Son Tay – Hoa Lac 2	2x15	New construction, connection on the 220kV side of 500kV Son Tay substation
5	500kV Son Tay – Hoa Lac	2x12	New construction, connection on the 220kV side of 500kV Son Tay substation
6	500kV Son Tay – Branch Son Tay – Vinh yen	4x5	New construction, connection on the 220kV side of 500kV Son Tay substation
7	Circuit 2 of Ha Dong – Ung Hoa – Phu Ly line	2x40	New construction, upgrade of one circuit to two circuits, expansion of 2 bays in the 220kV Ung Hoa substation
8	Dan Phuong 500kV – Cau Giay	2x20	New construction, overhead and underground cabling (inner city)
9	Hai Ba Trung – Thanh Cong	2x5	New construction, underground cabling
10	Hai Ba Trung – Mai Dong	2x3	New construction, underground cabling
11	Chuong My – Branch Hoa Binh – Ha Dong	2x2	New construction, connection of 220kV Chuong My substation
12	South Ha Noi 500kV – Phu Xuyen	2x15	New construction
13	Connection of 500kV South Ha Noi	2x15	New construction, connection of 500kV South Hanoi substation, branching to Ha

			Dong – Phu Ly and Ung Hoa – Phu Ly
14	Hai Phong 500kV – Duong Kinh	2x8	New construction
15	Hai Phong 2 500kV – Branch Trang Bach – Vat Cach	4x14	New construction, connection on the 220kV side of 500kV Hai Phong 2 substation
16	Hai Phong 2 500kV – Branch Yen Hung – Nam Hoa	4x7	New construction, connection on the 220kV side of 500kV Hai Phong 2 substation
17	Hai Phong 500kV – Tien Lang	2x14	New construction
18	Do Son – Duong Kinh	2x8	New construction
19	Dai Ban – Branch Hai Duong 2 – Duong Kinh	4x2	New construction, connection of 220kV Dai Ban substation
20	Hai Phong 1 (Tien Lang) LNG – Branch Hai Phong 500kV – Duong Kinh	4x10	New construction, synchronization of Hai Phong 1 LNG power plant
21	Hai Phong 1 (Tien Lang) LNG – Do Son	2x8	New construction, synchronization of Hai Phong 1 LNG power plant
22	Nhi Chieu – Branch Mao Khe – Hai Duong 2	4x2	New construction, connection of 220kV Nhi Chieu substation
23	Tu Ky – Branch Gia Loc – 500kV Hai Phong	4x4	New construction, connection of 220kV Tu Ky substation
24	Hung Yen 500kV – Dong Van	2x14	New construction, connection of 500kV Hung Yen substation
25	Van Giang – Branch Long Bien 500kV – Thuong Tin 500kV	4x2	New construction, connection of 220kV Van Giang substation
26	Hung Yen 500kV (Hung Yen city) - Branch Kim Dong – Pho Cao	4x5	New construction, connection of 500kV substation
27	Nam Dinh 2 – Branch Truc Ninh – Ninh Binh and Truc Ninh – Nam Dinh	2x2	New construction
28	Nghia Hung – Branch Nam Dinh 500kV thermal power plant – Hau Loc	4x2	New construction, connection of 220kV Nghia Hung substation
29	Thai Binh LNG – Truc Ninh	2x42	New construction, connection of 220kV Thai Binh LNG plant

30	Thai Binh LNG – Tien Lang	2x33	New construction, connection of 220kV Thai Binh LNG plant
31	Quynh Phu – Branch Thai Binh – Dong Hoa	4x2	New construction, connection of 220kV Quynh Phu substation
32	Van Ban – Branch Than Uyen – Lao Cai 500kV	4x10	New construction, connection of 220kV Van Ban substation, absorption of mini hydropower capacity
33	Dong Mo – Branch Bac Giang – Lang Son	4x3	New construction, connection of 220kV Dong Mo substation
34	Connection of expanded Tuyen Quang hydropower plant	2x5	Synchronization of expanded Tuyen Quang hydropower plant
35	Hiep Hoa 2 – Branch Hiep Hoa 500kV – Phu Binh 2	4x5	New construction, connection of 220kV Hiep Hoa substation
36	500kV Thai Nguyen – Phu Binh	1x26	New construction, double circuits, installation of conductor for one circuit first
37	Dai Tu – Branch Ha Giang – Thai Nguyen	2x2	New construction, connection of 220kV Dai Tu substation
38	Connection of 500kV Yen The	4x4	New construction, transition on two circuits of Phu Binh 2 branching to Lang Giang – Thai Nguyen line
39	Yen The 500kV – Viet Yen	2x25	New construction, connection of 220kV Viet Yen substation
40	Tan Yen – Branch Yen The – Viet Yen	4x5	New construction, connection of 220kV Tan Yen substation
41	Phu Tho 3 – Branch Nghia Lo – 500kV Viet Tri	4x5	New construction, connection of 220kV Phu Tho 3 substation
42	Phuc Yen – Branch 500kV Vinh yen – 220kV Vinh Yen	2x2	New construction, connection of 220kV Phuc Yen substation
43	Chan Hung – Branch 500kV Viet Tri – 220 kV Vinh yen	2x2	New construction, connection of 220kV Chan Hung substation
44	Dong Mo – Son Dong	2x60	New construction
45	Bac Ninh 6 – Branch Pha Lai –	4x3	New construction, connection of 220kV Bac Ninh 6

	500kV Pho Noi		substation
46	Bac Ninh 7 – Branch 500kV Dong Anh – Bac Ninh 4	4x2	New construction, connection of 220kV Bac Ninh 7 substation
47	Hai Ha – Mong Cai	2x40	New construction
48	Hai Ha industrial park – Hai Ha	2x10	New construction, ensuring of power supply for Hai Ha industrial park and capacity absorption for Hai Ha thermal power plant in case of failing to increase the capacity injected to the grid
49	Improvement of loadability of Quang Ninh – Hoanh Bo line	2x20	New construction
50	Connection of expanded Huoi Quang hydropower plant	2x5	Synchronization of expanded Huoi Quang hydropower plant
51	Improvement of loadability of Huoi Quang – Son La line	2x20	Synchronization of expanded Huoi Quang and Ban Chat hydropower plants
52	Moc Chau – Branch connected to Trung Son hydropower plant	2x35	New construction, connection of 220kV Moc Chau substation
53	Song Ma – Son La 500kV	2x83	New construction, absorption of mini hydropower capacity
54	Connection of Tan Lac	6x5	New construction, Tan Lac branching Hoa Binh – Yen Thuy and connection to Trung Son hydropower plant
55	Thieu Hoa – Branch 500kV Thanh Hoa – Hau Loc	4x5	New construction, connection of 220kV Thieu Hoa substation
56	Hoi Xuan hydropower power plant – Ba Thuoc	2x30	New construction
57	Tinh Gia – Branch Nong Cong – Nghi Son	2x8	New construction, connection of 220kV Tinh Gia substation
58	Can Loc – Branch Ha Tinh – Hung Dong	4x2	New construction, connection of 220kV Can Loc substation
59	Backup plan: new construction and improvement of the North region 220kV line in the period 2026-2030	185	Estimated volume

Projects to be put into operation in the period 2031-2035			
1	Thanh Cong – Mai Dong	1x8	New construction
2	Dong Anh 2 – Branch Van Tri – Tay Ho and Van Tri – Chem	4x2	New construction, connection of 220kV Dong Anh 2 substation
3	Dong Anh 3 – Branch Van Tri – Dong Anh 500kV	4x2	New construction, connection of 220kV Dong Anh 3 substation
4	500kV Dan Phuong – Phuc Tho	2x13	New construction
5	500kV Son Tay – Phuc Tho	2x6	New construction
6	Long Bien 500kV – Branch Pho Noi – Thuong Tin	4x4	New construction, branch Pho Noi – Van Giang and Pho Noi 500kV – Yen My
7	Hai Phong 2 (Cat Hai – Cai Trap) LNG – Branch Nam Hoa – Cat Hai	4x5	New construction, synchronization of Hai Phong 2 LNG plant
8	Nam Sach – Hai Duong thermal power plant	2x11	New construction
9	Kim Bang – Branch Phu Ly – Ha Dong	4x4	New construction, connection of 220kV Kim Bang substation
10	Giao Thuy – Branch Thai Binh – Truc Ninh	4x2	New construction, connection of 220kV Giao Thuy substation
11	Tien Hai – Branch Thai Binh – Truc Ninh	2x2	New construction, connection of 220kV Tien Hai substation
12	Quang Uyen – Branch Cao Bang – Lang Son	4x5	
13	Lang Son RE plant – Dong Mo (*)	2x48	New construction, connection of 220kV to collect power of Lang Son province
15	Son Duong – Branch Ha Giang – Dai Tu	2x20	New construction, connection of 220kV Son Duong substation
16	Yen Bai RE collector station – Branch Lao Cai 500kV – Yen Bai	4x5	Upgrade, loadability, connection of 220kV substation to collect RE power of Yen Bai province
17	Connection of 220kV Phuc Xuan	4x5	New construction, branch Thai

			Nguyen 500kV – Thai Nguyen and Thai Nguyen 500kV – Song Cong
18	Phu Tho 3 – Viet Tri 2	2x13	New construction, connection of 220kV Viet Tri 2 substation
19	Bac Giang 500kV – Chu	2x32	New construction
20	Chu – Branch Son Dong – Dong Mo	4x2	New construction, connection of 220kV Chu substation
21	Bac Ninh 8 – Long Bien	2x12	New construction, connection of 220kV Bac Ninh 2 substation
22	Sin Ho – Branch Lai Chau 500kV – Phong Tho	4x5	New construction, connection of 220kV Sin Ho substation, absorption of mini hydropower and RE capacity
23	Dien Bien 1 RE collector station – Dien Bien 500kV (*)	2x5	New construction, connection of Dien Bien RE collector station
24	Dien Bien 500kV – Dien Bien (*)	2x42	New construction, connection of the 220kV side of 500kV Dien Bien
25	Dien Bien 1 RE collector station – Lai Chau (*)	2x52	New construction, connection of Dien Bien RE collector station
26	Son La RE collector station – Son La (*)	2x35	New construction
27	Son La RE collector station – Branch Son La – Phu Tho (*)	2x4	New construction, connection of 220kV substation to collect RE capacity of Son La province
28	South Ha Noi 500kV – Luong Son	2x18	New construction
29	Hoa Binh RE collector station – Yen Thuy (*)	2x18	New construction, connection of 220kV substation to collect RE capacity of Hoa Binh province
30	Ngoc Lac – Branch Nho Quan – Thanh Hoa	2x30	New construction, connection of 220kV Ngoc Lac substation
31	Hoang Mai – 500kV Quynh Luu	2x10	New construction, connection of 220kV Hoang Mai substation

32	Tinh Gia – Sam Son	2x30	New construction, connection on the 220kV side of 500kV Tinh Gia substation
33	Tinh Gia 500kV – Branch Nghi Son – Ba Che	2x4	New construction, connection on the 220kV side of 500kV Tinh Gia substation
34	Tinh Gia 500kV – Branch Nong Cong – Nghi Son	4x4	New construction, connection on the 220kV side of 500kV Tinh Gia substation
35	Tinh Gia 500kV – changed connection to Tinh Gia 220kV	2x4	New construction, change of connection to Tinh Gia 500kV – Tinh Gia
36	Nghi Son LNG – Nghi Son Economic zone	2x5	New construction, connection on the 220kV side of Nghi Son LNG plant
37	Nghi Son LNG – Tinh Gia	2x30	New construction, connection on the 220kV side of Nghi Son LNG plant
38	Loc Ha – Branch Ha Tinh – Can Loc	4x7	New construction, connection of 220kV Loc Ha substation
39	Ha Tinh 1 RE collector station – Branch Vung Ang – Ha Tinh (*)	2x4	New construction, capacity absorption for Ha Tinh 1 RE plant in Ky Anh district
40	Backup plan: new construction and improvement of the North region 220kV line in the period 2031-2035	240	Estimated volume
Projects to be put into operation in the period 2036-2040			
1	Thanh Tri – Branch Thuong Tin – Mai Dong	2x5	New construction, connection of 220kV Thanh Tri
2	Gia Loc 500kV – Thanh Mien	2x11	New construction
3	Nam Dinh 2 – Branch Ninh Binh – Thai Binh	2x5	New construction, connection of 500kV Nam Dinh 2
4	Ninh Binh 500kV – Branch Ninh Binh – Tam Diep	4x21	New construction, connection on the 220kV side of 500kV Ninh Binh substation
5	Lao Cai 2 – Branch Lao Cai 220kV – China	2x2	New construction, connection of 220kV Lao Cai 2 substation

6	Improvement of loadability of Bac Kan – Thai Nguyen line	1x80	Upgrade, loadability improvement
7	Lap Thach – Branch Viet Tri – Tam Duong	4x5	New construction, connection of 220kV Lap Thach substation
8	Phu Luong – Branch Thai Nguyen – Bac Me hydropower plant	2x2	New construction, connection of 220kV Phu Luong substation
9	Bac Ninh 9 – Branch Bac Ninh 4 – Bac Ninh	4x2	New construction, connection of 220kV Bac Ninh 9 substation
10	Bac Ninh 2 500kV – Branch Dong Anh – Bac Ninh 2	4x6	
11	Quang Ninh 2 500kV – Uong Bi thermal power plant	2x12	New construction, in case of Uong Bi coal-fired power plant phases out
12	Connection of Quang Ninh 2 500kV	6x2	New construction, branch Hoanh Bo – Trang Bach and Hoanh Bo – Khe Than, change of connection to Son Dong thermal power plant
13	Dien Bien 2 RE collector station – Dien Bien 500kV (*)	2x18	New construction, connection of Dien Bien RE collector substation
14	Connection of expanded Ban Chat hydropower plant	2x5	Synchronization of expanded Ban Chat hydropower plant
15	Hoang Hoa – Branch Hau Loc – Nam Dinh	4x9	New construction, connection of 220kV Hoang Hoa substation
16	Tan Ky – Branch Khe Bo hydropower plant – Do Luong	2x32	New construction
17	Nam Cam – Cua Lo	2x11	New construction
18	Can Loc – Huong Son	2x43	New construction
19	Bo Trach – Branch Ba Don – Dong Hoi	4x2	New construction, connection of 220kV Bo Trach substation
20	Backup plan: new construction and improvement of the North region 220kV line in the period 2036-2040	267	Estimated volume

Projects to be put into operation in the period 2041-2045			
1	Thanh Oai – Branch Ung Hoa – Ha Dong	2x5	New construction, connection of 220kV Thanh Oai substation
2	Thanh Ha – Branch Gia Loc – 500kV Hai Phong (circuit 2)	2x6.5	New construction, synchronization and capacity upgrade of 220kV Thanh Ha substation to 750 MVA
3	Yen My – Branch Long Bien 500kV – Van Giang (circuit 2)	2x2	New construction, synchronization and capacity upgrade of 220kV Yen My substation to 750 MVA
4	Tuyen Quang 500kV – Branch Yen Son hydropower plant – Son Duong	2x5	New construction, connection of 500kV Tuyen Quang substation
5	Connection of Tuyen Quang 500kV	4x5	New construction, connection of 500kV Tuyen Quang substation
6	Dong Hy – Branch Thai Nguyen – Phu Binh 2	2x3	New construction, connection of 220kV Dong Hy substation
7	Nam Dinh 500kV thermal power plant – Nga Son	2x28	New construction
8	Dien Chau – Branch Quynh Luu – Nam Cam	4x3	New construction, connection of 220kV Dien Chau substation
9	Connection of Northern LNG power plant (**)	80	New construction, connection on the 220kV side of Northern LNG power plant in the high scenario
10	Backup plan: new construction and improvement of the North region 220kV line in the period 2041-2045	177	Estimated volume

Note: (*) The volume of RE connection lines in the above table is estimated. The accurate volume depends on the actual progress and applicable connection option of wind and solar power projects.

(**) Backup transmission projects, project addition or changes in high scenario vs. those in baseline scenario.

B. Central Region

Table b.1. List of newly built and improved 500kV transformer substations in the Central by 2045

No.	Project	Total capacity (MVA)	Note
Period to 2025			
1	Lao Bao (Huong Hoa) (*)	900	New construction, RE source synchronized
2	Quang Tri 2 switching station	Switching station	Construction of new switching station, transition of circuit 3 and 4 (Quang Trach – Doc Soi)
3	Quang Tri	900	New construction
4	Thanh My	1200	Improvement, capacity upgrade
5	Dung Quat	900	New construction
6	Binh Dinh	900	New construction, absorption of RE capacity
7	Van Phong	1800	New construction, connection to the distribution yard of Van Phong 1 thermal power plant
8	Pleiku 2	1800	Improvement, capacity upgrade
9	Pleiku 3 (*)	1800	New construction, RE sources synchronized
10	Nhon Hoa (*)	1800	New construction, RE sources synchronized. The progress of installing Unit 2 subjects to the development of regional RE projects
11	Ea Nam (*)	450	New construction, RE sources synchronized, capacity 450 MVA as approved in the letter ref. 911/TTg-CN dated 11 Jul 2020
12	Krong Buk (*)	1800	New construction, RE sources synchronized
13	Dak Nong (*)	1800	Improvement, capacity upgrade, absorption of RE capacity
14	Reserve capacity of 500kV	1200	New construction, or

No.	Project	Total capacity (MVA)	Note
	substation for load growth and power source development in the Central		improvement and capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2026-2030			
1	Lao Bao (Huong Hoa) (*)	1800	Improvement, capacity upgrade
2	Quang Tri	1800	Improvement, capacity upgrade
3	Da Nang	1800	Improvement, capacity upgrade
4	Pleiku	2700	Improvement, capacity upgrade, absorption of RE capacity of Gia Lai, Kon Tum provinces
5	Kon Tum (*)	Switching station	500kV switching station to connect the power source of Laos in case of increasing power import from Southern Laos
6	Reserve capacity of 500kV substation for load growth and power source development in the Central	600	New construction, or improvement, capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices

No.	Project	Total capacity (MVA)	Note
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2031-2035			
1	Quang Binh (Le Thuy) (*)	900	New construction, absorption of RE capacity
2	Huong Thuy	900	New construction
3	Da Nang 2	900	New construction
4	Tam Thang	900	New construction
5	Tuy Hoa	900	New construction
6	Dien Khanh	900	New construction
7	Binh Dinh	1800	Improvement, capacity upgrade, implementation progress subjected to the development of power sources
8	Kon Ray (*)	900	New construction, absorption of mini hydropower and RE capacity of Kon Tum province
9	Ea Nam (*) (**)	900	Improvement, capacity upgrade, implementation progress subjected to the development of power sources
10	Dak Lak 1 wind power plant (*) (**)	900	New construction, RE sources synchronized, need to construction 500kV Krong Buk substatioin and 500kV Krong Buk – Tay Ninh line
11	Ea Sup solar farm (*) (**)	2400	Capacity upgrade, solar PV sources synchronized
12	Mang Yang (*) (**)	900	New construction, RE sources synchronized in the baseline scenario
13	Dak Nong (*)	2700	Improvement, capacity upgrade, implementation progress subjected to the development of mini hydropower and RE

No.	Project	Total capacity (MVA)	Note
			sources
14	Reserve capacity of 500kV substation for load growth and power source development in the Central	900	New construction, or improvement, capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2036-2040			
1	Quang Binh (Le Thuy) (*)	1800	Improvement, capacity upgrade, absorption of RE capacity
2	Kon Ray (*)	1800	Improvement, capacity upgrade, implementation progress subjected to the development RE sources
3	Kon Tum (*) (**)	900	Installation of devices in the switching station, implementation progress subjected to the development of mini hydropower and RE sources
4	Dak Lak 1 wind power plant (*) (**)	1800	Improvement, capacity upgrade, synchronized development of RE sources
5	Dak Nong wind power plant (*) (**)	900	New construction
6	Mang Yang (*) (**)	1800	Improvement, capacity upgrade, implementation progress subjected to the development of RE sources

No.	Project	Total capacity (MVA)	Note
7	Dak Lak 2 wind power plant (*) (**)	900	New construction, RE sources synchronized
8	Dien Khanh	1800	Improvement, capacity upgrade
9	Reserve capacity of 500kV substation for load growth and power source development in the Central	1500	New construction, or improvement, capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2041-2045			
1	Doc Soi	1800	Improvement, capacity upgrade
2	Huong Thuy	1800	Improvement, capacity upgrade
3	Da Nang 2	1800	Improvement, capacity upgrade
4	Tam Thang	1800	Improvement, capacity upgrade
5	Binh Dinh	2700	Improvement, capacity upgrade
6	Tuy Hoa	1800	Improvement, capacity upgrade
7	Krong Buk	2700	Improvement, capacity upgrade, implementation progress subjected to the development of RE sources
8	Dak Nong wind power plant (*) (**)	1800	Improvement, capacity upgrade, implementation progress subjected to the development of RE sources
9	Dak Lak 2 wind power plant (*) (**)	1800	Improvement, capacity upgrade, RE sources synchronized

No.	Project	Total capacity (MVA)	Note
10	Reserve capacity of 500kV substation for load growth and power source development in the Central	2400	New construction, or improvement, capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors

Note: (*) The volume of RE connection lines in the above table is estimated. The accurate volume depends on the actual progress and applicable connection option of wind and solar power projects.

(**) Backup transmission projects, project addition or changes in high scenario vs. those in baseline scenario.

Table b.2. List of newly built and improved 500kV transmission lines in the Central by 2045

No.	Project	Nos. of circuit x km	Note
Projects to be put into operation by 2025			
1	Doc Soi – Pleiku 2	2x209	New construction
2	Quang Tri – Branch Vung Ang – Da Nang	4x5	New construction, connection of 500kV Quang Tri substation
3	Quang Tri 2 switching station – Branch Quang Trach – Doc Soi	4x5	New construction, connection of Quang Tri 2 switching station
4	Lao Bao (Huong Hoa) – 500kV Quang Tri 2 switching station	2x31	New construction
5	Monsoon – Thanh My (*)	2x22	New construction, synchronization of Monsoon (Laos) wind power plant
6	Thanh My – Branch Quang Trach – Doc Soi	4x35	New construction, connection of 500kV Thanh My substation

7	Dung Quat gas turbine power plant – Doc Soi	2x8	New construction, synchronization of Dung Quat 2, 3 gas turbine
8	Central gas turbine power plant – Doc Soi	2x18	New construction, synchronization of Central gas turbine
9	Dung Quat gas turbine power plant – Krong Buk	2x394	New construction, synchronization of Dung Quat 2, 3 gas turbine to replace the 500kV Central gas turbine power plant – Krong Buk line
10	Binh Dinh – Branch Dung Quat gas turbine power plant – Krong Buk	4x5	New construction, connection of 500kV Binh Dinh substation to replace for the 500kV Binh Dinh – branch Central gas turbine power plant – Krong Buk line
11	Van Phong – Binh Dinh	2x224	New construction
12	Van Phong – Thuan Nam	2x157	New construction, synchronization of Van Phong thermal power plant
13	KN Yaly Gia Lai solar farm – Yaly hydropower plant (*)	1x8	New construction, connection of KN Yaly Gia Lai solar farm, approved to add to the PDP in the letter ref. 1870/TTg-CN dated 31 Dec 2020
14	Pleiku 3 – Pleiku 2 (*)	2x10	New construction, connection of 500kV Pleiku 3 substation to collect wind power, approved in the letter ref. 911/TTg-CN dated 11 Jul 2020
15	Nhon Hoa – Branch Pleiku – Dak Nong (*)	2x4	New construction, connection of 500kV Nhon Hoa substation to collect power from RE power plants including Nho Hoa 1 (50MW), Nhon Hoa 2 (50MW), Nhon Hoa 3 (50MW), Nhon Hoa 4 (50MW), etc., wind farms, approved in the letter ref. 323/TTg-CN dated 17 Mar 2021
16	KN Srepok 3 solar farm – Branch	2x2	New construction, connection

	Pleiku 2 – Cau Bong (*)		KN Srepok 3 solar farm (phase 2), approved to be added to the PDP in the letter ref. 1870/TTg-CN dated 31 Dec 2020
17	Ea Nam – Branch Pleiku – Di Linh (*)	2x2	New construction, synchronization of Ea Nam Wind farm, approved in the letter ref. 911/TTg-CN dated 11 Jul 2020
18	Krong Buk – Tay Ninh 1	2x352	New construction
19	Krong Buk – Branch Pleiku 2 – Chon Thanh	4x2	New construction, synchronization of 5-00kV Krong Buk substation
20	Backup plan: new construction and upgradation of the Central region 500kV transmission line in the period to 2025	188	Estimated volume
Projects to be put into operation in the period 2026-2030			
1	Hatsan (Laos) – Kon Tum	2x100	New construction, in case of increasing power purchase from Laos
2	Kon Tum – Branch Thanh My – Pleiku 2	4x5	New construction, connection of 500kV Kon Tum switching station
3	Upgrade of Thanh My – Pleiku 2 to two-circuit line	2x199	New construction, upgrade of circuit 1, change of connection to 500kV Pleiku substation
4	Circuit 2 of Da Nang – Doc Soi line	2x100	New construction of circuit 2, upgrade of circuit 1, change of connection of circuit 2 to Central gas turbine power plant in case of impossibility to expand Doc Soi bay
5	Backup plan: new construction and upgradation of the Central region 500kV transmission line in the period 2026-2030	49	Estimated volume
Projects to be put into operation in the period 2031-2035			
1	Quang Tri thermal power plant – Quang Tri	2x17	New construction, synchronization of Quang Tri thermal power plant

2	Quang Binh – Branch Vung Ang – Quang Tri	4x5	New construction, connection of 500kV Quang Binh substation, branch circuit 2 of 500kV line
3	Huong Thuy 500kV – Branch Quang Tri – Da Nang (circuit 1, 2)	4x5	New construction, connection of 500kV Huong Thuy substation
4	Da Nang 2 – Branch Quang Tri 2 switching station – Thanh My (circuit 500kV 3, 4)	4x5	New construction, connection of 500kV Da Nang 2 substation
5	Tam Thanh – Branch Da Nang – Doi Soi	4x5	New construction, connection of 500kV Tam Thang substation
6	Mang Yang – Branch Dung Quat gas turbine power plant – Krong Buk (*)	4x5	New construction, synchronization of 500kV Mang Yang substation
7	Tuy Hoa – Branch Van Phong – Binh Dinh	4x5	New construction, connection of 500kV Tuy Hoa substation
8	Dien Khanh – Branch Van Phong – Thuan Nam	4x5	New construction, connection of 500kV Dien Khanh substation
9	Kon Ray – Branch Doc Soi - Pleiku 2 (*)	4x5	New construction
10	RE collector station – Branch Pleiku 2 – Cau Bong (circuit 2) (**)	2x2	New construction, in harmonization with the development of RE sources in Dak Lak province
11	RE collector station – Branch Pleiku 2 – Chon Thanh (*) (**)	2x4	New construction, subject to the development of RE sources in Gia Lai province
12	Dak Lak 1 RE collector station – Krong Buk (*) (**)	2x20	New construction, synchronization of 500kV substation to collect RE capacity of Dak Lak province
13	Backup plan: new construction and upgradation of the Central region 500kV transmission line in the period 2031-2035	120	Estimated volume
Projects to be put into operation in the period 2036-2040			

1	Dak Lak 1 RE collector station – Chon Thanh (*) (**)	2x250	New construction, in harmonization with the development of RE sources in the Highland
2	Dak Lak 2 RE collector station – Branch Dak Lak 1 RE collector station – Chon Thanh (*) (**)	4x5	New construction, in harmonization with the development of RE sources in the Highland
3	Dak Nong RE collector station – Branch Krong Buk – Tay Ninh (**)	4x7	New construction, synchronization of 500kV Dak Nong wind power plant substation
4	Backup plan: new construction and upgradation of the Central region 500kV transmission line in the period 2036-2040	35	Estimated volume
Projects to be put into operation in the period 2041-2045			
1	Hai Lang LNG – Quang Tri thermal power plant (**)	2x6	New construction, synchronization of Hai Lang LNG power plant in the high scenario
2	Backup plan: new construction and upgradation of the Central region 500kV transmission line in the period 2041-2045	100	Estimated volume

Note: (*) The volume of RE connection lines in the above table is estimated. The accurate volume depends on the actual progress and applicable connection option of wind and solar power projects.

(**) Backup transmission projects, project addition or changes in high scenario vs. those in baseline scenario.

Table b.3. List of newly built and improved 220kV transmission transformer substations in the Central by 2045

No.	Project	Total capacity (MVA)	Note
Period to 2025			
1	Dong Hoi	375	Improvement, capacity upgrade
2	Da Bon	375	Improvement, capacity upgrade
3	Dong Ha	375	Improvement, capacity upgrade
4	Lao Bao	500	New construction

No.	Project	Total capacity (MVA)	Note
5	Dong Nam	250	New construction
6	Huong Linh (*)	500	New construction
7	Huong Tan (*)	500	New construction
8	Hue	500	Improvement, capacity upgrade
9	Phong Dien	375	Improvement, capacity upgrade
10	Chan May	250	New construction
11	Ngu Hanh Son	500	Improvement, capacity upgrade
12	Hai Chau	250	New construction
13	Duy Xuyen	125	New construction
14	220kV Dak Ooc switching station	Switching station	Switching station, connection to Laos' hydropower plant
15	Tam Hiep	250	New construction
16	Doc Soi	375	Improvement, capacity upgrade
17	Son Ha	500	Improvement, capacity upgrade
18	Dung Quat 2	500	New construction
19	Phuoc An	375	Improvement, capacity upgrade
20	Phu My	250	Improvement, capacity upgrade
21	Nhon Hoi	250	New construction
22	Tuy Hoa	375	Improvement, capacity upgrade
23	Song Cau	250	New construction
24	Cam Ranh	250	New construction
25	Van Ninh	250	New construction
26	Bo Y	250	New construction
27	220kV Bo Y switching station	Switching station	Switching station, connection to Laos' hydropower plant
28	Chu Se	250	New construction

No.	Project	Total capacity (MVA)	Note
29	An Khe	250	New construction
30	500kV Pleiku 2 connecting substation	250	New construction
31	Krong Pa (*)	250	New construction
32	Krong Ana	250	New construction
33	500kV Krong Buk connecting substation (Cu M'Gar)	250	New construction
34	Aluminum smelting plant	750	New construction
35	Reserve capacity of 220kV substation for load growth and power source development in the Central	750	New construction, or improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2026-2030			
1	Huong Thuy (Phu Loc)	250	New construction
2	Lien Chieu	250	New construction
3	Da Nang Airport	250	New construction
4	Hai Chau	500	Improvement, capacity upgrade
5	Tien Sa (An Don)	250	New construction
6	Tam Ky	500	Improvement, capacity upgrade
7	Dien Ban	250	New construction
8	South Hoi An	250	New construction

No.	Project	Total capacity (MVA)	Note
9	Quang Ngai 2	250	New construction
10	Nhon Hoi	500	Improvement, capacity upgrade
11	Phuoc an	500	Improvement, capacity upgrade
12	Phu My	375	Improvement, capacity upgrade
13	South Phu Yen	250	New construction
14	Tuy Hoa	500	Improvement, capacity upgrade
15	Song Cau	500	Improvement, capacity upgrade
16	Van Ninh	500	Improvement, capacity upgrade
17	Cam Thinh	250	New construction
18	Krong Pa (*)	500	Improvement, capacity upgrade
19	Ea Kar	250	New construction
20	Aluminum smelting plant	1000	Improvement, capacity upgrade
21	Cam Ranh	500	Improvement, capacity upgrade
22	Krong Pa (*)	500	Improvement, capacity upgrade
23	Krong Ana	375	Improvement, capacity upgrade
24	500kV Krong Buk connecting substation (Cu M'Gar)	500	Improvement, capacity upgrade
25	Reserve capacity of 220kV substation for load growth and power source development in the Central	750	New construction, improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors,

No.	Project	Total capacity (MVA)	Note
			resistors
Period 2031-2035			
1	Le Thuy	250	New construction
2	Dong Hoi	500	Improvement, capacity upgrade
3	Ba Don	500	Improvement, capacity upgrade
4	Quang Binh 1 RE collector station (*)	250	New construction, RE sources synchronized
5	Dong Ha	500	Improvement, capacity upgrade
6	Dong Nam	500	Improvement, capacity upgrade
7	Huong Linh (*)	750	Improvement, capacity upgrade
8	Quang Tri 1 RE collector station	250	New construction, RE sources synchronized
9	Quang Tri 2 RE collector station	250	New construction, RE sources synchronized
10	Quang Tri RE collector station	250	New construction, RE sources synchronized
11	Phu Vang	250	New construction
12	Phong dien	500	Improvement, capacity upgrade
13	Chan May	500	Improvement, capacity upgrade
14	Huong Thuy (Phu Loc)	500	Improvement, capacity upgrade
15	Hoa Lien	250	New construction
16	Da Nang Airport	500	Improvement, capacity upgrade
17	Tam Hiep	500	Improvement, capacity upgrade
18	South Hoi An	500	Improvement, capacity upgrade
19	Duy Xuyen	375	Improvement, capacity upgrade
20	Quang Ngai	375	Improvement, capacity upgrade
21	Quang Ngai RE collector station (*)	250	New construction, RE sources synchronized

No.	Project	Total capacity (MVA)	Note
22	Phu My	500	Improvement, capacity upgrade
23	Phu Cat	250	New construction
24	South Phu Yen	500	Improvement, capacity upgrade
25	Dien Khanh	250	New construction
26	Nha Trang 2	250	New construction
27	Bo Y	500	Improvement, capacity upgrade
28	Kon Tum 2 RE collector station (*)	250	New construction, RE sources synchronized
29	Kon Tum RE collector station (*)	250	New construction, RE sources synchronized
30	Kon Tum 1 RE collector station (*)	250	New construction, RE sources synchronized
31	Duc Co	250	New construction
32	Pleiku	500	Improvement, capacity upgrade
33	PTTN Ea H'leo 3	250	New construction
34	Chu Se	375	Improvement, capacity upgrade
35	Krong Ana	500	Improvement, capacity upgrade
36	Ea Kar	500	Improvement, capacity upgrade
37	Dak Song	250	New construction
38	Dak Nong 2	125	New construction
39	Dak Nong RE collector station (*)	250	New construction, RE sources synchronized
40	Reserve capacity of 220kV substation for load growth and power source development in the Central	875	New construction, improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>

No.	Project	Total capacity (MVA)	Note
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2036-2040			
1	Le Thuy	500	Improvement, capacity upgrade
2	Bo Trach	250	New construction
3	Quang Binh 1 RE collector station (*)	500	Improvement, capacity upgrade subjected to the development of RE sources
4	Quang Binh 2 RE collector station (*)	250	New construction, RE source synchronized
5	Quang Tri 1 RE collector station (*)	500	Improvement, capacity upgrade subjected to the development of RE sources
6	Quang Tri 2 RE collector station (*)	500	Improvement, capacity upgrade subjected to the development of RE sources
7	Quang Tri 3 RE collector station (*) (**)	250	New construction, RE sources synchronized
8	Vinh Linh	125	New construction
9	Phu Vang	500	Improvement, capacity upgrade
10	Lien Chieu	500	Improvement, capacity upgrade
11	Tien Sa (An Don)	500	Improvement, capacity upgrade
12	Dien Ban	500	Improvement, capacity upgrade
13	Tam Thang connecting substation	250	New construction
14	Doc Soi	500	Improvement, capacity upgrade
15	Quang Ngai	500	Improvement, capacity upgrade
16	Quang Ngai RE collector station (*)	500	Improvement, capacity upgrade subjected to the development of

No.	Project	Total capacity (MVA)	Note
			RE sources
17	Phu Cat	500	Improvement, capacity upgrade
18	Phu Yen RE collector station (*)	250	New construction, RE sources synchronized
19	Dien Khanh	500	Improvement, capacity upgrade
20	Van Phong 2	250	New construction
21	Kon Tum RE collector station (*)	500	Improvement, capacity upgrade subjected to the development of RE sources
22	Kon Tum 1 RE collector station (*)	500	Improvement, capacity upgrade subjected to the development of RE sources
23	Kon Tum 3 RE collector station (*) (**)	250	New construction, RE source synchronized
24	An Khe	500	Improvement, capacity upgrade
25	500kV Pleiku 2 connecting substation	500	Improvement, capacity upgrade
26	Krong Pa (*)	750	Improvement, capacity upgrade
27	Ea Hleo	250	New construction
28	Ea Kar	750	Improvement, capacity upgrade
29	500kV Krong Buk connecting substation	750	Improvement, capacity upgrade
30	Dak Nong RE collector station (*)	500	Improvement, capacity upgrade
	Reserve capacity of 220kV substation for load growth and power source development in the Central	1375	New construction, improvement & capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents		To improve substation layout diagram towards more

No.	Project	Total capacity (MVA)	Note
	in the power system		flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors
Period 2041-2045			
1	Ang Son	250	New construction
2	Bo Trach	500	Improvement, capacity upgrade
3	Quang Binh 2 RE collector station (*)	500	Improvement, capacity upgrade subjected to the development of RE sources
4	Vinh Linh	250	
5	Chan May	750	Improvement, capacity upgrade
6	Ngu Hanh Son	750	Improvement, capacity upgrade
7	Hai Chau	750	Improvement, capacity upgrade
8	Lien Chieu	750	Improvement, capacity upgrade
9	Hoa Lien	500	Improvement, capacity upgrade
10	Duy Xuyen	500	Improvement, capacity upgrade
11	Quang Ngai 2	500	Improvement, capacity upgrade
12	Tam Quan	500	New construction
13	Nha Trang	750	Improvement, capacity upgrade
14	Van Phong 2	500	Improvement, capacity upgrade
15	Nha Trang 2	500	Improvement, capacity upgrade
16	Kon Tum 2 RE collector station (*)	500	Improvement, capacity upgrade subjected to the development of RE sources
17	Chu Se	500	Improvement, capacity upgrade
18	Duc Co	500	Improvement, capacity upgrade
19	Mang Yang	250	New construction
20	Reserve capacity of 220kV	1875	New construction, improvement

No.	Project	Total capacity (MVA)	Note
	substation for load growth and power source development in the Central		& capacity upgrade
Equipment/ facilities to improve the operation quality of the power system			
1	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
2	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
3	Voltage control devices		To install FACTS, capacitors, resistors

Note: The capacity figures in the above table refer to the substations' installed capacity. The option of new construction, improvement to upscale the capacity or installation of addition transformers (transformer unit 2 or unit 3, etc.) will be clarified when carrying out each specific project.

(*) The capacity of wind/PV collector substations is estimated. The accurate volume and progress depend on actual connection progress and options applicable to RE projects.

(**) Backup transmission projects, project addition or changes in high scenario vs. those in baseline scenario.

Table b.4. List of newly constructed and upgraded 220 kV transmission lines in the Central region by 2045

No.	Project	No. of circuit x km	Note
Projects to come into operation by 2025			
1	Ba Don – Branch Vung Ang – Dong Hoi	2x3	New construction, to be transited via the other circuit in case of high penetration of RE in Ba Don 220 kV substation
2	B&T1 wind power - Branch Dong Hoi – Dong Ha (*)	4x10	New construction, synchronization of B&T1 wind power, connection work changes from the connection plan approved at Document 911/TTg-CN dated 15 July 2020
3	B&T2 wind power - B&T1 wind power (*)	2x18	New construction, synchronization of B&T2 wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020
4	Improvement of Dong Hoi – Dong Ha loadability	2x108	Upgradation, improvement of loadability in case of major development of Quang Tri wind power

No.	Project	No. of circuit x km	Note
5	Dong Ha – Lao Bao	2x52	New construction, absorption of wind power in the west of Quang Tri province
6	Connection of Quang Tri 500 kV	6x2	New construction, to be transited via Dong Ha – Hue and Dong Ha – Phong Dien
7	Quang Tri 500 kV – Dong Nam	2x26.6	New construction, connection of Dong Nam 220 kV substation
8	Circuit 3 Dong Ha – Hue	1x78	Circuit 3 connected to the existing 220 kV Dong Ha – Hue circuit 2 transmission line
9	TNC Quang Tri 1 wind power – Huong Tan (*)	1x11	New construction, synchronization of TNC Quang Tri 1 & 2; connection plan was approved at Document 911/TTg-CN dated 15 July 2020.
10	Huong Linh – Lao Bao (*)	1x12	New construction, wind power capacity absorption, proposed phase separation line with a large cross-sectional area as approved at Document 911/TTg-CN dated 15 July 2020
11	LIG Huong Hoa 1 wind power – Huong Tan	1x13	New construction, synchronization of LIG Huong Hoa 1 wind power as approved at Document 911/TTg-CN dated 15 July 2020
12	LIG Huong Hoa 2 wind power – LIG Huong Hoa 1	1x8	New construction, synchronization of LIG Huong Hoa 2 wind power as approved at Document 911/TTg-CN dated 15 July 2020
13	Tai Tam wind power – Lao Bao (*)	1x12.4	New construction, wind power absorption, proposed phase separation line with a large cross-sectional area as approved at Document 911/TTg-CN dated 15 July 2020
14	Huong Tan – Lao Bao (*)	1x12	New construction, wind power absorption, proposed phase separation line with a large cross-sectional area as approved at Document 911/TTg-CN dated 15 July 2020
15	Amacao wind power – Lao Bao (*)	1x8	New construction, wind power absorption, proposed phase separation line with a large cross-sectional area as approved at Document 911/TTg-CN dated 15 July 2020
16	500 kV Lao Bao– Branch Lao Bao – Dong Ha	4x5	New construction, connection of the 220 kV side of the Lao Bao 500 kV substation (Huong Hoa)

No.	Project	No. of circuit x km	Note
17	500 kV Lao Bao– Branch Tai Tam wind power – Lao Bao	2x5	New construction, connection of the 220 kV side of the Lao Bao 500 kV substation (Huong Hoa)
18	Phong Dien – Branch Dong Ha – Hue (circuit 2)	2x5	New construction, one more circuit transited, improvement of RE absorption capacity from Phong Dien 220 kV substation; only 1 circuit transited at the moment
19	Chan May – Branch Hoa Khanh - Hue	4x4.2	New construction, connection of Chan May 220 kV substation
20	Hai Chau – Hoa Khanh	2x10	New construction
21	Lien Chieu – Branch Hoa Khanh - Hue	4x3	New construction, connection of Lien Chieu 220 kV substation
22	Hai Chau – Ngu Hanh Son	2x15	New construction
23	Duy Xuyen – Branch Da Nang – Tam Ky	4x2	New construction, connection of Duy Xuyen 220 kV substation
24	Thanh My – Duy Xuyen 500 kV	2x68.5	New construction
25	Tam Hiep – Branch Tam Ky – Doc Soi	4x2	New construction, connection of Tam Hiep 220 kV substation
26	Dak Mi 2 – Branch Dak My 3 – Dak My 4A	2x5	New construction, connection of Tam Hiep 220 kV substation
27	Nam Emoun hydropower – Dak Ooc switching substation	1x51	New construction, synchronization of Nam Emoun hydropower (Lao)
28	Dak Ooc 220 kV switching substation- Branch Xekaman 3 – Thanh My	4x2	New construction, connection of Dak Ooc 220 kV switching substation, synchronization of Nam Emoun hydropower (Lao)
29	Improvement of Dak Ooc – Thanh My loadability	2x31	Loadability improvement, N-1 security for Lao’s power source
30	Xekaman 4 – Xekaman 3 (Lao)	2x13	New construction, synchronization of Xekaman 4 (Lao)
31	Improvement of TBK Dung Quat – Dung Quat loadability	2x8	Loadability improvement, synchronization of TBK Dung Quat
32	Kon Tum Upstream Hydropower – Quang Ngai	2x76.4	New construction, synchronization of Kon Tum Upstream Hydropower
33	Circuit 2 Quang Ngai – Quy Nhon (Phuoc An)	2x142.4	Circuit 2 connection, replacement of circuit 1’s phase separation line, RE absorption capacity improvement
34	Dung Quat – Dung Quat 2	2x5	Electrification of Dung Quat 2 220 kV substation
35	Doc Soi 500 kV – Dung Quat 2	2x10	Electrification of Dung Quat 2 electrified, to be replaced by TBK Dung Quat – Dung Quat 2 220 kV line in case of problematic routing direction
36	TBK Dung Quat – Branch	4x2	New construction, synchronization

No.	Project	No. of circuit x km	Note
	Doc Soi – Dung Quat		of TBK Dung Quat 1
37	Improvement of TBK Dung Quat – Doc Soi loadability	2x8	Loadability improvement, synchronization of TBK Dung Quat
38	Circuit 2 Doc Soi – Quang Ngai	2x59.3	Circuit 2 construction, upgradation of the existing circuit on super thermal-resistant wire, RE absorption capacity improvement
39	Hydropower cluster of Nuoc Long – Branch Kon Tum Upstream – Quang Ngai	2x4	New construction, hydropower capacity absorption in accordance with Document 136/TTg-CN dated 29 January 2021
40	Pleiku 2 – Phuoc An	1x150.6	New construction of Circuit 2 or super thermal-resistant wire replacement
41	Phuoc An – Nhon Hoi	2x25	New construction
42	Binh Dinh 500 kV – Branch Phuoc An – Phu My	4x5	New construction, connection of the 220 kV side of Binh Dinh 500 kV substation
43	Binh Dinh 500 kV – Branch An Khe - Phuoc An and Pleiku 2 – Quy Nhon	4x35	New construction, connection of the 220 kV side of Binh Dinh 500 kV substation
44	Phu My – Branch Phuoc An – Quang Ngai (circuit 2)	2x2	New construction, one more circuit transited, improvement of RE absorption capacity from Phong Dien 220 kV substation; only 1 circuit transited at the moment
45	Bo Y – Kon Tum	2x28.2	New construction
46	Dak Mi 1 hydropower – Dak My 2 hydropower	1x15	New construction, synchronization of Dak Mi 1 hydropower
47	Nam Kong 3 – Bo Y 220 kV switching substation	1x76	New construction, synchronization of Nam Kong 1, 2 and 3 hydropower (Lao)
48	Bo Y 220 kV switching substation – Branch Xekaman 1 – Pleiku 2	4x2	New construction, connection of Bo Y switching substation, synchronization of Nam Kong 1, 2 and 3 hydropower (Lao)
49	Kon Plong wind power – Branch Kon Tum Upstream Hydropower – Quang Ngai (*)	2x19	New construction, synchronization of Kon Plong wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020
50	Hydropower cluster of Dak Lo – Branch Kon Tum Upstream – Quang Ngai (*)	2x2	New construction, hydropower capacity absorption in accordance with Document 136/TTg-CN dated 29 January 2021
51	Improvement of Kon Tum – Pleiku (*) loadability	2x36	Loadability improvement
52	Improvement of Pleiku – An Khe biomass power – An	2x98	Loadability improvement

No.	Project	No. of circuit x km	Note
	hydropower loadability		
53	Chu Se – Branch Pleiku 2 – Krong Buk	4x2	New construction, connection of Chu Se 220 kV substation, transited via both circuits
54	Circuit 2 Pleiku – Krong Buk	1x141	New construction, upgradation of one circuit to make two circuits
55	Krong Pa – Chu Se	2x60	New construction, connection of Krong Pa 220 kV substation
56	Nhon Hoa 1 wind power – Branch Krong Buk – Pleiku 2	4x4	New construction, connection of Nhon Hoa 1 & 2 wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020. One Nhon Hoa 500 kV substation comes into operation, Nhon Hoa 1 & 2 wind power shall be connected to Nhon Hoa 500 kV substation, bringing this line to its original condition.
57	Ia Pet Dak Doa wind power – Pleiku 3 (*)	2x23	New construction, synchronization of Ia Pet - Dak Doa wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020
58	Ia Le 1 wind power – Branch Krong Buk – Pleiku 2 (*)	2x6	New construction, synchronization of Ia Le 1 wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020
59	Ia Boong – Chu Prong wind power – Pleiku 2 (*)	1x21	New construction, synchronization of Ia Boong wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020
60	Hung Hai Gia Lai wind power – Branch Pleiku 2 – An Khe hydropower	2x14	New construction, synchronization of Hung Hai Gia Lai wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020
61	Yang Trung wind power – Branch Pleiku 2 – An Khe hydropower (*)	2x25	New construction, synchronization of Yang Trung wind power, Yang Trung 220 kV wind power – Branch Pleiku 2 – An Khe replacement approved at Document 911/TTg-CN dated 15 July 2020. In case Yang Trung wind power comes into operation before Hung Hai Gia Lai wind power, investments in Yang Trung wind power – Branch Pleiku 2 – An Khe should be synchronized. Hung Hai Gia Lai wind power shall be transited via both circuits of the 220 kV line of Yang Trung wind

No.	Project	No. of circuit x km	Note
			power – Branch Pleiku 2 – An Khe.
62	An Khe – Branch Pleiku 2 – Phuoc An	2x3	New construction, connection of An Khe 220 kV substation
63	Krong Ana – Branch Krong Buk – Kuop village	2x22	New construction, connection of Krong Ana 220 kV substation
64	Krong Buk 500 kV – Krong Buk	4x25.7	New construction, connection of Krong Buk 220 kV substation
65	Circuit 2 Krong Buk – Nha Trang	1x150.6	New construction, upgradation of one circuit to make two circuits
66	Krong Buk wind power – Branch Krong Buk – Pleiku 2 (*)	2x2	New construction, synchronization of Krong Buk 1 & 2 wind power and Cu Ne 1 & 2 wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020.
67	Improvement of Srepok 3 hydropower – Kuop village loadability	1x28	New construction, RE capacity absorption improvement
68	KN Srepok 3 PV power – Srepok 3 hydropower	1x1	New construction, connection of KN Srepok 3 PV power, the addition of this project to PDP was approved at Document 1870/TTg-CN dated 31 December 2020.
69	Ba Ha River hydropower – Krong Buk 500 kV	2x113	New construction, RE capacity absorption improvement
70	Improvement of Kuop village – Tua Shra village – Dak Nong 500 kV loadability	1x112	Upgradation, RE capacity absorption improvement
71	Improvement of Kuop village – Dak Nong 500 kV loadability	2x83	New construction, upgradation of one circuit to make two circuits or replacement of super thermal-resistant wire
72	Dak Hoa wind power – Branch Kuop village – Dak Nong 500 kV (*)	2x2	New construction, connection of Dak Hoa wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020.
73	Dak ND-rung 1, 2, 3 wind power – Dak Nong 500 kV (*)	2x18	New construction, synchronization of Dak ND-rung 1, 2, 3 wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020.
74	Cu Knia PV power – Cu Knia switching substation	1x7	New construction, connection of Cu Knia PV ; connection plan was approved at Document 1632/TTg-CN dated 20 November 2020.
75	Aluminum electrolysis plant – Branch Binh Long – Dak Nong 500 kV	4x3.2	Aluminum electrolysis plant electrified, completed.

No.	Project	No. of circuit x km	Note
76	Aluminum electrolysis plant – Branch Kuop village – Dak Nong 500 kV	2x5.7	Aluminum electrolysis plant electrified, completed.
77	Aluminum electrolysis plant – Dak Nong 500 kV	2x2	Aluminum electrolysis plant electrified, completed.
78	Cu Knia switching substation - Branch Kuop village – Aluminum electrolysis plant	2x2	New construction, connection of Cu Knia PV power; connection plan was approved at Document 1632/TTg-CN dated 20 November 2020.
79	Xuyen Ha PV power – Branch Kuop village – Tua Srah village (*)	2x2	New construction, connection of Xuyen Ha PV power; connection plan was approved at Document 1632/TTg-CN dated 20 November 2020.
80	KN Tua Srah PV power – Tua Srah hydropower (*)	1x1	New construction, connection of KN Tua Srah PV power; connection plan was approved at Document 1870/TTg-CN dated 31 December 2020.
81	Improvement of Tuy Hoa – Van Phong – Nha Trang loadability	2x118	Upgradation, RE capacity absorption improvement
82	Tuy Hoa – Phuoc An	2x95	New construction, RE capacity absorption improvement
83	HBRE An Tho – Tuy Hoa	1x16	Upgradation, RE capacity absorption improvement, synchronization of HBRE An Tho PV power
84	Improvement of Tuy Hoa – Quy Nhon loadability	1x93	Upgradation, loadability improvement, RE capacity absorption improvement
85	Connection of Song Cau 220 kV substation	4x5	New construction, connection of Song Cau 220 kV substation. Phase 1: transited via the existing Tuy Hoa – Quy Nhon 220 kV line. Phase 2: transited via 2 circuits of the Tuy Hoa – Phuoc 220 kV line one this line comes into operation.
86	Nha Trang – Thap Cham	2x88.6	New construction
87	Cam Ranh – Branch Nha Trang – Thap Cham	4x2	New construction, connection of Cam Ranh 220 kV substation.
88	Van Ninh – Branch Van Phong – Tuy Hoa	4x2	New construction, connection of Van Ninh 220 kV substation.
89	Van Phong 500 kV – Branch Tuy Hoa – Van Phong 220 kV (circuit 1)	2x25	New construction, connection on the 220 kV side of Van Phong 500 kV substation.
90	Van Phong 500 kV – Branch Tuy Hoa – Van Phong 220 kV (circuit 2)	2x25	New construction, connection on the 220 kV side of Van Phong 500 kV substation.
91	Van Phong 500 kV – Van	2x20	New construction

No.	Project	No. of circuit x km	Note
	Phong 220 kV		
92	Backup plan: new construction and upgradation of the Central Region 220 kV line in the 2021 – 2025 period	281	Estimated volume
	Projects to come into operation in the 2026 – 2030 period		
1	Xebanghieng (Lao) power plant cluster – Lao Bao 500 kV (Huong Hoa)	2x24.5	New construction, synchronization of Xebanghieng (Lao) power plant cluster
2	TBKHH Quang Tri – Branch Dong Nam – Quang Tri 500 kV	2x5	New construction, synchronization of TBK Quang Tri
3	TBKHH Quang Tri – Branch Dong Nam – Quang Tri 500 kV	2x5	New construction, synchronization of TBK Quang Tri
4	Huong Thuy – Branch Hue – Hoa Khanh	4x2	New construction, connection of Huong Thuy 220 kV substation
5	Improvement of Hue – Hoa Khanh loadability	2x82	Upgradation, loadability improvement
6	Improvement of Da nang – Tam Ky – Doc Soi loadability	2x100	Upgradation, loadability improvement
7	Tien Sa – Branch Hai Chau – Ngu Hanh Son	2x4	New construction, connection of An Don 220 kV substation
8	Da Nang Airport – Branch Hoa Khanh – Da Nang	2x5	New construction, connection of Da Nang Airport 220 kV substation via underground cables
9	Dien Ban – Nam Hoi An	2x24	New construction, connection of Nam Hoi An 220 kV substation
10	Da Nang 500 kV – Dien Ban	2x12	New construction, connection of Dien Ban 220 kV substation
11	Xekong 3 upstream hydropower - Monsoon	2x60	New construction, synchronization of Xekong 3 upstream hydropower (Lao)
12	Xekong 3 downstream hydropower – Xekaman 1	2x34	
13	Quang Ngai 2 – Branch Doc Soi – Quang Ngai	4x2	New construction, connection of Quang Ngai 220 kV substation
14	Binh Dinh 500 kV – Nhon Hoi	2x54	New construction, RE capacity absorption improvement to support high penetration of RE in Nhon Hoi area
15	Nam Phu Yen – Branch Nha Trang – Tuy Hoa	4x3.5	New construction, connection of Nam Phu Yen 220 kV substation
16	Cam Thinh – Branch Cam Ranh – Thap Cham	4x3	New construction, connection of Cam Thinh 220 kV substation

No.	Project	No. of circuit x km	Note
17	Bo Y 220 kV switching substation – Bo Y	2x30	New construction
18	Kon Tum upstream – Kon Tum (*)	2x83	New construction, hydropower and wind power capacity absorption, improved connection
19	Sesan 4 MR connection	2x5	Synchronization of Sesan 4 MR hydropower
20	Improvement of Sesan 3 – Pleiku loadability	2x42	Synchronization of Sesan 3 MR hydropower
21	Sesan 3 MR connection	2x5	Synchronization of Sesan 3 MR hydropower
22	Ea Kar – Branch Krong Buk – Nha Trang	4x2	New construction, connection of Ea Kar 220 kV substation
23	Backup plan: new construction and upgradation of the Central Region 220 kV line in the 2026 – 2030 period	84	Estimated volume
	Projects to come into operation in the 2031 – 2035 period		
1	Le Thuy - Branch Dong Hoi – Dong Ha	4x2	New construction, connection of Le Thuy 220 kV substation
2	Quang Binh 500 kV – Branch Dong Hoi – Dong Ha	4x5	Proposed to connect Quang Binh 500 kV substation and Le Thuy 220 kV substation. In case of different investors, a 220 kV line should be constructed to connect Quang Binh 500 kV substation.
3	Quang Binh 1 RE collector substation – Quang Binh 500 kV (*)	2x21	New construction, synchronization of Quang Binh 1 RE collector substation
4	Quang Tri 2 RE collector substation – Lao Bao 500 kV (*)	1x16	New construction, connection of Quang Tri 2 RE collector 220 kV substation
5	Quang Tri 1 RE collector substation – Lao Bao 500 kV (*)	1x20	New construction, connection of Quang Tri 1 RE collector 220 kV substation
6	Quang Tri 500 kV – Phu Vang (*)	2x56	New construction in case Circuit 2 Dong Ha – Hue is impossible
7	Quang Tri RE collector substation – Quang Tri 500 kV (*)	2x53	
8	FP Huong Loc – lao bao 500 kV (*)	1x12	New construction, wind power capacity release
9	Da Nang 500 kV – Branch Ngu Hanh son – Duy Xuyen	2x8	To complete the circuit diagram on the 220 kV side of Da Nang 500 kV substation (after the expansion of Da Nang 500 kV substation)

No.	Project	No. of circuit x km	Note
10	Huong Thuy 500 kV – Phu Vang	2x24	New construction
11	Huong Thuy – Lien Chieu	2x100	In case of Chan May Economic Zone's major development, its connection to Chan May 220 kV substation will be considered.
12	Da Nang 2 500 kV – Lien Chieu	2x8	in case of strong load growth in Lien Chieu port
13	Da Nang 2 500 kV – Branch Hoa Khanh – Hai Chau	4x10	New construction, synchronization of Da Nang 2 500 kV substation
14	Hoa Lien – Branch Hoa Khanh – Thanh My	4x2	New construction, connection of Hoa Lien 220 kV substation
15	Tam Thang 500 kV – Nam Hoi An	2x18	
16	Tam Thang 500 kV – Branch Duy Xuyen – Tam Ky	4x4	New construction, connection on the 220 kV side of Tam Thang 500 kV substation
17	Connection of Quang Ngai RE collector substation	2x10	Connection of Quang Ngai RE collector substation
18	Phu Cat – Branch Binh Dinh – Phuoc An	2x5	New construction, connection of Phu Cat 220 kV substation
19	Kon Tum 2 RE collector substation - Kon Tum 1 Re collector substation (*)	2x14	New construction, synchronization of RE source
20	Kon Ray 500 kV – Branch Kon Tum upstream – Kon Tum (*)	4x5	New construction, RE capacity absorption
21	Kon Tum RE collector substation – Kon Tum (*)	2x15	New construction, RE collector substation
22	Kon Tum 1 RE collector substation - Kon Ray 500 kV (*)	2x26	New construction, RE source synchronized
23	Duc Co – Branch Se San 4A – Pleiku 2	2x23	New construction, connection of Duc Co 220 kV substation
24	PTTN Ea Hleo 3 – Ea Nam 500 kV (*)	1x12	New construction, connection of RE source
25	Dak Song – Branch Dak Nong 500 kV – Kuop village	2x2	New construction, connection of Dak Song 220 kV substation c
26	Dak Nong RE collector substation – Dak Nong 500 kV (*)	1x12	New construction, connection of Dak Nong RE collector substation
27	Dak Nong 2 - Branch Kuop village – Tua Srah village	2x10	New construction, connection of Dak Nong 2 220 kV substation
28	Dien Khanh – Branch Nha Trang – Cam Ranh	4x7	New construction, connection of Dien Khanh 220 kV substation
29	Dien Khanh – Nha Trang 2	2x12	New construction
30	Backup plan: new construction and upgradation of the Central Region 220	41	Estimated volume

No.	Project	No. of circuit x km	Note
	kV line in the 2031 – 2035 period		
	Projects to come into operation in the 2036 – 2040 period		
1	Quang Binh 2 RE collector substation – Quang Binh 500 kV (*)	2x25	New construction, synchronization of Quang Binh 2 RE collector substation
2	Vinh Linh – Branch Dong Hoi – Dong Ha	4x2.2	New construction,
3	Quang Tri 3 RE collector substation – Branch Lao Bao – Dong Ha (*)	2x5	New construction, connection of Quang Tri 3 RE collector substation
4	Kon Tum 500 kV – Branch Bo Y – Kon Tum 220 kV (*)	4x5	Connection on the 220 kV side of Kon Tum 500 kV substation
5	Ea Hleo – Branch Krong Buk – Chu Se	4x5	New construction, connection of Ea Hleo 220 kV substation
6	Kon Tum 3 RE collector substation – Kon Ray 500 kV (*)	2x26	New construction, synchronization of RE source
7	Phu Yen RE collector substation – Tuy Hoa (*)	2x21	New construction, subject to RE source development progress
8	Van Phong 2 – Branch Van Phong 500 kV – Tuy Hoa	4x2	New construction, connection of Van Phong 2 220 kV substation
9	Backup plan: new construction and upgradation of the Central Region 220 kV line in the 2036 – 2040 period	38	Estimated volume
	Projects to come into operation in the 2041 – 2045 period		
1	Ang Son – Quang Binh 2 RE collector substation	2x8	New construction, connection of Ang Son 220 kV substation
2	Tam Quan – Branch Phu My – Quang Ngai	4x5	New construction, connection of Tam Quan 220 kV substation
3	Mang Yang - Branch An Khe hydropower – Pleiku (*)	2x5	New construction, connection of Mang Yang 220 kV substation
4	Backup plan: new construction and upgradation of the Central Region 220 kV line in the 2041 – 2045 period	45	Estimated volume

Note: (*) The volume of RE connection in the above table is estimated. The accurate volume depends on actual connection progress and options applicable to wind and solar power projects.

(**) Backup transmission projects, project addition or changes in high scenario vs. those in baseline scenario.

Unofficial GIZ-Translation

C. Southern Region

Table c.1. List of newly constructed and upgraded 500 kV substations in the period up to 2045

#	Name of substation	Total capacity (MVA)	Note
I	Period up to 2045		
1	Ninh Son	1800	New construction, RE capacity absorption. Recommendation: to design a substation which allows flexible operation, busbar segments supporting different operation modes.
2	Cu Chi	1800	New construction
3	Tay Ninh 1	1800	New construction
4	Binh Duong 1	900	New construction
5	Long Thanh	900	New construction
6	Dong Nai 2	900	New construction
7	Bac Chau Duc	900	New construction
8	Long An	900	New construction
9	Thot Not	1800	New construction
10	Long Phu	1500	New construction, RE capacity absorption.
11	Thuan Nam	2700	Upgradation, capacity improvement, RE capacity absorption
12	Nha Be	1800	Upgradation, capacity improvement
13	Chon Thanh	1800	Upgradation, capacity improvement
14	Tan Uyen	2700	Upgradation, capacity improvement
15	Song May	1800	Upgradation, capacity improvement
16	Phu My	900	Upgradation, capacity improvement
17	Duc Hoa	1800	Upgradation, capacity improvement
18	O Mon	1800	Upgradation, capacity improvement
19	Duyen Hai	900	Upgradation, capacity improvement, RE capacity absorption
	Equipment to support the improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility,

#	Name of substation	Total capacity (MVA)	Note
			install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors
II	Period 2026 – 2030		
1	Son My	900	New construction
2	Hong Phong	1800	New construction, RE capacity absorption
3	Tay Ninh 2	1800	New construction
4	Tien Giang	900	New construction
5	Di Linh	1800	Upgradation, capacity improvement, RE capacity absorption
6	Cau Bong	2700	Upgradation, capacity improvement
7	Tan Dinh	2700	Upgradation, capacity improvement
8	Binh Duong 1	1800	Upgradation, capacity improvement
9	Long Thanh	1800	Upgradation, capacity improvement
10	Dong Nai 2	1800	Upgradation, capacity improvement
11	Bac Chau Duc	1800	Upgradation, capacity improvement
12	Long An	1800	Upgradation, capacity improvement
13	Reserve capacity for load growth and power source expansion in Southern region	2100	New construction or capacity improvement
	Equipment to support the improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors
III	Period 2031 – 2035		
1	Da Phuoc	1800	New construction. Recommendation: to design a substation which allows flexible operation, busbar segments supporting different operation

#	Name of substation	Total capacity (MVA)	Note
			modes.
2	Thu Duc city	1800	New construction. Recommendation: to design a substation which allows flexible operation, busbar segments supporting different operation modes.
3	Binh Duong 2	900	New construction
4	Long Dien	900	New construction
5	Duc Hoa 2	1800	New construction
6	Long An 2 500 kV switching substation	Switching substation	New construction Recommendation: to design a substation which allows flexible operation, busbar segments supporting different operation modes.
7	Dong Thap	900	New construction
8	An Giang	900	New construction
11	Ben Tre (*) (**)	1200	Upgradation, RE capacity absorption; larger scale compared to baseline scenario
10	Tra Vinh 500 kV switching substation (*)	Switching substation	Upgradation, RE capacity absorption. Recommendation: to design a substation which allows flexible operation, busbar segments supporting different operation modes.
9	Ben Tre (*) (**)	1800	New construction, RE capacity absorption
12	Soc Trang (RE collector substation) (*) (**)	1800	Upgradation, capacity improvement, RE capacity absorption
13	Bac Lieu (RE collector substation) (*)	1800	New construction, RE capacity absorption
14	Ca Mau (RE collector substation) (*)	1800	New construction, RE capacity absorption
15	Binh Duong 1	2700	Upgradation, capacity improvement
16	Song May	2700	Upgradation, capacity improvement
17	Long Thanh	2700	Upgradation, capacity improvement
18	Dong Nai 2	2700	Upgradation, capacity improvement
19	Bac Chau Duc	2700	Upgradation, capacity improvement
20	Duc Hoa	2700	Upgradation, capacity improvement
21	Long Phu	1800	Upgradation, capacity

#	Name of substation	Total capacity (MVA)	Note
			improvement
22	Reserve capacity for load growth and power source expansion in Southern region	2100	Newly constructed or improved capacity
	Equipment to support the improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors
IV	Period 2036 – 2040		
1	Dong Nai 3	900	New construction
2	Cu Chi	2700	Upgradation, capacity improvement
15	Da Phuoc	2700	Upgradation, capacity improvement
3	Thu Duc city	2700	Upgradation, capacity improvement
4	Chon Thanh	2700	Upgradation, capacity improvement
5	Tay Ninh 1	2700	Upgradation, capacity improvement
6	Binh Duong 2	1800	Upgradation, capacity improvement
7	Long Dien	1800	Upgradation, capacity improvement
8	Dong Thap	1800	Upgradation, capacity improvement
9	An Giang	1800	Upgradation, capacity improvement
10	Tien Giang	1800	Upgradation, capacity improvement
11	Bac Lieu (RE collector substation) (*)	2700	Upgradation, capacity improvement, RE capacity absorption
12	Ca Mau (RE collector substation) (*) (**)	2700	Upgradation, capacity improvement, RE capacity absorption; faster progress compared to baseline scenario
13	Reserve capacity for load growth and power source expansion in Southern region	2100	New construction or capacity improvement

#	Name of substation	Total capacity (MVA)	Note
	Equipment to support the improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors
V	Period 2041 – 2045		
1	Tay Ninh 2		Upgradation, capacity improvement
2	Binh Duong 2		Upgradation, capacity improvement
3	Dong Nai 3		Upgradation, capacity improvement
4	Duc Hoa 2		Upgradation, capacity improvement
5	Duyen Hai 2 (RE collector substation) (*)		Upgradation, capacity improvement, RE capacity absorption
6	Reserve capacity for load growth and power source expansion in Southern region		New construction or upgradation, capacity improvement
	Equipment to support the improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors

Note: The capacity figures in the above table refer to the substations' installed capacity.
 (*) The capacity of wind/PV collector substations is estimated. The accurate volume and progress depend on actual connection progress and options applicable to RE projects.
 (**) Backup transmission projects, project addition or changes in high scenario vs. those in baseline scenario.

Table c.2. List of newly constructed and upgraded 500 kV transmission lines in Southern region by 2045

#	Name of transmission line	No. of circuit x km	Note
I	Projects to come into operation by 2025		
1	Thuan Nam – Chon Thanh	2x308	New construction, RE capacity absorption in South Central region
2	Ninh Son – Branch Thuan Nam – Chon Thanh	4x2	New construction, connection of Ninh Son 500 kV substation
3	Ninh Son – Branch Van Phong – Thuan Nam	4x13	New construction, connection of Ninh Son 500 kV substation
4	Improvement of Di Linh– Tan Dinh 500 kV line loadability		Line upgradation, series capacitor replacement
5	Improvement of Cau Bong – Dak Nong 500 kV line loadability		Line upgradation, series capacitor replacement
6	Cu Chi – Branch Chon Thanh – Duc Hoa	2x16	New construction, connection of Cu Chi 500 kV substation
7	Tay Ninh 1 – Branch Chon Thanh – Duc Hoa	4x2	New construction, connection of Tay Ninh 1 500 kV substation
8	Binh Duong 1 – Branch Song May – Tan Dinh	2x35	New construction, connection of Binh Duong 1 500 kV substation
9	Binh Duong 1 – Chon Thanh	2x17	New construction, loop circuit set up, improvement of the South Central region’s power supply reliability
10	Long Thanh – Branch Phu My – Song May (circuit 1)	2x16.8	New construction, connection of Long Thanh 500 kV substation
11	Dong Nai 2 – Branch Vinh Tan – Song May	4x5	New construction, transited via circuit 3&4 on Vinh Tan – Branch Song May – Tan Uyen line
12	TBKHH Nhon Trach 4 – Branch Phu My – Nha Be	2x4.2	New construction, synchronization of TBKHH Nhon Trach 4
13	Bac Chau Duc – Branch Phu My – Song May and Phu My – Long Thanh	4x11	New construction, connection of Bac Chau Duc 500 kV substation
14	Song Hau – Duc Hoa (phase 2)	2x96.6	New construction, synchronization of Song Hau 1 power plant; phase 1 of Song Hau – Duc Hoa 500 kV line was completed in 2020
15	Duc Hoa – Chon Thanh	2x104	New construction, transited via Chon Thanh – My Tho
16	Long An – Branch Nha Be – My Tho	2x1	New construction, connection of Long An 500 kV substation
17	O Mon – Thot Not	2x35	New construction, improvement of the Southwest transmission grid; O Mon Power Center capacity absorption
18	TBKHH Bac Lieu – Thot Not	2x130	New construction, synchronization of TBKHH Bac Lieu

#	Name of transmission line	No. of circuit x km	Note
19	Backup plan for new construction and upgradation in the 2021 – 2025 period	114	New construction or loadability improvement
II	Projects to come into operation in the 2026 – 2030 period		
1	Bac Ai pumped storage hydropower – Ninh Son	2x25	New construction, synchronization of TBKHH Bac Ai, replacement of Bac Ai pumped storage hydropower – Branch Van Phong – Thuan Nam
2	Phuoc Hoa pumped storage hydropower – Branch Bac Ai pumped storage hydropower – Ninh Son (**)	2x12	New construction, synchronization of TBKHH Phuoc Hoa in high scenario, faster progress compared to baseline scenario
3	Ca Na pumped storage hydropower – Thuan Nam (**)	2x30	New construction, synchronization of TBKHH Ca Na in high scenario, faster progress compared to baseline scenario
4	Ca Na pumped storage hydropower – Binh Duong 1 (**)	2x280	New construction, synchronization of TBKHH Ca Na; TBKHH Ca Na and South Central offshore wind power capacity absorption; faster progress compared to baseline scenario.
5	Ninh Thuan 1 offshore wind power – Thuan Nam (*) (**)	2x20	New construction, Ninh Thuan offshore wind power release in high scenario; faster progress compared to baseline scenario.
6	Hong Phong 500 kV – Branch Vinh Tan – Song May	4x10	New construction, connection of Hong Phong 500 kV
7	Son My – Bac Chau Duc	2x80	New construction, synchronization of TBK Son My II. TBK Son My II's first generating unit will be connected to Son My 220 kV busbar. Other generating units at TBK Son My II and all generating units at TBK Son My I will be connected to Son My 500 kV busbar.
8	Binh Thuan 1 offshore wind power – Thuan Nam (*) (**)	2x50	New construction, Binh Thuan offshore wind power release in high scenario; faster progress compared to baseline scenario.
9	Binh Thuan 3 offshore wind power – Branch TBKHH Ca Na - Thuan Nam (*) (**)	2x15	New construction, Binh Thuan offshore wind power release in high scenario; faster progress compared to baseline scenario.
10	Tay Ninh 2 – Branch Tay Ninh 1 – My Tho	2x20	New construction, connection of Tay Ninh 2 500 kV
11	Dau Tieng Lake PV power	4x2	New construction, connection of Dau

#	Name of transmission line	No. of circuit x km	Note
	(phase 2) – Branch KrongBuk – Tay Ninh 1 (*)		Tieng Lake 500 kV PV power (phase 2)
12	Tien Giang – Branch O Mon – My Tho	4x5	New construction, connection of Tien Giang 500 kV substation
13	Thot Not – Duc Hoa	2x135	New construction, synchronization of generating unit 2 of TBKHH Bac Lieu. To consider installing more segment breakers at Duc Hoa 500 kV distribution yard and enabling busbar separation in the way that allows direct power transmission from Thot Not to Cau Bong; or constructing Thot Not – Duc Hoa 500 kV line transited to Cau Bong to reduce short-circuit currents.
14	Improvement of Duc Hoa – Cau Bong 500 kV line loadability	2x24	To upgrade and improve loadability, synchronize generating unit 2 of TBKHH Bac Lieu, release TBKHH Bac Lieu and RE source in the Southwest
15	Backup plan for new construction and upgradation in the 2026 – 2030 period	292	New construction or upgradation, improvement of loadability
III	Projects to come into operation in the 2031 – 2035 period		
1	Pumped storage in the South – Branch Ninh son – Chon Thanh	4x18	New construction, synchronization of pumped storage in the South
2	Ninh Thuan 2 offshore wind power – Ninh Son (*)	2x55	New construction, absorption of Ninh Thuan offshore wind power capacity
3	Binh Thuan 2 offshore wind power – Long Thanh (*)	2x110	New construction, absorption of Binh Thuan offshore wind power capacity
4	Da Phuoc – Branch Phu Lam – Nha Be	2x8	New construction, connection of Da Phuoc 500 kV substation
5	Thu Duc city – Long Thanh	2x25	New construction, connection of Thu Duc City 500 kV substation
6	Binh Duong 2 – Branch Tay Ninh 1 – Chon Thanh	2x5	New construction, connection of Binh Duong 2 500 kV substation
7	Long Thanh – Branch Phu My – Song May (circuit) 500 kV line	2x16	Connection of Long Thanh 500 kV substation transited via the other circuit of Phu My – Song May 500 kV line. Absorption of power source in this region. Cross-sectional area should match the loadability of the upgraded 500 kV line from Branch Long Thanh to Song May (proposal: to improve loadability in the 2031 – 2035 period)

#	Name of transmission line	No. of circuit x km	Note
8	Improvement of 500 kV line loadability from Branch Long Thanh to Song May	2x22	Loadability improvement, capacity absorption in the region
9	TBKHH Long Son – bac Chau Duc (**)	2x36	New construction, synchronization of TBKHH Long Son in high scenario; faster progress compared to baseline scenario
10	Long Dien – Branch Long Son – Bac Chau Duc	2x10	New construction, connection of Long Dien 500 kV substation
11	Duc Hoa 2 – Branch Song Hau – Duc Hoa	2x13	New construction, connection of Duc Hoa 2 500 kV substation
12	Long An 2 500 kV switching substation transited via My Tho 500 kV – Tay Ninh 2 and My Tho – Cu Chi	4x3	New construction, connection of Long An 2 500 kV substation
13	Dong Thap – Long An 2 500 kV switching substation	2x92	New construction, connection of Dong Thap 500 kV substation
14	Bac Lieu 500 kV substation – Branch TBKHH Bac Lieu – Thot Not	2x20	New construction, connection of Bac Lieu 500 kV substation to release RE capacity in Bac Lieu province
15	Bac Lieu 500 kV substation – Dong Thap	2x190	New construction, RE capacity absorption
16	An Giang – Branch Bac Lieu 500 kV substation – Dong Thap	4x18	New construction, connection of An Giang 500 kV substation
17	Tra Vinh 500 kV switching substation – Branch Duyen Hai – My Tho	4x0.2	New construction, connection of Tra Vinh 500 kV switching substation, wind power capacity in Tra Vinh province
18	Tra Vinh 500 kV switching substation – Da Phuoc	2x107	New construction, connection of Tra Vinh 500 kV switching substation, wind power capacity in Tra Vinh province
19	Duyen Hai 2 500 kV - Tra Vinh 500 kV switching substation	2x26	New construction, connection of Duyen Hai 2 500 kV switching substation, wind power capacity in Tra Vinh province
20	Ben Tre – Branch Tra Vinh switching substation – Da Phuoc	4x5	New construction, connection of Ben Tre 500 kV substation, wind power capacity in Ben Tre province
21	Soc Trang 500 kV RE collector substation – Long Phu 500 kV (*)	2x40	New construction, connection of Soc Trang 500 kV substation, wind power capacity in Soc Trang province
22	Long Phu III thermal power – Tra Vinh 500 kV switching substation	2x32	New construction, synchronization of Long Phu III thermal power. Recommendation: to allow Long Phu III thermal power connection to be independent of Long Phu I & II thermal power for minimizing short-

#	Name of transmission line	No. of circuit x km	Note
			circuit currents and overload on O Mon 500 kV – Tien Giang – My Tho line.
23	Ca Mau 500 kV substation – Bac Lieu 500 kV substation	2x67	New construction, connection of Ca Mau 500 kV substation in baseline scenario, RE capacity absorption
	Backup plan for new construction, upgradation in the 2031 – 2035 period	180	New construction or upgradation, loadability improvement
IV	Projects to come into operation in the 2036 – 2040 period		
1	Ninh Thuan 3 offshore wind power – Branch Ninh Thuan 2 offshore wind power – Ninh Son (*)	2x37	New construction, release of offshore wind power capacity in Ninh Thuan province
2	Binh Thuan 4 offshore wind power – Binh Thuan 2 offshore wind power (*)	2x25	New construction, release of offshore wind power capacity in Binh Thuan province
3	TBKHH Phu My 3.1 – Phu My 500 kV (**)	2x2	New construction, synchronization of TBKHH Phu My 3.1 in high scenario. This is an addition to baseline scenario.
4	Connection of offshore power in the South in the 2036 – 2040 period (**)	100	New construction, synchronization of offshore power in the South in high scenario. This is an addition to baseline scenario.
5	Backup plan for new construction, upgradation in the 2036 – 2040 period	100	New construction or upgradation, loadability improvement
V	Projects to come into operation in the 2041 – 2045 period		
1	Dong Nai 3 – Branch Song May – tan Uyen	2x10	New construction, connection of Dong Nai 3 500 kV substation
2	Connection of offshore power in the South in the 2041 – 2045 period (**)	50	New construction, synchronization of offshore power in the South in high scenario. This is an addition to baseline scenario.
3	Backup plan for new construction, upgradation in the 2041 – 2045 period	100	New construction or upgradation, loadability improvement

Note: (*) The volume of RE connection in the above table is estimated. The accurate volume depends on actual connection progress and options applicable to wind and solar power projects.

(**) Backup transmission projects, project addition or changes in high scenario vs. those in baseline scenario.

Table c.3. List of newly constructed and upgraded 220 kV substations in the South by 2045

#	Name of substation	Total capacity (MVA)	Note
I	Period up to 2025		
1	Da Nhim 220 kV switching substation	Switching substation	New construction, RE capacity absorption as Da Nhim 220 kV substation's 220 kV feeder cannot be expanded
2	Ca Na	250	New construction
3	Ham Thuan Nam	500	New construction
4	Thai Hoa 220 kV switching substation (*)	Switching substation	New construction, RE capacity absorption
5	Vinh Hao	500	New construction, RE capacity absorption
6	Hoa Thang	500	New construction, RE capacity absorption
7	Hong Phong	250	New construction, RE capacity absorption
8	Ham Cuong	250	New construction, RE capacity absorption
9	Binh Thuan RE collector substation (*)	125	New construction, RE capacity absorption
10	Tan Cang	500	New construction
11	Tan Son Nhat	500	New construction
12	Dam Son	500	New construction
13	Thu Thiem	500	New construction
14	Binh Chanh 1	500	New construction
15	Ba Queo	500	New construction
16	District 7	500	New construction
17	Nam Hiep Phuoc	500	New construction
18	District 9	500	New construction
19	Phuoc Long	250	New construction
20	Tan Bien	500	New construction
21	Phuoc Dong	250	New construction
22	Ben Cat 2	500	New construction
23	Tan Dinh 2	500	New construction
24	An Thanh (VSIP)	500	New construction
25	Binh My	250	New construction
26	Bac Tan Uyen	250	New construction
27	Lai Uyen	250	New construction
28	An Phuoc	500	New construction
29	Tam Phuoc	500	New construction
30	Thong Nhat	250	New construction
31	Nhon Trach Economic Zone	500	New construction
32	Dinh Quan	250	New construction
33	Long Khanh	250	New construction
34	Bien Hoa	500	New construction
35	Phu My 3 Economic Zone	500	New construction
36	Phuoc Thuan	250	New construction
37	Long Son	250	New construction

#	Name of substation	Total capacity (MVA)	Note
38	Ben Luc	500	New construction
39	Duc Hoa 2	500	New construction
40	Duc Hoa 500 kV	250	New construction, 220 kV substation connected to Duc Hoa 500 kV substation
41	Duc Hoa 3	250	New construction
42	Lap Vo	250	New construction
43	Hong Ngu	250	New construction
44	Chau Thanh (An Giang)	250	New construction
45	Cho Moi	250	New construction
46	Tan Phuoc	250	New construction, this project is to replace Cai Be 220 kV substation in the Revised PDP VII approved at the Prime Minister's Decision 428/QD-TTg dated 18 March 2016
47	Go Cong	250	New construction
48	Vinh Long 3	250	New construction
49	Binh Dai	250	New construction, RE capacity absorption
50	Thanh Phu (*) RE collector substation	250	New construction, RE capacity absorption
51	An Bien	250	New construction
52	Phu Quoc	500	New construction
53	Chau Thanh (Hau Giang)	250	New construction
54	Duyen Hai	250	New construction
55	Vinh Chau	500	New construction, RE capacity absorption
56	Gia Rai	250	New construction
57	Hoa Binh (Bac Lieu province) (*)	250	New construction, RE capacity absorption (Bac Lieu province)
58	Nam Can	250	New construction
59	Duc Trong	375	Upgradation, capacity improvement
60	Da Nhim	188	Upgradation, capacity improvement
61	Phuoc Thai PV power (*)	625	Upgradation, capacity improvement, RE capacity absorption
62	Ham Thuan hydropower	125	Upgradation, capacity improvement
63	Dai Ninh hydropower	250	Upgradation, capacity improvement
64	Nha Be	500	Upgradation, capacity improvement
65	Binh Tan	750	Upgradation, capacity improvement
66	Chon Thanh 500 kV	500	Upgradation, capacity improvement, 220 kV substation connected to Chau Thanh 500 kV

#	Name of substation	Total capacity (MVA)	Note
			substation
67	Tay Ninh 2	500	Upgradation, capacity improvement
68	Tri An hydropower	500	Upgradation, capacity improvement
69	Ba Ria	250	Upgradation, capacity improvement
70	Chau Duc	500	Upgradation, capacity improvement
71	Can Duoc	500	Upgradation, capacity improvement
72	Sa Dec	500	Upgradation, capacity improvement
73	Long Xuyen	500	Upgradation, capacity improvement
74	My Tho	500	Upgradation, capacity improvement
75	Mo Cay	375	Upgradation, capacity improvement
76	Kien Binh	500	Upgradation, capacity improvement
77	Tra Noc	500	Upgradation, capacity improvement
78	Can Tho	500	Upgradation, capacity improvement
79	O Mon	375	Upgradation, capacity improvement
80	Soc Trang	500	Upgradation, capacity improvement
	Equipment to support the improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors
II	Period 2026 – 2030		
1	Ta Nang (RE collector) (*) (**)	250	New construction, RE capacity absorption, faster progress compared to baseline scenario
2	Tay Bac Cu Chi	250	New construction, Recommendation: to design a substation which allows flexible

#	Name of substation	Total capacity (MVA)	Note
			operation, busbar segments
3	Phu Hoa Dong	250	New construction
4	Binh Chanh 2	250	New construction, Recommendation: to design a substation which allows flexible operation, busbar segments
5	Binh Phuoc RE collector substation (*) (**)	375	New construction, RE capacity absorption in Binh Phuoc province, faster progress compared to baseline scenario
6	Dong Xoai	250	New construction
7	Ben Cau	250	New construction
8	Tay Ninh 3	250	New construction
9	Tan Chau 1 (RE collector) (*)	500	New construction, RE capacity absorption
10	Ho Nai	500	New construction
11	Dau Giay	500	New construction
12	Dong Nai RE collector substation (*)	750	New construction, RE collection in Dong Nai province. Recommendation: to design a substation which allows flexible operation, busbar segments
13	Phu My city	250	New construction
14	Tan Lap	250	New construction
15	Can Giuoc	250	New construction
16	Kien Tuong	250	New construction
17	Bao Loc	500	Upgradation, capacity improvement
18	Duc Trong	500	Upgradation, capacity improvement
19	Da Nhim	375	Upgradation, capacity improvement
20	Ca Na	500	Upgradation, capacity improvement
21	Hong Phong	500	Upgradation, capacity improvement, RE capacity absorption
22	Binh Thuan RE collector substation	250	Upgradation, capacity improvement, RE capacity absorption
23	Phuoc Long	500	Upgradation, capacity improvement
24	Phuoc Dong	500	Upgradation, capacity improvement
25	Tan Dinh	750	Upgradation, capacity improvement
26	Binh My	500	Upgradation, capacity improvement
27	Bac Tan Uyen	500	Upgradation, capacity

#	Name of substation	Total capacity (MVA)	Note
			improvement
28	Lai Uyen	500	Upgradation, capacity improvement
29	Thong Nhat	500	Upgradation, capacity improvement
30	Dinh Quan	500	Upgradation, capacity improvement
31	Long Khanh	500	Upgradation, capacity improvement
32	Phuoc Thuan	500	Upgradation, capacity improvement
33	Duc Hoa 500 kV	500	Upgradation, capacity improvement
34	Duc Hoa 3	500	Upgradation, capacity improvement
35	Cai Lay	500	Upgradation, capacity improvement
36	Tan Phuoc	500	Upgradation, capacity improvement
37	Go Cong	500	Upgradation, capacity improvement
38	Vinh Long 3	500	Upgradation, capacity improvement
39	Mo Cay	500	Upgradation, capacity improvement
40	Binh Dai	500	Upgradation, capacity improvement, RE capacity absorption
41	Thanh Phu (RE collector) (*)	500	Upgradation, capacity improvement, RE capacity absorption
42	O Mon	500	Upgradation, capacity improvement
43	Chau Thanh (Hau Giang)	500	Upgradation, capacity improvement
44	Tra Vinh	500	Upgradation, capacity improvement
45	Bac Lieu	375	Upgradation, capacity improvement
46	Hoa Binh (Bac Lieu province) (*)	500	Upgradation, capacity improvement, RE capacity absorption
47	Nam Can	500	Upgradation, capacity improvement
48	Reserve capacity of 220 kV substation for load growth and power source expansion in Southern region	2750	New construction, upgradation or capacity improvement
	Equipment to support the		

#	Name of substation	Total capacity (MVA)	Note
	improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors
III	Period 2031 – 2035		
1	Da Lat	250	New construction
2	Phuoc Dinh (*)	750	New construction, RE capacity absorption in Ninh Thuan province
3	Thanh Hai (*)	750	New construction, RE capacity absorption in Ninh Thuan province
4	Hong Liem (*)	500	New construction, RE capacity absorption in Binh Thuan province
5	Hoc Mon 2	250	New construction
6	Connection to Da Phuoc 500 kV	500	New construction, 220 kV substation connected to Da Phuoc 500 kV substation
7	Connection to Thu Duc City 500 kV	500	New construction, 220 kV substation connected to Thu Duc City 500 kV substation
8	Hon Quan	250	New construction
9	Tan Bien 2 (PV power collector) (*)	500	New construction, RE capacity absorption
10	Phu Giao	250	New construction
11	Bon Cat 3	250	New construction
12	Bau Bang	250	New construction
13	Connection to Binh Duong 2 500 kV	250	New construction, 220 kV substation connected to Binh Duong 2 500 kV substation
14	Connection to Long Thanh 500 kV	500	New construction, 220 kV substation connected to Long Thanh 500 kV substation
15	Long Thanh 2 industrial zone	500	New construction
16	Connection to Dong Nai 2 500 kV	500	New construction, 220 kV substation connected to Dong Nai 2 500 kV substation
17	Dong Nai 2 RE (*)	750	New construction, RE collection in Dong Nai province. Recommendation: to design a substation which allows flexible operation, busbar segments.
18	Hac Dich	250	New construction

#	Name of substation	Total capacity (MVA)	Note
19	Vung Tau 2	250	New construction
20	Hoa Binh (BRVT)	250	New construction (Ba Ria – Vung Tau province)
21	Connection to Dong Thap 500 kV	250	New construction, 220 kV substation connected to Long Thanh 500 kV substation
			New construction, 220 kV substation connected to Dong Thap 500 kV substation
22	Connection to Tien Giang 500 kV	500	New construction, 220 kV substation connected to Tien Giang 500 kV substation
23	Ba Tri (RE collector) (*)	500	New construction, RE collection in Ben Tre province
24	Thoi Lai	250	New construction
25	Vi Thanh	250	New construction
26	Cau Ngang	250	New construction
27	Tran De (RE collector) (*)	500	New construction, RE collection in Soc Trang province
28	Dong Hai (RE collector) (*)	500	New construction, RE collection in Bac Lieu province
29	Phuoc Long (RE collection in Bac Lieu province) (*)	500	New construction, RE collection in Bac Lieu province
30	Ca Mau 3	250	New construction
31	Ca Mau 4 (RE collector) (*)	500	New construction, RE collection in Ca Mau province
32	Nha Be	750	Upgradation, capacity improvement
33	Tay Bac Cu Chi	500	Upgradation, capacity improvement
34	District 7	750	Upgradation, capacity improvement
35	Phu Hoa Dong	500	Upgradation, capacity improvement
36	Binh Chanh 2	500	Upgradation, capacity improvement
37	Dong Xoai	500	Upgradation, capacity improvement
38	Phuoc Dong	750	Upgradation, capacity improvement
39	Ben Cau	500	Upgradation, capacity improvement
40	Tay Ninh 3	500	Upgradation, capacity improvement
41	My Phuoc	750	Upgradation, capacity improvement
42	Uyen Hung	750	Upgradation, capacity improvement
43	Ben Cat	750	Upgradation, capacity

#	Name of substation	Total capacity (MVA)	Note
			improvement
44	Ben Cat 2	750	Upgradation, capacity improvement
45	Tan Dinh 2	750	Upgradation, capacity improvement
46	Tan Uyen	750	Upgradation, capacity improvement
47	An Thanh (VSIP)	750	Upgradation, capacity improvement
48	Long Thanh	750	Upgradation, capacity improvement
49	Nhon Trach industrial zone	750	Upgradation, capacity improvement
50	Bien Hoa	750	Upgradation, capacity improvement
51	Chau Duc	750	Upgradation, capacity improvement
52	Phu My city	500	Upgradation, capacity improvement
53	Duc Hoa 2	750	Upgradation, capacity improvement
54	Duc Hoa 3	750	Upgradation, capacity improvement
55	Tan Lap	500	Upgradation, capacity improvement
56	Can Giuoc	500	Upgradation, capacity improvement
57	Kien Tuong	500	Upgradation, capacity improvement
58	Lap Vo	500	Upgradation, capacity improvement
59	Hong Ngu	500	Upgradation, capacity improvement
60	Cho Moi	500	Upgradation, capacity improvement
61	Chau Thanh (An Giang)	500	Upgradation, capacity improvement
62	Tan Phuoc	750	Upgradation, capacity improvement
63	An Bien	500	Upgradation, capacity improvement
64	Thot Not	375	Upgradation, capacity improvement
65	Duyen Hai	500	
66	Bac Lieu	500	
67	Gia Rai	500	
68	Reserve capacity of 220 kV substation for load growth and power source expansion	2875	New construction or capacity improvement

#	Name of substation	Total capacity (MVA)	Note
	in Southern region		
	Equipment to support the improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors
IV	Period 2036 – 2040		
1	Tanh Linh	250	New construction
5	Cu Chi 2	500	New construction
6	Tan Chau 2	250	New construction
7	Go Dau	250	New construction
8	Vinh Cuu	500	New construction
9	Xuan Loc 2	500	New construction
10	Dat Do	250	New construction
11	Ben Luc 2	500	New construction
12	Can Giuoc 2	500	New construction
13	Cho Moi 2	250	New construction
14	Cai Be 2	250	New construction
15	Vinh Quang	250	New construction
16	Ke Sach	250	New construction
17	Ca Mau 5 (RE collector) (*)	500	New construction, RE capacity absorption
18	Ta Nang (RE collector) (*)	500	Upgradation, capacity improvement
19	Da Lat	500	Upgradation, capacity improvement
20	Da Nhim hydropower	500	Upgradation, capacity improvement
21	Ham Thuan	250	Upgradation, capacity improvement
22	Dai Ninh	500	Upgradation, capacity improvement
23	Phu Lam	375	Upgradation, capacity improvement
24	Nha Be	375	Upgradation, capacity improvement
25	Tao Dan	750	Upgradation, capacity improvement
26	District 8	750	Upgradation, capacity improvement
27	Tan Son Nhat	750	Upgradation, capacity

#	Name of substation	Total capacity (MVA)	Note
			improvement
28	District 9	750	Upgradation, capacity improvement
29	Hoc Mon 2	500	Upgradation, capacity improvement
30	Hon Quan	500	Upgradation, capacity improvement
31	Lai Uyen	750	Upgradation, capacity improvement
32	Phu Giao	500	Upgradation, capacity improvement
33	Ben Cat 3	500	Upgradation, capacity improvement
34	Bau Bang	500	Upgradation, capacity improvement
35	Connection to Binh Duong 2 500 kV	500	Upgradation, capacity improvement
36	Song May	750	Upgradation, capacity improvement
37	An Phuoc	750	Upgradation, capacity improvement
38	Tam Phuoc	750	Upgradation, capacity improvement
39	Vung Tau 2	500	Upgradation, capacity improvement
40	Hoa Binh (BRVT)	500	Upgradation, capacity improvement
41	Connection to Dong Thap 500 kV	500	Upgradation, capacity improvement
42	Thot Not	500	Upgradation, capacity improvement
43	Vi Thanh	500	Upgradation, capacity improvement
44	Cau Ngang	500	Upgradation, capacity improvement
45	Ca Mau 3	500	Upgradation, capacity improvement
46	Reserve capacity of 220 kV substation for load growth and power source expansion in Southern region	3875	New construction or capacity improvement
	Equipment to support the improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit		To improve substation layout

#	Name of substation	Total capacity (MVA)	Note
	currents in the power system		diagram towards more flexibility, install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors
V	Period 2041 – 2045		
1	Da Lat 2	500	New construction
2	Nha Be 2	500	New construction
3	Thu Duc 2	500	New construction
4	Dong Phu	250	New construction
5	Tan Uyen 2	500	New construction
6	Nhon Trach 2 city	500	New construction
7	Connection to Dong Nai 3 500 kV	500	New construction, 220 kV substation connected to Dong Nai 3 500 kV substation
8	Xuyen Moc	250	New construction
9	Cho Gao	250	New construction
10	Vinh Long 4	250	New construction
11	Ca Na	750	Upgradation, capacity improvement
12	Ham Thuan Nam	750	Upgradation, capacity improvement
13	Tanh Linh	500	Upgradation, capacity improvement
14	Phu Lam	750	Upgradation, capacity improvement
15	Dam Sen	750	Upgradation, capacity improvement
16	Binh Chanh 1	750	Upgradation, capacity improvement
17	Tan Chau 2	500	Upgradation, capacity improvement
18	Go Dau	500	Upgradation, capacity improvement
19	Thong Nhat	750	Upgradation, capacity improvement
20	Dau Giay	750	Upgradation, capacity improvement
21	Connection to Dong Nai 2 500 kV	750	Upgradation, capacity improvement
22	Long Son	500	Upgradation, capacity improvement
23	Hac Dich	500	Upgradation, capacity improvement
24	Dat Do	500	Upgradation, capacity improvement
25	Long An	750	Upgradation, capacity improvement
26	Can Giuoc	750	Upgradation, capacity improvement

#	Name of substation	Total capacity (MVA)	Note
			improvement
27	Cho Moi 2	500	Upgradation, capacity improvement
28	Cai Be 2	500	Upgradation, capacity improvement
29	Phu Quoc	750	Upgradation, capacity improvement
32	Vinh Quang	500	Upgradation, capacity improvement
33	Ke Sach	500	Upgradation, capacity improvement
34	Reserve capacity of 220 kV substation for load growth and power source expansion in Southern region	4875	New construction or capacity improvement
	Equipment to support the improvement of the operation quality of the power system		
-	For improving power system stability		To install <i>synchronous compensator, flywheel, FACTS, etc.</i>
-	For reducing short-circuit currents in the power system		To improve substation layout diagram towards more flexibility, install short-circuit protection devices
-	Voltage control devices		To install FACTS, capacitors, resistors

Note: The capacity figures in the above table refer to the substations' total installed capacity. New construction, upgradation or transformer installation plans shall be elaborated during the implementation of each project.

(*) The capacity of wind/PV collector substations is estimated. The accurate volume and progress depend on actual connection progress and options applicable to RE projects.

(**) Backup transmission projects, project addition or changes in high scenario vs. those in baseline scenario.

Table c.4. List of newly constructed and upgraded 220 kV transmission lines in Southern region by 2045

#	Name of transmission line	No. of circuit x km	Note
I	Projects to come into operation by 2025		
1	Circuit 2 of Bao Loc – Song May	1x127	Construction of Circuit 2 of Bao Loc – Song May
2	Improvement of Bao Loc – Song May (circuit 1) loadability	1x127	Improvement of Bao Loc – Song May (circuit 1) loadability

#	Name of transmission line	No. of circuit x km	Note
3	Da Nhim – Di Linh 220 kV switching substation	2x85	Construction of a new double-circuit transmission line, RE capacity absorption; new construction of Da Nhim 220 kV switching substation as Da Nhim 220 kV distribution yard cannot expand its 220 kV feeder
4	Da Nhim – Di Linh 220 kV switching substation – Branch Thap Cham – Da Nhim	2x1	New construction, synchronization of Da Nhim 220 kV switching substation
5	Dong Nai 2 hydropower – Branch Duc Trong – Di Linh (and transited via Duc Trong - Dong Nai 2 hydropower to replace Duc Trong – Di Linh)	1x15	Construction of a new 220 kV single-circuit transmission line Duc Trong - Dong Nai 2 hydropower – Di Linh to replace the 220 kV double-circuit transmission line Dong Nai 2 hydropower – Di Linh
6	Nha Trang – Thap Cham	2x88	New construction, RE capacity absorption
7	Ninh Son 500 kV – Branch Thap Cham – Ninh Phuoc	4x22	New construction, connection of Ninh Son 500 kV substation
8	Ninh Son 500 kV – Ninh Phuoc	2x35	New construction to replace Ninh Phuoc – Vinh Tan 220 kV line
9	Ninh Son 500 kV – Da Nhim 220 kV switching substation	2x18	New construction, RE capacity absorption
10	Thap Cham - Da Nhim 220 kV switching substation	2x46	New construction, RE capacity absorption. Proposed to construct Da Nhim 220 kV switching substation to connect the 220 kV double-circuit transmission line outgoing to Duc Trong – Di Linh and 220 kV single-circuit transmission line incoming from Thap Cham as 220 kV feeder at 220 kV Da Nhim substation cannot be expanded
11	Duc Trong – Branch Da Nhim 220 kV switching substation – Di Linh	2x0.5	New construction, RE capacity absorption
12	Vinh Tan 500 kV – Ca Na	2x14	New construction, connection of Ca Na 220 kV
13	Ninh Phuoc – Thuan Nam 500 kV	2x25	New construction, RE capacity absorption
14	Thai Hoa 220 kV switching substation – Branch Vinh Tan – Phan Thiet	2x0.5	New construction, connection of Thai Hoa 220 kV (RE collector) switching substation
15	Ham Tan – Branch Phan Thiet – Tan Thanh (circuit 2)	2x6	Connection of Ham Tan 220 kV substation transited via the other circuit of Phan Thiet – Tan Thanh 220 kV line
16	Ham Thuan Nam - Branch	4x3.5	New construction, connection of Ham

#	Name of transmission line	No. of circuit x km	Note
	Phan Thiet – Ham Tan		Thuan Nam 220 kV
17	Vinh Hao – Branch Vinh Tan – Phan Ri	2x2	New construction, connection of Vinh Hao 220 kV substation
18	Hoa Thang – Branch Phan Thiet – Phan Ri	2x7.2	New construction, connection of Hoa Thang 220 kV substation
19	Hong Phong 220 kV - Branch Phan Thiet – Phan Ri	2x1	New construction, connection of Hong Phong 220 kV substation
20	Ham Cuong – Ham Thuan Nam	2x7	New construction, connection of Ham Cuong 220 kV substation
21	Improvement of Ham Thuan – Da My – Xuan Loc loadability	2x95	Loadability improvement
22	Improvement of Phan Thiet - Ham Thuan loadability	2x45	Loadability improvement
23	Binh Thuan 220 kV wind power plant 1 – Branch Vinh Tan – Phan Thiet	2x4	New construction, connection of Binh Thuan 220 kV wind power plant 1
24	Cat Lai – Tan Cang	2x15.2	New construction
25	Binh Chanh 1 – Cau Bong	2x13	New construction
26	Thuan An – Tan Son Nhat	2x15.2	New construction
27	Tan Son Nhat – Branch Hoc Mon – Thu Duc	2x9.3	New construction
28	Phu Lam – Dam Sen	2x6	New construction
29	Dam Sen – Ba Queo – Tan Son Nhat	2x10	New construction
30	Long Thanh 500 kV – High-Tech	2x25	New construction
31	Cu Chi 500 kV – Branch Cu Chi – Trang Bang	4x0.5	New construction
32	Cu Chi 500 kV – Branch Cu Chi – Tan Dinh	4x0.5	New construction
33	Thu Thiem – Branch Lat Lai – Tan Cang	4x0.5	New construction
34	Tao Dan – Tan Cang	2x7	New construction
35	District 7 – Nha Be	2x6	New construction
36	District 9 – branch Long Thanh – High-tech	2x5	New construction
37	TBKHH Hiep Phuoc 1 – branch Phu My – Can Duoc	4x2.3	New construction, synchronization of TBKHH Hiep Phuoc 1
38	Improvement of Phu My – Can Duoc loadability	2x57	Loadability improvement, synchronization of TBKHH Hiep Phuoc 1
39	Nam Hiep Phuoc – Branch Phu My – Can Duoc	4x2	New construction
40	Improvement of Thu Duc – Tan Uyen – Long Binh loadability	2x44	Upgradation, loadability improvement
41	Improvement of Binh Long Chon Thanh 220 kV line	2x32	Upgradation, loadability improvement, RE capacity absorption

#	Name of transmission line	No. of circuit x km	Note
	loadability		
42	Phuoc Long – Branch Dinh Long – Dak Nong	2x5	New construction
43	Dinh Quan – Branch Bao Loc – Song May	4x1	New construction
44	Tan Bien – Tay Ninh	2x25	New construction
45	Tay Ninh 1 500 kV – Branch Tay Ninh 2 – Trang Bang	4x8	New construction, synchronization of Tay Ninh 1 500 kV substation
46	Tay Ninh 1 500 kV – Phuoc Dong	2x8	New construction
47	Chon Thanh – Ben Cat	2x28	New construction
48	Ben Cat 2 – Branch Tan Dinh – Cu Chi	4x1	New construction
49	Ben Cat 2 – Branch Ben Cat - Chon Thanh	2x20	New construction
50	Tan Dinh 2 – Branch My Phuoc – Ben Cat	4x11	New construction
51	Binh Duong 1 500 kV – Branch Uyen Hung – Song May	4x40	New construction, connection to Binh Duong 1 500 kV substation
52	An Thanh (VSIP) – Branch Tan Uyen – Thuan An	4x3	New construction
53	Binh My – Branch Binh Duong 1 – Uyen Hung	4x1	New construction
54	Lai Uyen – Branch Chon Thanh – Ben Cat	4x1	New construction
55	Bac Tan Uyen – Branch Binh My – Uyen Hung	4x7	New construction
56	Song May – Tam Phuoc	2x14	New construction
57	Tam Phuoc – Branch Long Binh – Long Thanh	4x0.5	New construction
58	Long Thanh 500 kV - Branch Long Binh – Long Thanh	4x10	New construction, connection of Long Thanh 500 kV
59	An Phuoc - Branch Long Binh – Long Thanh	4x0.5	New construction
60	Dong Nai 2 500 kV – Branch Xuan Loc – Long Thanh	4x12	New construction
61	Long Khanh - Branch Xuan Loc – Long Thanh	4x0.5	New construction
62	Bien Hoa – Branch Tan Uyen – Long Binh	4x1	New construction
63	Nhon Trach 3 thermal power – Branch My Xuan – Cat Lai	2x10	New construction, synchronization of Nhon Trach 3 thermal power to replace Nhon Trach 3 thermal power - Cat Lai line transited to Thu Duc due to challenges in line route
64	Nhon Trach 3 thermal power – Long Thanh 500 kV	2x44	New construction, synchronization of Nhon Trach 3 thermal power, of which

#	Name of transmission line	No. of circuit x km	Note
			about 12km joins the same route with the 220 kV line of Long Thanh 500 kV – High-tech and the 220 kV line connected to Long Thanh 500 kV substation
65	Nhon Trach industrial zone – Branch Nhon Trach 3 thermal power - Long Thanh 500 kV substation	4x3	New construction, synchronization of Nhon Trach 220 kV substation. In case Nhon Trach 3 thermal power plant is behind schedule, construction of Nhon Trach industrial zone 220 kV - Long Thanh 500 kV route shall be considered first.
66	Improvement of My Xuan – Cat Lai loadability	2x40	Loadability improvement, synchronization of Branch Nhon Trach 3 thermal power
67	Improvement of Song May – Long Binh (circuit 1) loadability	1x16	Loadability improvement
68	Improvement of Song May – Long Binh (circuit 2) loadability	1x25	Loadability improvement
69	Thong Nhat – Branch Bao Loc – Song May	4x2	New construction
70	Improvement of Tan Dinh – Binh Hoa loadability	2x10.9	Loadability improvement
71	Tri An hydropower expansion project - Tri An hydropower	2x1.14	New construction, synchronization of Tri An hydropower expansion project
72	Improvement of Phu My – Tan Thanh loadability	2x11	Loadability improvement
73	Improvement of Phu My – Long Thanh loadability	2x25	Loadability improvement
74	Phu My 3 industrial zone – Branch Tan Thanh – Chau Duc	4x0.5	New construction
75	Bac Chau Duc 500 kV – Branch Chau Duc – Tan Thanh	4x9.7	New construction
76	Phu My – Tan Thanh circuits 3 & 4 and transited via Tan Thanh 220 kV substation	2x9.5	New construction
77	Phuoc Thuan – Branch Phan Thiet – Tan Thanh and Ham Tan – Tan Thanh	4x6	New construction
78	Long Son – Branch Chau Duc – Phu My 3 industrial zone	2x8	New construction, selection of the cross-sectional area for this line to match the cross-sectional area of the upgraded 220 kV line Chau Duc - Phu My 3 (in the 2026 – 2030)

#	Name of transmission line	No. of circuit x km	Note
79	Improvement of Tan Thanh – Vung Tau loadability	2x30	Loadability improvement
80	Ben Luc – Branch Phu Lam – Long An (circuit 2)	2x0.5	New construction
81	Improvement of Long An – Ben Luc loadability	2x14	Loadability improvement
82	Can Duoc – Go Cong	2x27	New construction
83	Construction of two more 220 kV circuits Duc Hoa 500 kV– Duc Hoa 1	2x24.6	Construction of circuits 3 & 4 (electric pole with 4 circuits available)
84	Construction of two more 220 kV circuits Cau Bong 500 kV – Duc Hoa 1	2x35.2	Construction of circuits 3 & 4 (electric pole with 4 circuits available)
85	Duc Hoa 500 kV – Branch Phu Lam – Long An (transited via the other circuit of Phu Lam 220 kV – Long An line)	2x20	New construction, only circuit 1 transited at the moment
86	Duc Hoa 2 – Branch Duc Hoa 500 kV – Duc Hoa 1	4x8	New construction
87	Duc Hoa 3 - Branch Duc Hoa 500 kV – Branch Phu Lam – Long An	4x1.5	New construction
88	Long An 500 kV – Branch Can Duoc – Phu My	4x1	New construction
89	Thot Not 500 kV – Lap Vo	2x22	New construction
90	Sa Dec – Branch O Mon – Vinh Long (circuit 2 to be transited)	2x0.2	New construction, only circuit 1 transited up to present
91	Improvement of O Mon – Sa Dec – Vinh Long – Cai Lay loadability	2x75	Loadability improvement
92	Long Xuyen – Branch Chau Doc – Thot Not (circuit 2 to be transited)	2x0.1	New construction, only circuit 1 transited up to present
93	Cho Moi – Branch Chau Doc – Long Xuyen	2x11.5	New construction
94	New construction, upgradation of Chau Doc 220 kV – Kien Binh 1 single-circuit line into double-circuit line	2x75	New construction, upgradation of single-circuit line into double-circuit line
95	Tan Phuoc – My Tho 500 kV – Long An	4x7	New construction
96	My Tho – Branch My Tho 500 kV – Can Duoc (circuit 2 to be transited)	2x4	New construction, only circuit 1 transited up to present
97	Can Duoc – Branch Phu My – My Tho (circuit 2 to be	2x5	New construction, only circuit 1 transited up to present

#	Name of transmission line	No. of circuit x km	Note
	transited)		
98	Improvement of My Tho 500 kV – My Tho – Can Duoc loadability	2x55	Upgradation, improvement of 220 kV line's loadability
99	Vinh Long 3 – Branch Vinh Long – Tra Vinh	4x0.5	New construction
100	An Cu PV power – Branch Chau Doc – Kien Binh (**)	2x0.5	New construction, synchronization of An Cu PV power, approved to be added to PDP at Document 401/TTg-CN dated 1 April 2021. Faster progress compared to baseline scenario.
101	Ben Tre – Binh Dai	2x50	New construction, RE capacity absorption
102	Mo Cay – My Tho 500 kV	2x42	New construction, RE capacity absorption
103	Thanh Phu – Mo Cay	2x42	Construction of circuits 3 & 4 (electric pole with 4 circuits available); New construction, RE capacity absorption; Recommendation: to select phase separation line with large cross-sectional area for Thanh Phu – Mo Cay 220 kV line. In case Hai Phong wind power comes into operation before Thanh Phu 220 kV substation, Hai Phong wind power – Mo Cay 220 kV line shall be constructed first and synchronized with Hai Phong wind power.
104	Upgradation of Rach Gia 2 – Kien Binh 220 kV single-circuit line into double-circuit line	2x74	New construction, upgradation of single-circuit line into double-circuit line
105	An Bien – Branch Ca Mau thermal power – Rach Gia	2x16.8	New construction
106	Duyen Hai 220 kV – Branch Duyen Hai 500 kV – Mo Cay	4x3	New construction
107	Chau Thanh (Hau Giang) – Branch O Mon – Soc Trang	4x2	New construction
108	Kien Binh – Phu Quoc	2x84	New construction
109	Chau Thanh (An Giang) – Branch Long Xuyen – Chau Doc	4x2	New construction
110	Vinh Chau – Branch Long Phu – Soc Trang (circuit 1)	2x20	New construction
111	Vinh Chau – Branch Long Phu – Soc Trang (circuit 2)	2x20	New construction
112	Gia Rai – Branch bac Lieu –	4x2.2	New construction

#	Name of transmission line	No. of circuit x km	Note
	Ca Mau thermal power		
113	Ca Mau – Nam Can	2x57.8	New construction
114	Improvement of Ca Mau – Ca Mau thermal power loadability	2x5.7	Loadability improvement
115	Bac Lieu – Branch Ca Mau thermal power - Soc Trang	2x5	New construction, RE capacity absorption to replace the project “Double-circuit 220 kV line connected to Bac Lieu 220 kV substation and transited via Ca Mau thermal power – Bac Lieu 220 kV line” in Document 441/TTg-CN dated 16 April 2020
116	Phuoc Thai PV power – Branch Vinh Tan – Thap Cham (circuit 2)	2x2.5	Connection of Phuoc Thai 220 kV substation transited via the other circuit of Vinh Tan – Thap Cham 220 kV line. RE capacity absorption.
117	Phuoc Trung PV power – Branch Nha Trang – Thap Cham	2x0.4	New construction, synchronization of Phuoc Trung PV power; connection plan was approved at Document 1632/TTg-CN dated 20 November 2020.
118	Phuoc Huu 2 PV power – Ninh Phuoc 220 kV	1x4	New construction, connection of Phuoc Huu 2 PV power plant (230 MWp) to replace the 220 kV line Phuoc Huu 2– Vinh Tan 500 kV as approved at Document 1632/TTg-CN dated 20 November 2020 (reason: challenges in line route)
119	Phuoc Huu wind power – Ninh Phuoc 220 kV	1x2	New construction, connection of Phuoc Huu wind power (50 MW) (Ninh Thuan province) to replace the 110 kV line Phuoc Huu wind power – Ninh Phuoc 110 kV as at Decision 3768/QD-BCT dated 17 July 2011 approving additional connection of Phuoc Huu wind power plant in “Ninh Thuan Province’s Power Development Plan for the 2006-2010 period with vision to 2015” (reason: the 110 kV power grid is unable to absorb Phuoc Huu 220 kV step-up substation at voltage level of 63 MVA).
120	BIM wind power – Quan The 220 kV switching substation (connected to BIM 3 PV power plant)	1x3	New construction, synchronization of BIM wind power plant; connection plan was approved at Decision 911/TTg-CN dated 15 July 2020
121	Ninh Thuan 5 wind power – Ninh Phuoc 220 kV	2x2	New construction, synchronization of Ninh Thuan 5 wind power plan; connection plan was approved at Decision 911/TTg-CN dated 15 July

#	Name of transmission line	No. of circuit x km	Note
			2020
123	Hoa Dong 2 wind power – Branch Vinh Chau – Long Phu	2x1	New construction, RE capacity absorption; connection plan was approved at Decision 911/TTg-CN dated 15 July 2020
124	Lac Hoa 2 wind power – Hoa Dong 2 220 kV substation	1x6	New construction, RE capacity absorption; connection plan was approved at Decision 911/TTg-CN dated 15 July 2020
125	Phase 3 of Bac Lieu wind power – Bac Lieu	2x18	New construction, RE capacity absorption; connection plan was approved in PDP
126	Hoa Binh (Bac Lieu province) – Branch Gia Rai – Bac Lieu	4x13	New construction, synchronization of Hoa Binh 220 kV substation (Bac Lieu province), RE capacity absorption
127	Hoa Binh 5 wind power – Hoa Binh (Bac Lieu province)	2x8	New construction, synchronization of Hoa Binh 5 wind power. In case Hoa Binh 5 wind power comes into operation before Hoa Binh 220 kV substation, the 220 kV line Hoa Binh 5 wind power – Branch Gia Rai – Bac Lieu (branch circuit is circuit 1, 2x12km) for the purpose of synchronization of Hoa Binh 5 wind power. Construction of Hoa Binh 220 kV transmission line, 2 branch circuits on 220 kV line connecting Hoa Binh 5 wind power plant (4x5km) and the 220 kV line Hoa Binh – Branch Gia Rai – Bac Lieu (circuit 2, 2x13km); synchronization of Hoa Binh 220 kV substation.
128	Vien An wind power – Nam Can	1x20	New construction, RE capacity absorption; connection plan was approved at Decision 911/TTg-CN dated 15 July 2020
129	Ca Mau 1 wind power cluster – Ca Mau	2x52	New construction, synchronization of Ca Mau 1 wind power cluster (350 MW); connection plan was approved in PDP
130	Long My 1 wind power – branch Ca Mau thermal power – O Mon	2x1	New construction, synchronization of Long My 1 wind power; connection plan was approved at Decision 911/TTg-CN dated 15 July 2020
131	Ben Tre 19 wind power – Binh Dai	2x12	New construction, connection of 220 kV substation of Ben Tre 19 wind power (collection of Ben Tre 19 & 20 wind power) to replace the 220 kV line Ben Tre 19 wind power – Ben Tre; connection plan was approved at

#	Name of transmission line	No. of circuit x km	Note
			Decision 911/TTg-CN dated 15 July 2020
132	220 kV substation of Hai Phong wind power – Thanh Phu	2x9	New construction, synchronization of Hai Phong wind power plant. Connection plan is revised, based on the approved plan at Decision 911/TTg-CN dated 15 July 2020 (as it is constructed before Thanh Phu 220 kV substation and Thanh Phu – Mo Cay 220 kV line). In case Hai Phong wind power comes into operation before Thanh Phu 220 kV substation, Thanh Phu wind – Mo Cay 220 kV line should be constructed first for synchronization with Hai Phong wind power (in accordance with Decision 911/TTg-CN dated 15 July 2020).
133	Dong Thanh 1 wind power – Duyen Hai 500 kV	2x4	New construction, synchronization of Dong Thanh 1 wind power. Connection plan is revised, based on the approved plan at Decision 911/TTg-CN dated 15 July 2020 (replacing the 220 kV line Dong Thanh 1 wind power – Branch Dong Hai 1 – Duyen Hai 500 kV).
134	Thang Long wind power – Duyen Hai 220 kV	1x11.5	New construction, synchronization of Thang Long wind power; connection plan was approved at Decision 911/TTg-CN dated 15 July 2020
135	Soc Trang 4 wind power – Vinh Chau	2x5	New construction, synchronization of Soc Trang 4 wind power; connection plan was approved at Decision 911/TTg-CN dated 15 July 2020
136	Phu Cuong 1A & 1B wind power – Vinh Chau	2x22	New construction, synchronization of Phu Cuong 1A & 1B wind power; connection plan was approved at Decision 911/TTg-CN dated 15 July 2020
137	Dong Nai 1 RE – Song May (* (**))	2x42	New construction, connection of 220 kV substation of Dong Nai 1 RE plant. Recommendation: to select large cross-sectional area to absorbing RE power in Dong Nai province. Faster progress in high scenario compared to baseline scenario.
138	Connection of KN Tri An PV power (phase 2) (* (**))	4x10	New construction, RE collection at the 220 kV substation of Dong Nai 1 RE plant. The addition of KN Tri An PV power project to PDP was approved at Document 1870/TTg-CN dated 31

#	Name of transmission line	No. of circuit x km	Note
			December 2020. Faster progress in high scenario compared to baseline scenario.
139	Backup plan for new construction and upgradation in the period up to 2025	130	New construction or upgradation, loadability improvement
II	Projects to come into operation in the 2026 - 2030 period		
1	Da Nhim hydropower expansion project - Da Nhim hydropower	1x2	New construction, synchronization of Da Nhim hydropower expansion project
2	Ta Nang – Branch Duc Trong – Di Linh (new circuit) (*) (**)	2x20	New construction, RE capacity absorption, connection to the 220 kV line of Da Nhim switching substation – Duc Trong – Di Linh which is newly constructed
3	Hong Phong 500 kV – Branch Phan Ri – Phan Thiet	4x5	New construction, synchronization of Hong Phong 500 kV substation
4	Improvement of Phan Ri – Phan Thiet loadability	2x52	Upgradation, loadability improvement for the route with a cross-sectional area of ACSR-2x330mm ² on the 220 kV line Phan Ri – Phan Thiet to absorb RE capacity
5	Phan Ri – Dai Ninh hydropower	2x40	New construction, improvement of RE capacity absorption
6	Improvement of Ham Tan – Chau Duc loadability and Ham Tan – Da Bac PV – Chau Duc loadability	2x60	Upgradation, improvement of loadability and local grid capacity absorption
7	Son My 500 kV – Branch Ham Tan – Phuoc Thuan	4x4	New construction, connection of Son My 500 kV, to consider selecting a cross-sectional area that matches the cross-sectional area of the upgraded 220 kV lines Ham Tan – Chau Duc and Ham Tan - Da Bac PV – Chau Duc
8	Binh Chanh 1 – Duc Hoa	2x10	New construction
9	Phu Hoa Dong – Branch Cu Chi – Cau Bong	4x5	New construction
10	Tay Bac Cu Chi – Branch Duc Hoa 500 kV – Duc Hoa 1	2x2	New construction
11	Binh Chanh 2 – Branch Duc Hoa – Phu Lam	4x2	New construction
12	Improvement of Cau Bong – Cu Chi 220 kV line loadability	2x22	Upgradation, improvement of loadability
13	Improvement of Cau Bong –	2x34	Upgradation, improvement of

#	Name of transmission line	No. of circuit x km	Note
	Binh Tan – Phu Lam line loadability		loadability
14	Dong Nai 1 RE – Tan Uyen	2x60	New construction. Recommendation: to select phase separation line with a large cross-sectional area that can absorb RE capacity in Dong Nai province
15	Dong Xoai – Chon Thanh	2x20	New construction
16	Binh Long – Chon Thanh (circuits 3 & 4)	2x32	New construction, RE capacity absorption
17	Improvement of Chon Thanh 500 kV – My Phuoc 220 kV line loadability	2x45	New construction, improvement of loadability, RE capacity absorption
18	Tay Ninh 2 500 kV – Branch Tay Ninh – tay Ninh 2	4x19	New construction
19	Ben Cau – Tay Ninh 2 500 kV	2x12	New construction
20	Dong Binh Phuoc PV – Branch Binh Long - Aluminum electrolysis plant (**)	2x12	New construction, connection of the 220 kV of substation Binh Phuoc RE
21	Tay Ninh 3 - Tay Ninh 2 500 kV	2x20	New construction
22	Tan Chau 1 (RE collector substation) – Tan Bien	2x16	New construction, RE capacity absorption
23	Tan Dinh 2 – Binh My	2x14	New construction
24	Phu Giao – Branch Binh Duong 1 – Song May	4x2	New construction
25	Dau Giay – Dong Nai 2 500 kV	2x30	New construction
26	Dau Giay – Long Thanh 500 kV	2x12	New construction
27	Improvement of Long Thanh – An Phuoc - Tam Phuoc 220 kV line loadability	2x16	Upgradation, improvement of loadability for the routes with a cross-sectional area of ACSR795MCM (or equivalent to ACSR400mm ²)
28	Improvement of Long Thanh 500 kV – Long Thanh 220 kV line loadability	2x19	Upgradation, improvement of loadability
29	Ho Nai – Branch Song May – Tam Phuoc	4x1	New construction
30	Phu My city – Branch Phu My – Ba Ria	4x2	New construction
31	Phu My city – Bac Chau Duc 500 kV	2x30	New construction
32	Improvement of Ben Luc – Phu Lam loadability	2x28	Upgradation, improvement of loadability
33	Tan Lap – Branch Duc Hoa 500 kV – Long An	4x9	New construction

#	Name of transmission line	No. of circuit x km	Note
34	Kien Tuong - Branch Duc Hoa 2 500 kV	2x45	New construction
35	Can Giuoc – Branch Long An 500 kV – Nam Hiep Phuoc	4x3	New construction
36	Chau Doc – Hong Ngu	2x40	New construction
37	Chau Thanh (An Giang) – Cho Moi	2x0.5	New construction
38	Lap Vo – Hong Ngu	2x55	New construction
39	Tien Giang 500 kV – Branch Vinh Long – Sa Dec	4x15	New construction
40	Tien Giang 500 kV – Branch Cai Lay – Cao Lanh	4x4	New construction
41	Improvement of Tra Vinh – Vinh Long loadability	2x62.2	Upgradation, improvement of loadability
42	Thien Tan 1.4 PV power – Branch Nha Trang – Thap Cham (new circuit) (*)	2x2	New construction, synchronization of Thien Tan 1.4 PV power in Thien Tan PV power cluster approved in the revised PDP VII
43	Thien Tan 2.1 PV power – Branch Thap Cham – My Son Hoan Loc Viet PV power (*)	2x0.5	New construction, synchronization of Thien Tan 2.1 PV power in Thien Tan PV power cluster approved in the revised PDP VII
44	Thien Tan 3.3 PV power – Branch Thuan Nam – Vinh Tan (*)	2x5	New construction, synchronization of Thien Tan 3.3 PV power in Thien Tan PV power cluster approved in the revised PDP VII
45	Thien Tan 3.4 PV power – Branch Cam Ranh – Thap Cham (*)	2x0.5	New construction, synchronization of Thien Tan 3.4 PV power in Thien Tan PV power cluster approved in the revised PDP VII
46	Thien Tan 3.5 PV power – Branch Thien Tan Solar – Nha Trang (*)	2x9	New construction, synchronization of Thien Tan 3.5 PV power in Thien Tan PV power cluster approved in the revised PDP VII
47	Thien Tan 3.6 PV power – Branch Thap Cham – Da Nhim (*)	2x3	New construction, synchronization of Thien Tan 3.6 PV power in Thien Tan PV power cluster approved in the revised PDP VII
48	Hai Ly Binh Phuoc 1 PV power – Loc Tan 220 kV switching substation (*)	1x3.5	New construction, connection of the 220 kV substation of Hai Ly Binh Phuoc 1 PV power plant; connection plan was approved at Document 1632/TTg-CN dated 20 November 2020.
49	Backup plan for new construction an upgradation in the 2026 – 2030 period	308	New construction or upgradation, improvement of loadability
III	Projects to come into		

#	Name of transmission line	No. of circuit x km	Note
	operation in the 2031 – 2035 period		
1	Da Lat – Da Nhim 220 kV switching substation	2x30	New construction
2	Phuoc Dinh – Thuan Nam 500 kV (*)	2x20	New construction, RE capacity absorption in Ninh Thuan province
3	Thanh Hai – Thap Cham (*)	2x23	New construction, RE capacity absorption in Ninh Thuan province
4	Long Dien 500 kV – Phuoc Thuan	2x16	New construction, synchronization of Long Dien 500 kV substation
5	Hong Liem – Hong Phong 500 kV	2x6	New construction, connection of Hong Liem 220 kV substation
6	Da Phuoc 500 kV – Binh Chanh 2	2x10	New construction, synchronization of Da Phuoc 500 kV substation
7	Da Phuoc 500 kV – Binh Chanh	2x9	New construction, synchronization of Da Phuoc 500 kV substation
8	Da Phuoc 500 kV – Dam Sen	2x22	New construction, synchronization of Da Phuoc 500 kV substation. To consider enabling busbar separation in the Ba Queo 220 kV substation to minimize short-circuit currents
9	Transit Phu Lam – District 8 (instead of Phu Lam – Binh Chanh – District 8)		To transit and expand 220 kV loop circuit to minimize short-circuit currents. This will be synchronized with the 220 kV line of Da Phuoc 500 kV – Binh Chanh.
10	Long Dien 500 kV – Vung Tau 2	2x13	New construction, synchronization of Long Dien 500 kV substation
11	Long Dien 500 kV – Branch Ba Ria Vung Tau	2x10	New construction, synchronization of Long Dien 500 kV substation
12	Hoa Binh (BRVT) – Bac Chau Duc 500 kV	2x22	New construction
13	Hoa Binh (BRVT) – Son My 500 kV	2x34	New construction
14	Cu Chi 500 kV – Tay Bac Cu Chi	2x12	New construction
15	Hoc Mon 2 – Branch Cau Bong – Binh Chanh 1	4x1	New construction
16	Hon Quan – Branch Binh Long – Chon Thanh	2x4	New construction
17	Tan Bien 2 (PV power collector) – Tay Ninh 3 (*)	2x23	New construction
18	Thu Duc city 500 kV – Branch High-tech – District 9	4x5	New construction
19	Improvement of Cat Lai – Thu Duc 220 kV line loadability	2x13	To upgrade and improve loadability, synchronize with Thu Duc city 500 kV substation
20	Thu Duc city 500 kV	2x5	New construction, synchronization of

#	Name of transmission line	No. of circuit x km	Note
	substation – Cat Lai transited via Thu Duc 220 kV substation (separation of Cat Lai – Thu Duc linkage)		Thu Duc city 500 kV substation. To transit connection for minimizing short-circuit currents. To select a cross-sectional area with good loadability for the upgraded Cat Lai – Thu Duc 220 kV line.
21	Long Thanh 2 industrial zone – Branch Xuan Loc – Long Thanh	4x0.5	New construction
22	Improvement of Tan Dinh – Uyen Hung 220 kV line loadability	2x16	Upgradation, improvement of loadability
23	Binh Duong 2 500 kV connection transited via Ben Cat – Ben Cat 2 and Chon Thanh – Ben Cat 2	4x12	New construction, synchronization of Binh Duong 2 500 kV substation
24	Ben Cat 3 - Binh Duong 2 500 kV	2x10	New construction
25	Dong Nai 2 RE – Uyen Hung	2x31	New construction, connection of Dong Nai 2 220 kV RE substation. Recommendation: to select phase separation line with a large cross-sectional area to absorb RE capacity in Dong Nai province.
26	Bau Bang connection transited via Chon Thanh – Ben Cat and Chon Thanh – Binh Duong 2 500 kV	4x1	New construction. In case Binh Duong 2 500 kV substation comes into operation after Bau Bang 220 kV substation, the name of the project will be “ <i>Bau Bang – Branch Chon Thanh – Ben Cat and Branch Chon Tanh – Ben Cat 2</i> ”.
27	Hac Dich – Branch Phu My city – Bac Chau Duc 500 kV	4x2.6	New construction
28	Vung Tau 2 – Vung Tau	2x8.8	New construction
29	TBKHH Long An 1 – Can Duoc	2x18	New construction, synchronization of TBKHH Long An 1
30	TBKHH Long An 1 – Ben Luc	2x30	New construction, synchronization of TBKHH Long An 1
31	Ben Tre 500 kV – Branch Binh Dat – Ben Tre	4x13	New construction, connection of Ben Tre 500 kV substation
32	Ben Tre 500 kV – Branch Thanh Phu – Mo Cay	4x12	New construction, connection of Ben Tre 500 kV substation
33	Ben Tre 500 kV – Ba Tri (RE collector substation)	2x16	New construction, RE capacity absorption in Ben Tre province
34	Dong Thap 500 kV – Branch Hong Ngu – Lap Vo	4x12	New construction, connection of Dong Thap 500 kV substation
35	An Giang 500 kV – Branch Kien Binh – Rach Gia	2x26	New construction, connection of An Giang 500 kV substation
36	An Giang 500 kV – Chau	2x28	New construction, connection of An

#	Name of transmission line	No. of circuit x km	Note
	Thanh (An Giang)		Giang 500 kV substation
37	Thoi Lai – Branch O Mon – Ca Mau	4x3	New construction
38	Vi Thanh – Branch O Mon – Ca Mau thermal power	4x12	New construction
39	Cau Ngang – Branch Duyen Hai – Tra Vinh	4x2	New construction
40	Soc Trang 220 kV – Long Phu 500 kV	2x35	New construction, RE capacity absorption in Soc Trang province
41	Tran De - Long Phu 500 kV	2x24	New construction, RE capacity absorption
42	Improvement of Soc Trang – Chau Thanh (Hau Giang) loadability	2x50	Upgradation, loadability improvement for RE capacity absorption
43	Bac Lieu 500 kV – Branch Hoa Binh – Bac Lieu	4x6	New construction, synchronization of Bac Lieu 500 kV substation
44	Dong Hai (RE collector substation) – Bac Lieu 500 kV (*)	2x30	New construction, RE capacity absorption
45	Phuoc Long (RE collector substation) – Bac Lieu 500 kV (*)	2x10	New construction, RE capacity absorption
46	Nam Can – Dong Hai (RE collector substation) (*)	2x70	New construction, RE capacity absorption. In case the construction of Dong Hai 220 kV substation (RE collector substation in Bac Lieu province) is behind schedule, the 220 kV line Nam Can– Bac Lieu 500 kV will be constructed first.
47	Ca Mau 3 – Branch Ca Mau 1 wind power – Ca Mau	2x7	New construction
48	Ca Mau 500 kV – Branch Nam Can – Ca Mau	4x8	New construction, connection of Ca Mau 500 kV substation
49	Ca Mau 500 kV – Branch Ca Mau 1 wind power – Ca Mau	4x8	New construction, connection of Ca Mau 500 kV substation
50	Ca Mau 4 (RE collector substation) – Nam Can (*)	2x30	New construction, RE capacity absorption
51	Backup plan for new construction and upgradation in the 2031 – 2035 period	272	New construction or upgradation, loadability improvement
IV	Projects to come into operation in the 2036 - 2040 period		
1	Da Lat 2 – Da Lat	2x12	New construction
2	Tanh Linh – Branch Ham Thuan – Long Thanh	2x0.5	New construction
3	Tan Chau 2 – Branch Binh Long – Dau Tieng Lake PV power	2x10	New construction

#	Name of transmission line	No. of circuit x km	Note
4	Go Dau – Ben Cau	2x10	New construction
5	Cu Chi 2 – Branch Cau Bong 500 kV – Phu Hoa Dong	2x10	New construction
6	Cai Be 2 – Branch My Tho 500 kV – Tan Phuoc	4x1	New construction
7	Dat Do – Long Dien 500 kV	2x7	New construction
8	Vinh Cuu – Branch Dong Nai 1 RE – Tan Uyen	4x2	New construction
9	Xuan Loc 2 - Dong Nai 2 500 kV	2x22	New construction
10	Dong Nai 2 RE – Branch Binh Duong 1 RE	2x45	New construction. Recommendation: to select phase separation line with large cross-sectional area for absorbing RE capacity in Dong Nai province.
11	Ben Luc 2 – Duc Hoa 2 500 kV	2x17	New construction
12	Vinh Quang – Branch Rach Gia – Kien Binh	2x1	New construction
13	Can Giuoc 2 – Branch TBKHH Long An 1 – Can Duoc	4x4	New construction
14	Cho Moi 2 – Branch Lap Vo – Dong Thap 500 kV	2x14	New construction
15	Ke Sach – Branch Long Phu 500 kV – Can Tho	2x5	New construction
16	Ca Mau 5 (RE collector substation) – Ca Mau 500 kV (*)	2x26	New construction, RE capacity absorption
17	Backup plan for new construction and upgradation in the 2036 – 2040 period	261	New construction or loadability improvement
V	Projects to come into operation in the 2041 – 2045 period		
1	Dong Phu – Dong Xoai	2x15	New construction
2	Xuyen Moc – Phuoc Thuan	2x14	New construction
3	Nha Be 2 – Branch Nha Be 500 kV – Phu My 500 kV	4x1	New construction
4	Thu Duc 2 – Branch Thu Duc – Tan Uyen 500 kV	4x2	New construction
5	Tan Uyen 2 - Tan Uyen 500 kV	2x6	New construction
6	Dong Nai 3 500 kV – Long Binh connection transited via Tam Phuoc (separating Long Binh – Tam Phuoc linkage)	2x13	New construction, synchronization of Dong Nai 3 500 kV substation
7	Dong Nai 3 500 kV – Branch Ho Nai- Tam Phuoc	4x8	New construction, synchronization of Dong Nai 3 500 kV substation

#	Name of transmission line	No. of circuit x km	Note
8	Nhon Trach 2 - Branch Nhon Trach 3 thermal power - Nhon Trach industrial zone	4x1	New construction
9	Cho Gao – Branch Binh Dai – Ben Tre	2x12	New construction
10	Vinh Long 4 – Branch Vinh Long – Vinh Long 3	2x11	New construction
11	Backup plan for new construction and upgradation in the 2041 – 2045 period	371	New construction or loadability improvement

Note: (*) The volume of RE connection in the above table is estimated. The accurate volume depends on actual connection progress and options applicable to wind and solar power projects.

(**) Backup transmission projects, project addition or changes in high scenario vs. those in baseline scenario.

D. Risk scenario

Table d.1. List of power grid projects connected to reserve power supply by 2030 in the schedule risk scenario

#	Name of project	No. of circuit x km	Voltage level (kV)	Region	Operational period	Note
1	Hai Phong 2 LNG (Cat hai – Cai Trap) – Hai Phong	2x50	500	Northern region	2026-2030	New construction, synchronization of Hai Phong 2 LNG. Changes in baseline scenario: Hai Phong 2 LNG – Hai Phong line will be constructed first instead of Hai Phong 2 LNG - Branch Hai Phong – Hai Phong 2.
2	Hai Phong 1 LNG (Tien Lang) – Branch Hai Phong 2 – Hai Phong	4x10	500	Northern region	2031-2035	New construction, replacement of Hai Phong 1 LNG – Hai Phong line
3	Thanh Hoa LNG – Branch Nghi Son LNG – Quynh Lap	4x5	500	Northern region	2026-2030	New construction, synchronization of Thanh Hoa LNG, earlier than 2036-2040
4	Thanh Hoa LNG – Nam Ha Noi	2x220	500	Northern region	2026-2030	New construction, synchronization of Thanh Hoa LNG, to speed up in risk scenario
5	Hai Phong 2 LNG – hai Phong 2		500	Northern region	2031-2035	New construction, changes from baseline scenario
8	Long Son LNG – Bac Chau Duc	2x36	500	Southern region	2026-2030	New construction, earlier than baseline scenario schedule
9	Binh Dien – Branch Long Son LNG – Bac Chau Duc	2x10	500	Southern region	2031-2035	New construction, connection of Binh Dien 500 kV substation to replace the 500 kV line Binh Dien – Bac Chau Duc in baseline scenario