POLICY NOTE

DECENTRALIZED RENEWABLE ENERGY BROKE VIETNAM'S POWER PLANNING LOGIC

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Vietnam Initiative for Energy Transition

NOTES ON THE 1st DRAFT OF VIETNAM'S POWER DEVELOPMENT PLAN VIII

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Abstract

Early 2021, Vietnam's Mininistry of Industry and Trade released for public discussion the draft Power Development Plan VIII describing how the country will produce its electricity for the next ten years. Focused on developing gas-fired power, the draft reuses a renewable energy development strategy elaborated six years ago. That strategy was ambitious then but is now outdated by an ongoing solar and wind boom. Obsolete before publication, the draft fails to plan the ongoing energy transition which is all about PV, wind, storage, transport electrification, and increasing climate policy goals. To remain relevant in the energy transition era, quinquennial planning update has to become more agile.

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Executive Summary

In February 2021, Vietnam's Ministry of Industry and Trade released the draft Power Development Plan VIII (draft PDP8), which outlines how the country will produce its electricity for the next ten years.

The draft focuses on developing gas-fired power. It reuses a renewable energy development strategy elaborated six years ago, ambitious then but now outdated by the solar and wind boom. Over the next ten years, it would more than double the sector's CO_2 and PM2.5 emissions.

The bias towards gas-fired power generation is more the symptom of a problem in the planning process than the outcome of well-informed political choices. In recent years, Vietnam's Power Development Plan 7 turned into a record-keeping list of authorized energy projects. That broke the logic of planning.

The function of a masterplan is to think forward five to ten years. The future may be unpredictable; there will always be surprises like the COVID crisis. This is why a plan should identify no-regret investments, which remain relevant for a wide range of scenarios.

Policymakers need a coherent strategy about rooftop PV, floating PV, offshore wind, electricity storage, grid expansion financing, production capacity procurement with auctions, transport electrification, and long-term climate policy options. The current draft PDP8 study is short on these questions. Beyond the socio-economic plan, the PDP should coordinate with the marine and transportation plans.

There is an opportunity to address these topics by revising the draft to finalize the PDP8. Furthermore, the planning process must become more agile to keep up with the accelerated changes in the energy landscape. The draft PDP8 proposes a Law on Renewable Energy, and new regulatory institutions working on a shorter than quinquenal cycle. These changes are necessary to restore the planning process function as an useful decision support mechanism in the de-centralized energy systems era.

1 Introduction

In February 2021, Vietnam's Ministry of Industry and Trade released the draft Power Development Plan VIII (Institute of Energy, 2021) (draft PDP8), which outlines how the country will produce its electricity for the next ten years. Under Article 12 of the Planning Law, effective 01 January 2019, regarding the public participation in the planning activities, the draft has been open for comments. This text shares a few thoughts regarding this vital discussion about keeping the lights on with high reliability at an affordable financial, social and environmental cost.

This Power Development Plan, like all others, is the outcome of a rational decision analysis process. The planning logic, visible in the outline of the draft PDP8, is as follows:

a. Public and private investors propose electricity production projects. Currently, about 162GW of projects is registered, disproportionally in the Central region.

b. Economists forecast how much electricity will be needed. This is about 9% more per year until 2025, with the Northern region growing faster than the Central or Southern parts.

c. The Government authorizes as many projects as needed according to its priorities.

d. Knowing how the load and sources will expand in each province gives a roadmap for grid engineers to build the necessary transmission network. See the Map 1 at the end of this document.

e. This reveals the amount of investment to be financed: a lot. According to the draft PDP8, over the next ten years, the power sector requires USD9.5bn per year for generation and USD3.3bn per year for transmission.

The total investment required is more than half the Vietnam trade surplus, which was 20 billion USD in 2020. The investment need, about 300 trillion VND per year, exceeds the Vietnam state expenditure on education and training, which was 245 trillion VND in 2019. The State owned entreprises do not have the financial surface to sustain the required investment rate. Total assets of the Vietnam Electricity company was 706 trillion VND in 2018. The Power Development Plan has billions-dollars-per-year implications for the private sector.

The hard choices are in step c. The projects' selection is based on multiple criteria: national energy security, costs, and other environmental/social objectives. This draft PDP8 is built following Vietnam's Politburo Resolution No. 55 (Vietnam's Politburo, 2020, 55), which gave two

orientations: "*To synchronously and rationally develop and diversify various types of energy; prioritize full and efficient exploitation and use of renewable energies, new and clean energies;*" and "*To prioritize to gas-fired power development and suitable roadmap to reduce the share of coal-fired power.*" The focus on natural gas and renewable energy sources makes a change compared to the past strategy since the previous plan (PDP7) focused on developing a fleet of coal-fired power plants to meet the growth of electricity needs.

Since Resolution 55 defines both renewable energies and gas-fired power as priorities, there is a balance to be found. Coal and LNG supporters said that the new focus on renewable energy was excessive: solar and wind would never cover the country's energy consumption and require too much capital. On the other side, energy transition supporters (Brown, 2021) noted that the draft PDP8 focused too much on coal and gas, which failed to deliver according to the previous plans. Compromises are always criticized from both sides, but being attacked from both sides is not proof that the plan found a just balance. Does it? We will find the answer discussing Table 1, which compares the key 2030 targets of the draft PDP8 with the present situation and trends.

Image by Johannes Plenio from Pexels

Table 1: PDP8 objectives in the base case, compared to past and present trends

	Past		Present	PDP8 draft	
	2010	**2019**	**2020**	**2025**	**2030**
Electricity used (TWh)	85.4	210.5	216.8	335	491
Total installed capacity (GW)	20.4*	55.9*	69.3	102.1	137.7
CO_2 emissions (Mt)			118	186	246
PM2.5 emissions (kt)			9.450	21.312	31.707
Installed capacity by technology and energy source (GW)					
Hydroelectricity	**8.575**	**20.632**	**20.685**	**24.497**	**25.992**
Large hydro >30 MW			*17.085*	*19.697*	*19.792*
Small hydro <30 MW			*3.600*	*4.800*	*5.000*
Coal-fired power plants	**3.941**	**20.267**	**20.431**	**29.523**	**37.323**
Domestic coal			*14.281*	*16.841*	*16.941*
Imported coal			*6.150*	*12.682*	*20.362*
Gas/oil-fired power plants	**7.846**	**9.070**	**9.030**	**14.055**	**28.871**
Domestic gas			*7.097*	*9.054*	*10.636*
Imported LNG			*0*	*4.103*	*18.097*
Oil			*1.933*	*0.898*	*0.138*
Solar PV	**0**	**4.696**	**16.640**	**17.240**	**18.640**
Wind power	**0**	**0.377**	**0.630**	**11.320**	**18.010**
Onshore and nearshore			*0.630*	*11.320*	*16.010*
Offshore			*0*	*0*	*2.000*
Biomass & other renewable	**0.049**	**0.325**	**0.570**	**2.050**	**3.150**
Imports	**0**	**0.570**	**1.272**	**3.508**	**5.677**
From Laos	*0*	*0.570*	*0.572*	*2.808*	*4.977*
From China	*n/a*	*n/a*	*0.700*	*0.700*	*0.700*
*Storage***			*0*	*0*	*1.200*

Sources: PDP8 draft 3 chapter 1, chapter 6 p. 239, chapter 9 pp. 352, 354.

*Notes: *Excluding import capacity from China. **Includes pumped hydro and batteries.*

2 What the recent past reminds about the best-laid plans

We can compare the Past and Present columns in the table with the previous plan –PDP7A, the 2016 revision of the PDP7– to understand the planning exercise's nature better.

The PDP7A forecasted the 2020 national commercial power output to be between 228 TWh and 245 TWh. The actual level was 216.8 TWh in 2019, with a pre-COVID power output growth rate of 9.7% per year (and a 2019-2020 growth rate of about zero). At that rate, the power output would have been within the range of the forecast. The demand estimate was overestimated, although not by much. The over-estimation of the economic growth rate forecasts used to prepare the PDP7A explains well this error.

The PDP7A planned to have 26 GW of coal-fired generation capacity, 9 GW of gas-fired capacity, 18 GW of hydro, 0.85 GW of solar power, and 0.8 GW of wind power in 2020. In reality, coal-fired generation capacity increased only to 20.4 GW in 2020. While EVN delivered projects mostly as planned, projects under the responsibility of other state-owned enterprises and foreign investors were delayed. Gas-fired generation capacity was 7.2 GW in 2020, as the domestic offshore fields were not put in production as planned.

The PDP8 planned to have 4.6 GW of nuclear power capacity operational by 2030. The National Assembly officially stopped the Ninh Thuan nuclear project in November 2016, eight months after the PDP7A was published. As the plant was planned to start in 2028, keeping or abandonning it had no influence on the electricity supply for the next ten years.

Facing the risk of electricity shortages as early as 2020-2021, the Government increased the price at which EVN buys solar and wind power. While it takes at least five years to build a coal power plant, it takes only one year to set up a solar farm. Between 2018 and 2020, photovoltaics reached 25% of Vietnam power generation capacity: 7.9 GW for rooftop PV, 8.6 GW for ground-mounted PV. Now Vietnam has more solar power than the UK or South Korea. About 11 GW of wind power capacity are currently under construction, with 4.43 GW on track to have COD before 31/10/2021 according to EVN (letter 1380/EVN-TTĐ on 22/03/2021).

The transmission network did not anticipate such a significant deviation from the plan. Consequently, in 2020 and 2021, we waste a sizable fraction of the electricity produced by solar and wind farms because it cannot be transmitted to the users. Considering the delay in

grid investment, it takes two to three years to solve these issues, assuming there are no difficulties acquiring the land use authorizations for substations and transmission lines.

Reality always derails plans. As the proverb says, "The best-laid plans of mice and men oft go astray." Since a gap between well prepared rational plan and the course of events is unavoidable, timely adaptation deviating from the initial plan is always necessary to achieve desired outcomes. Here, the Government changed the policies to add generation capacity and alleviate the supply security issue.

The renewable energy boom has demonstrated that a 5-year planning update cycle does not match the timescale of today's changes in the energy system. Solar PV gained a 25% share in the capacity mix in two years. We can expect more rapid advances in decentralized energy production. The draft PDP8 proposes to give additional responsibilities to the National Steering Committee for Electricity Development in Implementation of the PDP 8 (conclusion 19.11) and to allow power planning on a one or two years cycle as a basis to organize bidding and choose investors for power projects (conclusion 19.12). These recommendations about regulatory changes are more critical than long term forecasts.

Da Mi floating solar. Image by VIET.

3 Comments on how the PDP8 scenario was defined

Before we go back to Table 1 to see how the draft PDP8 balances the 'prioritize renewable energy and 'prioritize gas-fired power', let us discuss how these numbers were obtained.

As the introduction said, the hard choices in the planning process are to select projects meeting the demand that best fit with the policy goals. The draft PDP8 conducted a very comprehensive study to that end. It explored a set of 11 scenarios using models with detailed technological, spatial and temporal resolutions. It then performed a multicriteria ranking of these scenarios using five dimensions: Fit with current policy goals, System cost, CO_2 emissions, New grid needs, Diversification. The winning candidate KB1B_CLNLTT is defined as follows (p.383-384):

This scenario adopts the 2015 Renewable Energy Development Strategy goals (Nguyễn Tấn Dũng, 2015) (Decision 2068). Accordingly, the proportion of electricity produced from renewable sources (including large hydro) reaches 38% by 2020, 32% in 2030 and 43% in 2050. […] This strategy is also suitable with Resolution 55 (Vietnam's Politburo, 2020, 55), which stipulates the rate renewable energy sources in the total primary energy supply reach 15-20% by 2030 and 25-30% by 2045, corresponding to the proportion of electricity of renewable energy in the total electricity National production capacity of about 30% in 2030 and 40% in 2045.[…] External costs of emissions are included in the cost minimization.

Further sensitivity analysis of this scenario examined how it performs when under perturbed conditions: different load, a dry year, different primary fuel prices, different cost of offshore wind technology, different CO_2 prices. We want to offer these academic comments on the way the scenario was selected and analyzed:

- Having only one 'vision for 2045' is a scientific shortcoming. A robust planning exercise should instead aim to find "no regret solutions", that is, investments in the short term that will still be useful in a long time for a broad range of plausible futures. There is no need to discuss the plan's post-2030 targets. These numbers have little forecast value; authorities will revise the strategy many times before.

- This sensitivity analysis severely underestimated the variability of future fossil fuel prices. The draft PDP8 considers an uncertainty range for LNG price in 2025 of 10.6 – 11.0 USD/MMBTU and coal 81 – 88 USD/ton (page 402). Fossil fuel prices variability is much greater than that. For example, LNG's spot price in Asia (Platts Japan-Korea

Marker) was around 2 USD/MMBTU mid-summer 2020, before it hit a record high of around 20 USD/MMBTU in January. While long-term supply prices are not as volatile as the spot price, most are indexed on uncertain oil prices. The PDP8 draft fails to provide an adequately calibrated analysis of the economy's exposure to fossil fuel price risks.

- The draft PDP8 scenarios analysis explore only a tiny part of the space of feasible scenarios (see page 387, for example). The plan is an official document; it legally has to be based on projects already signed. But following old policy documents is not a legal constraint. On the contrary, the new plan has legitimacy to account for recent development and propose a new vision. Thus going beyond the 2015 renewable energy development strategy is allowed. For the low carbon scenarios KB4_CO_2, it could have been remembered that Vietnam belongs to a club of countries vulnerable to climate change, which publicly and officially subscribed to the goal of carbon neutrality by 2050.

- The five dimensions used in the multicriteria ranking miss some of the system's most desirable qualities: flexibility and finance availability. Finance availability is about the appetite of investors for different technologies. It is crucial as far as the private sector will fund most of the new infrastructure. System flexibility is the speed at which the power system responds to operation decisions for ensuring supply-demand balance. It is crucial to the stable and secure operation of a system that integrates significant shares of intermittent energy sources, and this is already the case. It is urgent to study the role of energy storage in much more detail.

- The draft PDP8 coordinates vertically with the socio-economic masterplan. It should also link horizontally with the Transport plan. The PDP8 is an opportunity to anticipate how road transport electrification will change the load curve and infrastructure requirements. Link with the Marine plan is also necessary to harmonize the location and capacity of future seaports necessary for importing fuels and for the offshore wind industry.

Within these limits, we admire the study's quality and comprehensiveness, which is totally in line with the planning logic and laws. Including external environmental costs in the calculation was an important step forward. The publication of the modelling assumptions as a technology catalogue (Jakob Lundsager, Nguyễn Ngọc et Mikael Togeby, 2019) and a more open dialogue with the community of experts and stakeholders certainly improved the results' transparency and quality.

4 A look at the 2025 and 2030 targets

Finally, let us look at the 2025 and 2030 objectives in Table 1.

The table's top shows a 200% to 250% growth in system size, greenhouse gases and dust pollution over the next ten years. Sadly, these numbers remind us that much more change is needed to put the electricity sector on a sustainable development trajectory. The draft PDP8 points out correctly that it achieves reduction below the baseline according to the current national targets. At some point these targets will become more ambitious and switch to stabilizing CO_2 emissions, before moving to carbon neutrality. This target switch may well happen before 2045, that is within the PDP8 planning horizon. Instead of reduction below a counter-factual baseline, showing the absolute numbers of environmental damage could motivate more strongly key and non-key energy users to improve energy efficiency.

Resource potential constrains hydroelectricity and biomass; they do not weigh much in the match between gas and other renewables. The case of biomass illustrates an essential point about state-owned vs private ownership of generation assets. In the Renewable Energy Development Strategy, the Government planned to create for State-owned utilities a Renewable Portfolio Standards system (RPS). The RPS system would mandate operators to source a fraction of their energy from renewable sources – directly or by buying certificates from other operators who have excess renewable energy capacity. In many countries, utilities fulfilled their RPS mandate by co-firing biomass along with coal in their thermal plants. Such constraints are more difficult to legally impose on private operators, who have been given the protection of a power purchase agreement before their Build-Operate-Transfer investment.

For coal, the PDP8 adds no new coal-fired thermal power other than those already under construction. Yet, the pipeline of projects is enough to add 9 GW between 2020 and 2025. This figure raises concerns about a strong dependence on imported primary fuels when the domestic coal and gas production remain the same or decline. According to the General Department of Customs, Vietnam imported approximately 55 million tons of coal in 2020, mainly for electricity generation. In the last five years, many coal plants projects faced difficulties and delays. It is not clear from our reading of the draft PDP8 if and how these problems will be solved. Most financial institutions, banks and insurers in the world have stopped funding new construction projects of this type in an attempt to show their commitment to the Paris Agreement 2015 to fight against climate change. The next 5-years power development plan of China, to be published later in 2021, maybe the turning point for this primary energy source.

The draft PDP8 sets to develop 18 GW of imported LNG generation capacity over the next ten years. This technology has complementarity with intermittent renewables, as gas turbines can ramp production up and down quickly. It is also possible to have long term flexibility by renting instead of building: floating regasification, storage and even generation units can be returned or moved where necessary. Analysts might have considered this real-option dimension more in the planning: LNG is not only for traditional existing power centres. The analysis also did not weigh in its multicriteria analysis the risks of macroeconomic costs and energy security issues of importing large amounts of LNG, which are essential to inform policy. Finally, the PDP8 also inherits a pipeline of delayed projects from the previous plan, mainly those using domestic gas. It is not clear that their issues are resolved.

The draft PDP8 goals for solar power are severely outdated. The plan follows a renewable energy development strategy defined six years ago. It was ambitious at that time but needs rethinking now after the solar and wind boom. The draft PDP8 imposes that the share of renewable energy sources used to produce electricity decreases from 38% to 32% between 2020 and 2030. While the country succeeded in installing 16GW in two years, the draft restricts the sector by adding 120 MW per year until 2025. Floating solar technology technologies has not started to give their potential. Auctions can be conducted to benefit from lower prices and control the geographic location of the development - the Northern provinces are lagging when it comes to solar. And there are still millions of rooftops available.

Installed wind power capacity was about 630 MW in 2020, and the draft PDP8 aims for 11.3 GW in 2025. This is going to be outdated fast. The 2025 target is to build all projects already added in the previous masterplan, for which the deadline is the end of October this year, 2021. At the end of the year, we are likely to be in the same situation as for solar PV: the plan objectives are achieved, now what? The 2030 target adds onshore projects currently registered but not approved, plus 2 GW of offshore wind power out of 44.6 GW of identified projects.

The bottom rows of Table 1 are about imports and storage. Both capacities are essential in the long run. The interconnects' sizes are politically determined. They are not a control variable in the PDP8. Trading electricity is not just trading kWh; it also contributes to grid stability. Connecting to a grid rich in dispatchable hydro, like Laos, will be an asset for a grid rich in must-run intermittent renewable, like Vietnam. Storage is also a requirement to integrate a high share of solar and wind. It is logical for the Power Development Plan to reconsider the storage strategy at the same time as the solar and wind targets.

5 Conclusion

In introduction, we asked if the draft PDP8 found a balance between two priorities. The answer is negative. The draft envisions gas-fired power as the backbone of the system development for the next 10 years. It practically ignores the offshore wind option, which could be a game-changer.

There is a problem with the solar and wind targets, which are outdated compared to the recent developments. Since 1975, the Vietnam energy system has followed a constant line: develop the domestic energy sources (Hà Dương Minh et Trương An Hà, 2019). The first twenty years the focus was on hydroelectricity, then it went to domestic natural gas for ten years, and then to domestically produced coal for ten years. The solar and wind boom since 2018 is in line with this constant need to ensure energy independence. Thus, relying on importing fossil fuels goes against the long-term historical trends as much as against short term recent development.

This is more a symptom of a problem in the planning system than the outcome of well-informed political choices. The planning was not agile enough to catch up with the renewable energy boom of the last three years.

Planning is always a challenging exercise, but the conditions are the moment are unstable if not chaotic. In 2019, the new planning Law became effective in January, its application Decree was issued in May (Nguyễn Xuân Phúc, 2019), and the Prime Minister's decision on PDP8 contents was issued in October. Some technological costs are falling fast, upheaving the merit order of different options. The grid's nature changes from centralized to decentralized. Power development accelerated. Nowadays it encompasses herding hundreds of small projects, not only planning GW-scale power plants to open years from now. The position of the State is ambiguous, as in a general move towards a market-oriented economy, the energy system remains as a national security asset with many natural monopolies. Instead of command and control, the State has to rely on indirect instruments, and the private sector is agile and fast to move when the incentives are there. Not to mention the global health and economic crisis, on top of climate change redefining energy policy.

Rational decision making remains crucial to continue the success story of the Vietnam energy system. The planning logic exposed in the introduction must evolve to new conditions. The more uncertain environment justifies the PDP8 draft's proposition to have a shorter planning cycle. Under the necessary new supervisory institutions, short term no-regrets investment could receive more attention. At the same time, the long-term strategy function of

the PDP should be restored. In the last years, PDP7 has not been used as a planning document but devolved as an administrative list of authorized projects. The draft PDP8 proposes a Law on Renewable Energy. This could be a venue to update the renewable energy development strategy from 2015, and update the PDP accordingly. There is a need to plan the continuous expansion of the solar PV and wind sectors, including offshore.

Image by Nikolay Shulga from Pexels

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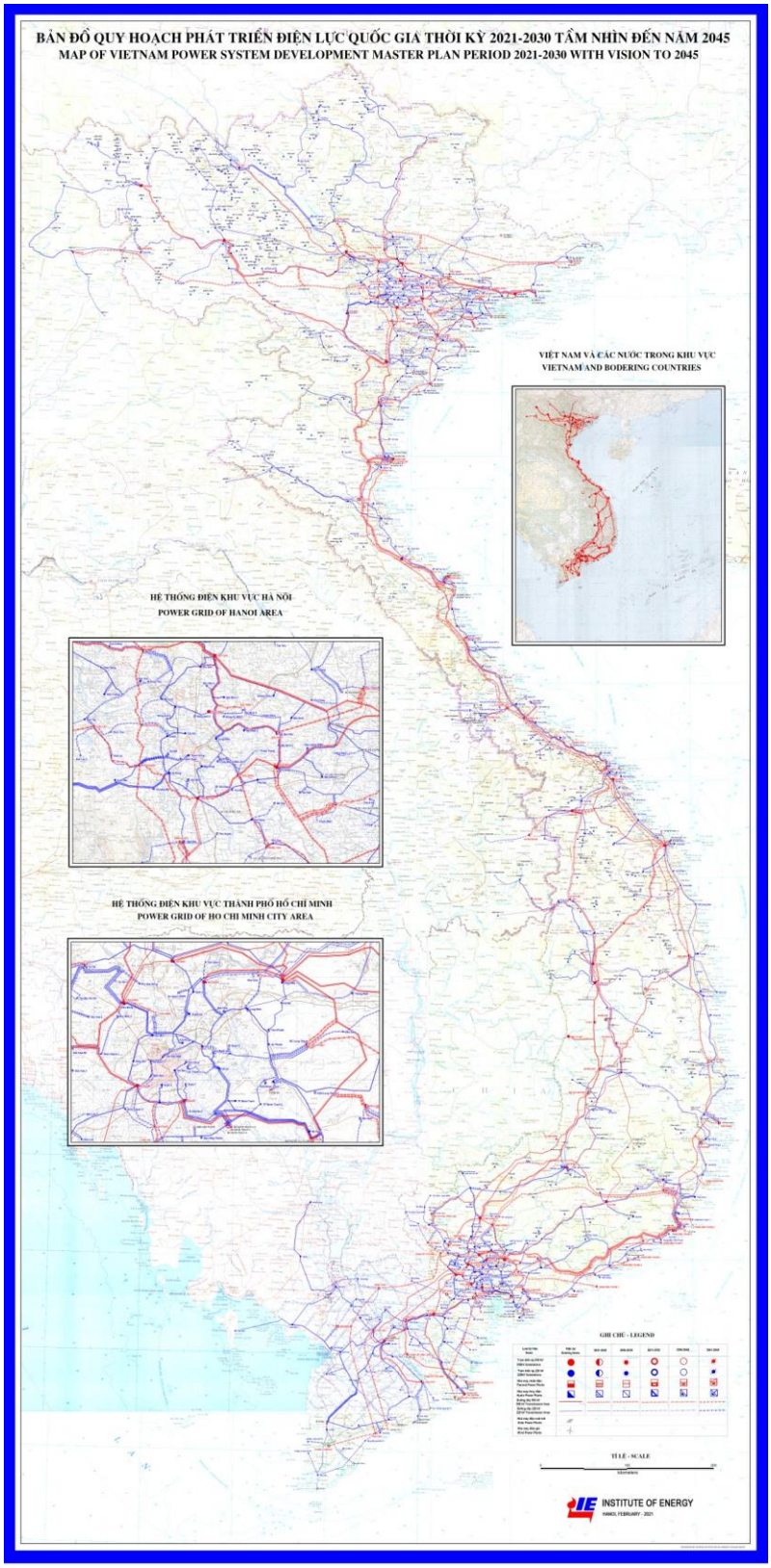
Figure 1: Blueprint to develop the electricity system in Vietnam, PDP8 draft 3.



Sources: Institute of Energy

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