

POLICY BRIEF

**A chance to reduce coal share in the Vietnam power mix
toward sustainable development**



I. INTRODUCTION

Power development plays a very important role in a country's economy development, as well as assurance of social welfare and national security.

Revised Law of Electricity required that electricity planning have to be synchronized with power sources planning while considering renewable and sustainable energy sources. Concurrently, the planning must show the connection between local planning and national planning. It must be effective and feasible for investment, and appropriate for sustainable development and environmental security.

Power Development Plan VII (PDP VII) was approved by Prime Minister by Decision 1208/QĐ.TTg released on July 21st 2011 which has been activate for over 3 years. In addition to its positive contribution on providing electricity for the whole nation from the status of power shortage to provide enough with reserve, PDP VII has expressed some macroscopic drawbacks interfering its feasibility, which are:

- High electricity demand forecast, which leads to over demand of capital investment that outreaches the economy's capability. Excessive dependence on coal power results in enormous amount of required coal for electricity generation which maybe not feasible even import coal. This is absolutely not environmental-friendly and against sustainable development.
- The economic effectiveness was not fully taken into account, particularly the energy efficiency and conservation. There is also a lack of connection to the electricity market developing process.
- Renewable energy was not appraised as it should have been.

Therefore, it is essential and urgent to revise the PDP VII in order to overcome the above shortages.

Recently, Green Innovation and Development Centre (GreenID) and Vietnam Sustainable Energy Alliance (VSEA) have been conducted many researches. They included review and assess the implementation of PDP VII up till 2013; evaluation of planning methodology; re-estimation of the electricity demand including re-valuate the share and potential of renewable energy in Vietnam power mix; analysis of coal market and electricity price; monitoring field trips for environmental and social impact assessments; and investigation into current barriers and potential to increase the share of renewable and sustainable energy. By composing the brief conclusion of those researches' key findings, it is hoped to contribute to the upcoming revision of Power Development Plan VII.



I. SUMMARY OF CONTENT AND CURRENT STATUS OF PDP VII

1. There are three social economic development scenarios created in the PDP VII. The higher and lower scenarios were developed as backup options. The base scenario, which has been selected as the main option, shows the economic development as follow:

Period	2010	2015	2020	2030
Total GDP %	7.5	8.0	7.8	

2. Consequently, the amount of commercial electricity and generated electricity are

Year	2010	2015	2020	2025	2030
Generated electricity	100	194.3	329.4	489.6	695.1
Commercial electricity	86.7	169.8	289.8	430.8	615

3. The power mix and required electricity output till 2030:

Due to the limitation of nationwide primary energy, PDP VII has to depend mainly on coal power. The expected installed electricity capacity and electricity output in 2030 vision are:

Power plants	Total capacity		Total generated output	
	MW	%	Billion kWh	%
Total capacity and production, in which:	137,000	100	695	100
Hydropower	22,500	16.4	60.3	8.7
Coal-fired power	76,300	55.7	431.0	62.0
Gas	17,300	12.6	90.9	13.1
Renewable energy	4,900	3.8	13.7	2.0
Nuclear power	10,700	7.8	74.4	10.7
Imported electricity	5,300	3.8	24.9	3.6

Notice: Renewable energy includes micro-hydroelectricity.

4. Domestic and imported coal demand for electricity generation under base scenario

Year	2012	2015	2020	2025	2030
Coal demand for electricity generation	12.6	33.3	79.0	116	188.7
Imported coal	0.83	3.2	46.7	83.4	157.5

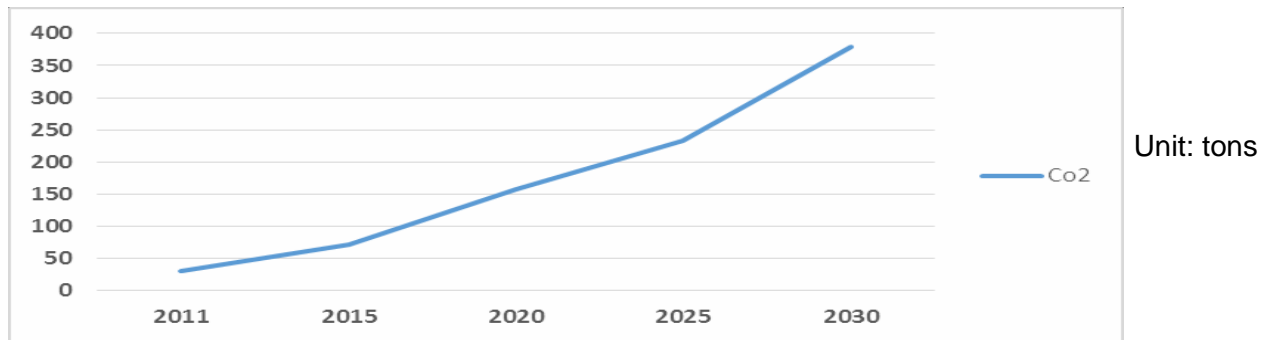


5. Environmental impacts according to PDP VII:

- By coal-fired power:

Greenhouse-Gas emission by coal-fired power

Unit: million tons CO₂



The GHGs emission by coal power stands for 89% of total GHGs emission by energy sector.

Air pollutants emission by coal-fired power

Year	2011	2015	2020	2025	2030
Dust	4,796	6,547	14,050	21,230	34,462
SO ₂	31,710	50,080	105,463	151,568	246,448
NO _x	72,6	85,152	119,778	153,349	118,196

- By hydroelectricity: The most impact to environment and society by hydroelectricity planning is the migrant of 61,571 people and other problems related to resettlement, affected forest area and river biodiversity changes.

6. Assessment on economic damages by environmental pollution

Unit: million USD

Year	2011	2030
Economic damages by climate change due to coal-fired power	1,200	900
Economic damages by acid rain	94	729
Human health damage by dust, SO ₂ and NO _x	99	639

7. PDP VII's capital investment:

The demanded investment in order to carry out the PDP VII following the base scenario is:

- 2011 – 2020 period: 48.8 billion USD, average 4.88 billion USD/year.
- 2021 – 2030 period: 75 billion USD, average 7.5 billion USD/year.

(Source of all data above: PDP VII)



II. PDP VII PERFORMANCE TILL 2013

Until 2013, the results of 3 years of PDP VII's implementation are:

	PDP VII	Actual Result	Deviation
Actual demand on electricity in 2013	131 billion kWh	115 billion kWh	16 billion kWh (the PDP VII pre- dicted 16 billion kWh higher than the real demand)
Installed capacity	23,957 MW	20,010 MW	3,947 MW (the PDP VII predicted higher than reality)
Electricity growth rate (2011 – 2015)	14.1 %	9.9 %	4.2 % (the PDP VII predicted higher than reality)

- Due to the slow growth rate of the whole economy (GDP less than 6%), the actual demand only stands for 89% of PDP VII's prediction. However, it is the first time Vietnam has enough electricity with reserve included.
- Because of the shortage and unfocused capital investment, delayed ground clearance, low qualified contractors, lack of supporting devices, the installation of electricity source and grids are overdue. These leads to the fact that there are places having no electricity access, while others have excess of power.

III. THE REMAINING PROBLEMS AND DRAWBACKS OF PDP VII

1. Over-forecasting of electricity demand

Electricity demand forecast is one of the most important stages of the power development plan. Accurate or nearly accurate forecast will contribute to the balanced development of electricity source, transmission and supply. Over-forecasting of electricity demand will require costly investment for ground clearance and infrastructure which may be infeasible. The unnecessary power plants would be wasteful and would cause more serious environmental pollution. The reasons for PDP VII's high electricity demand forecast are:

- GDP forecast outreach reality: Vietnam GDP for the period of 2010 to 2015 was projected to range from 7.5 % to 8%. In reality, it was only 6%, similar to the following years.
- Methodology in planning is inappropriate, data is lacked and simplified (details below)



2. Underestimation of energy efficiency and conservation

PDP VII set the aims on the energy efficiency (EE) too low (from 1 to 3%/year) to compare with the high potential. Currently, EE has been only promoted and encouraged, not yet been requested as a formal regulation, which resulted in the high forecast of electricity demand. If the forecast could be lower thanks to EE, there will be less coal power plans needed, less investment cost, less coal imported, less greenhouse gas emission, less impacts on the environment, whereas strengthening the energy security.

3. Sustainable development is not thoroughly taken into account

PDP VII has been developed with more priorities to economic growth than sustainable development, which is the balance of economic, social and environmental development. The social and environmental protection targets have been only encouraged, not yet been set into action plans. Share from coal-fired power is increased to account for 56% of total electricity capacity in 2030 putting high pressure on society and environment. The import of an enormous amount of coal stays questionable. Meanwhile, renewable energy is underestimated than potential.



4. Uncertainty of energy security:

Due to the high dependence on fossil fuels (coal, oil), Vietnam energy security will be affected. According to GreenID's research, all the index for Vietnam energy security following the PDP VII will fall dramatically, which leads to the uncertainty of national energy security. *(Please find more details in in-depth research of GreenID).*

In summary, it is necessary to revise the PDP VII since itself is now facing multiple challenges, shortcomings and becoming unrealistic. Recently, GreenID has performed a series of researches, which are electricity demand forecast, energy efficiency and conservation potential, coal market, external cost of some types of power plants, coal power pricing and environmental impact assessment of PDP VII. Based on the results, we would like to propose the following recommendations to the decision makers and planning developer with the aim of revising PDP VII to become more effectively for investment saving, energy and environmental security assurance and sustainable development.

IV. RECOMMENDATIONS BY GREENID AND VSEA ON PDP VII REVISION

1. Electricity demand forecast:

Based on the mentioned analysis, GreenID propose two main solutions: 1. more suitable and realistic selection of input data; 2. more accurate method for calculating electricity load.

- In terms of the GDP rate, our selection is based on the Directive No. 22/Ct-TTg on 5/8/2014 by Prime Minister on the elaboration of the 05-year socio-economic development plan from 2016 to 2020. The population growth rate follows Ministry of Planning and Investment's number, which ranges from 0.7%/year to 1.3%/year. Energy price is based on Word Bank's forecast.
- In terms of calculation method, we apply the bottom-up approach, which means that the power forecast is divided into individual sectors of power load, namely domestic, industry, service and commerce, agriculture, fishery and others. Industrial sector was divided into smaller fields to apply energy intensity method and econometric method. In domestic sectors, the method is calculation on end-use devices. In other sectors, similar to other countries, the method of econometric method is applied.



The result for electricity demand by 2020, with vision to 2030 following the BAU scenario is:

GreenID forecast of electricity capacity

BAU Scenario

Index	Year				
	2010	2015	2020	2025	2030
GDP rate (%/year)	5.8	6.9	7.0	7.0	7.0
Generated electricity growth rate (%/year)	10.7	10	8.0	8.9	8.9
Electricity demand (billions Kwh)	84.6	141	227	333	464.7
Electricity elastic coefficient	1.86	1.45	1.14	0.98	0.98

2. The potential of energy efficiency

GreenID recommends applying energy efficiency as an approach to reduce electricity demand. This is a worldwide-known method which is applied by many countries over the world. In Vietnam context, the National Assembly has promulgated Law on Economical and Efficient use of energy and the National Target Programs on economical and efficient use of energy. A variety of targets for energy using has been set up. The PDP 7 also men-



tioned the encouragement to energy efficiency, yet it has not become a regulation. In addition, the calculation stayed inaccurate. GreenID has attempted to calculate more cautiously. In addition to figure out the energy uses in residential area, commerce and service building likewise the National Target Program does, the industry sector, which is considered as the most energy-consuming factor, is also taken into account in our research. Below are the results:

Energy efficiency potential in different sectors

Sector	Unit	2020	2025	2030
Resident	%	2.4	5.7	10.1
Industry	%	4.9	9.8	15.3
Commerce & Service	%	2.6	7.5	13.1
Others	%	2.2	6.2	10.9

Considering above energy efficiency potentials and the energy demand forecast from 2010 – 2030, GreenID proposes the following Saving Energy Scenario:

Index	Year				
	2010	2015	2020	2025	2030
GDP rate (%/year)	5.8	6.9	7.0	7.0	7.0
Generated electricity growth rate (%/year)	10.7	9.15	7.03	5.83	5.83
Electricity demand (billions kWh)	84.6	141	218	307	407.7
Electricity elastic coefficient	1.86	1.33	1.00	0.83	0.83

In comparison to the BAU scenario, the saving energy scenario proposed by GreenID anticipates a decrease of 57 billion Kwh, approximately 10,000 MW capacity. Hence, it reduces 25 million tons of coal to be burnt annually and 15 billion USD investment on building new power plants.

3. Renewable energy as alternative to fossil fuel energy, coal energy in particular

In PDP VII, since the energy demand was set too high while the country's primary energy source (domestic coal, oil, and gas) and hydroelectricity has been becoming limited, coal-fired power appears to be a proper solution. During the process of developing PDP VII, the price of coal power remained low due to fossil fuel subsidy (coal fuel was only charged for 40-50% of its price). On the other hand, the price of renewable energy at that moment was high and uncompetitive despite of the government's encouraging policy.



Therefore, it was challenging to propose renewable energy as alternatives to thermoelectricity such as wind and solar energy. Recently, one of our researches has pointed out that the fossil fuel subsidy no longer existed. Since July 2014, price of input coal for coal power production has followed the market price. As a result, the price of coal-fired power increased. For instance, in some operating power plants such as Mao Khe, Cam Pha, Quang Ninh 1 and Quang Ninh 2, the commercial price of electricity ranged from 3.7 to 4.2 USCent/kWh. After the end of subsidy policy, the price went up to 5.5 – 6.5 USCent/kWh. Power plants that use imported coal for input as Na Duong, Long Phu 1, Song Hau 2, have the price increased to 8.38 USCent/kWh. Assuming that coal's price only increases 2% per year and the carbon tax must be added, the commercial price of electricity will rise up to 10.4 ± 1 USCent/kWh. It means that the wind energy price definitely can be competitive in that situation. Thus, we strongly recommend increasing the share of wind energy as alternative to reduce coal power at a higher level in PDP VII.

V. CONCLUSION AND RECOMMENDATIONS:

Based on aforementioned analysis, GreenID and VSEA's recommendation will help to cut down the electricity demand. Required capital investment will shrink accordingly and environmental impacts from coal power will be reduced, especially climate change. In the near future, renewable energy, especially wind energy can play a more important role in Vietnam electricity system.

Comparison of electricity demand forecast between GreenID's recommendation and PDP VII's.

Scenario	Unit	2010	2015	2020	2025	2030
Commercial electricity production by PDP VII	Billions Kwh	86.7	170	290	430	615
Commercial electricity production by GreenID (BAU scenario)	Billions Kwh	84.6	141	227	333	464
Reduction	%	-	17	21.7	22.5	24.5
Commercial electricity production by GreenID (saving energy scenario)	Billions Kwh	84.6	141	218	307	407
Reduction	%	-	17.1	24.8	23.6	33.8

In comparison to PDP VII, GreenID's recommendations will save from 151 to 208 billion kWh from the power production, which saves 45 – 50 billion USD from investing in building new power plants and reduce 35,000 – 45,000 MW of total capacity (including 30,000 - 40,000 MW of coal-fired power and 5000 MW of nuclear power) while fully meeting demand. It also cuts down 150 million tons of CO₂ emission.

Comparison of PDP VII's Capacity and power output and those of GreenID's proposal by 2020

Source	Capacity (10 ³ MW)						Power Output (TWh)					
	PDP VII	Ratio (%)	BAU scenario GreenID	Ratio (%)	Power Saving Scenario GreenID	Ratio (%)	PDP VII	Ratio (%)	BAU scenario GreenID	Ratio (%)	Power Saving Scenario GreenID	Ratio (%)
Total	66.9	100	54.0	100	52.2	100	329.3	100	256	100	246	100
Hydropower	17.7	26.5	17.7	32.8	17.7	33.9	62.6	19.0	62.6	24.4	62.6	25.4
Gas & oil thermal power	12.5	18.7	12.5	23.1	12.5	23.9	67.1	20.4	67.1	26.2	67.1	27.3
Coal-fired power	30.7	46.0	18.9	35.0	17.1	32.8	178.0	54.1	109.6	42.8	99.6	40.5
Small hydro & RE	3.1	4.6	3.1	5.7	3.1	5.9	8.9	2.7	8.9	3.4	8.9	3.6
Nuclear	1.0	1.5	0.0	0.0	0.0	0.0	4.9	1.5	0.0	0.0	0.0	0.0
Power Import	1.8	2.7	1.8	3.3	1.8	3.4	7.8	2.4	7.8	3.0	7.8	3.2



Comparison of PDP VII's Capacity and power output and those of GreenID's proposal by 2020

Sources	Capacity (10 ³ MW)						Power output (TWh)					
	PDP VII	Ratio (%)	BAU Scenario GreenID	Ratio (%)	Power Saving Scenario GreenID	Ratio (%)	PDP VII	Ratio (%)	BAU Scenario GreenID	Ratio (%)	Power saving scenario GreenID	Ratio (%)
Total	137.0	100	102.9	100	91,7	100	695.2	100	524	100	459	100
Hydropower	22.5	16.4	22.5	21.9	22,5	24.5	60.3	8.7	60.3	11.5	60.3	13.1
Gas & oil thermal power	17.3	12.6	17.3	16.8	17,3	18.9	90.9	13.1	90.9	17.3	90.9	19.8
Coal-fired power	76.3	55.7	47.1	45.8	35,9	39.1	431.0	62.0	273.5	52.2	208.5	45.4
Small hydro &RE	10.7	7.8	10.7	10.4	10,7	11.7	74.4	10.7	74.4	14.2	74.4	16.2
Nuclear	4.9	3.6	0.0	0.0	0,0	0.0	13.7	2.0	0.0	0.0	0.0	0.0
Power Impact	5.3	3.9	5.3	5.2	5.3	5.8	24.9	3.6	24.9	4.8	24.9	5.4

RECOMMENDATIONS

1. Under the government's direction, Ministry of Industry and Trade is now revising the PDP VII. We appreciate this necessary and insightful action. To make our contribution to the revision of PDP VII, the paper was carried out with experienced experts' professional and responsible participation. We would like to emphasize three main points with the PDP VII Board of Revision for consideration:

- **Use a more accurate and suitable calculation of electricity demand;**
- **Formalize the energy efficiency and conservation to become an official regulation;**
- **Raise the proportion of renewable energy as alternative to fossil fuel energy.**

2. An innovation in mindset is required to value more the economical and efficient use of energy. Energy will not only develop to meet the demand of economy and social use but also need to have better management for more effective and conservative use from different sectors. The PDP VII should evaluate other factors than economic development itself, attempt to minimize the environmental impacts to achieve a sustainable energy development.

3. An effective planning depends much on reliable data inputs from other fields. It is necessary for the Government to pay more attention to gather authentic data source.

4. The price of coal-fired power is continuously increasing since it depends on importing coal's price. Renewable energy is becoming more affordable, comparable and competitive to coal-fired power. It is highly recommend to be strongly promoted into national energy planning.

5. Because of the importance and wide influence of Power Planning and National Energy, we suggest that the Government should consult widely with public participation before they approved. It is help to achieve consensus and implementation process more feasible in Vietnam Power Development Plan.





The document compiled and printed by GreenID

For more information, please visit our website:
www.en.greenidvietnam.org.vn

GREEN INNOVATION AND DEVELOPMENT CENTRE

Suite 707, 7th floor, D11 Sunrise Building, Tran Thai Tong Str., Hanoi, Vietnam
Tel: +84 4 3795 6372 - Email: info@greenidvietnam.org.vn