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## Realising Vietnam's Renewable Energy Potential

Le Viet Phu and Thach Phuoc Hung*

### EXECUTIVE SUMMARY

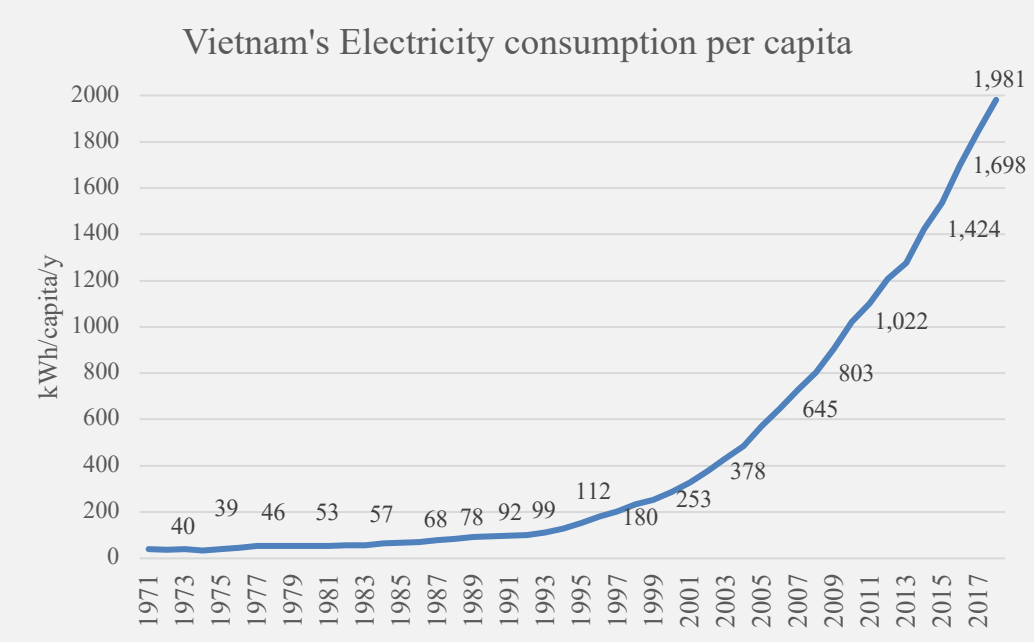

- Vietnam's electricity demand has been growing at more than 10 per cent per year for the last two decades, outstripping its annual GDP growth rate.
- The domestic supply of cheap electricity from hydropower and coal has largely fuelled Vietnam's socio-economic development in the past. New sources of these are becoming increasingly scarce.
- Most coal-fired power plants are running far behind schedule, and are no longer favoured by international financial backers. They are highly polluting, leading to growing domestic opposition against their use.
- Vietnam possesses vast potential solar and wind resources, which can help diversify the country's energy mix and contribute to economic growth.
- However, Vietnam needs to overcome many legal, human-resource and economic challenges to take advantage of these abundant renewable resources.


** Le Viet Phu and Thach Phuoc Hung are researchers at the Fulbright School of Public Policy and Management, Fulbright University of Vietnam. They can be reached at phu.le@fulbright.edu.vn and hung.thach.fsppm@fulbright.edu.vn.*

## STATE OF PLAY – VIETNAM'S ENERGY SECTOR

Over the past two decades, Vietnam has witnessed a dramatic increase in energy demand. Electricity consumption has increased by about 10-13 per cent per year, doubling the rate of economic growth. The country's total generation capacity has increased from a modest 8.7GW in 1990 to 27GW in 2000 and over 48GW in 2018. After more than 30 years of economic reforms, Vietnam has become one of the most electrified countries in the world, with grid electricity reaching 98 per cent of the population.

**Figure 1: Electricity Consumption Per Capita in Vietnam (1971-2017)**




Source: *The World Bank, 2020*[1]

Before the start of *Doi Moi* reforms in 1986, Vietnam consumed only 70kWh of electricity per person. This figure has now reached over 2,000kWh (see Figure 1 above), although per capita consumption is still much lower than many other countries in the region – Malaysia, Thailand, and China consume 4,600kWh, 2,500kWh, and 3,900kWh of electricity per capita respectively, for instance.[2] However, considering its low-middle income level, Vietnam's economy is in fact among the most energy-intensive in the world.

At its current growth rate, per capita electricity consumption in Vietnam will reach over 5,000kWh by 2030.[3] The government estimates that Vietnam will need about US$130 billion of new investment capital by 2030, with an average of about US$12 billion per year, of which about US$9 billion will need to be invested in electricity production assets and US$3 billion in transmission grid investments.[4]

Until recently, domestic energy resources – primarily hydropower and coal – have largely met the rising demand for socio-economic development. However, cheap energy sources are becoming increasingly scarce. In addition, government-backed projects to build coal-fired thermal powerplants have experienced significant delays due to both financing

difficulties as well as environmental concerns. Vietnam's air quality has declined rapidly over the past decade, and is now ranked among the worst in the world.[5] The increase in coal prices, coupled with the rapidly declining cost of solar and wind power, has made coal financially unattractive for Electricity Vietnam (EVN) – the sole state-owned buyer of the electricity generation market and that also dominates generation capacity in Vietnam.

Furthermore, public opposition to coal power has created a coalition of non-governmental organisations, scientists, and concerned citizens with a common cause. Several high-profile incidents related to the Vinh Tan powerplant and more recently the Formosa steel manufacturer[6] have also pushed the Vietnamese government to take on a much more progressive role in phasing out previously planned coal powerplants and replacing them with solar and wind projects. The Vinh Tan and Formosa multi-billion dollar projects are foreign-backed investments with Chinese investors taking a controlling stake. In parallel with these developments in renewable energy, investors have indicated significant interest in converting conventional thermal powerplants from using imported coal to using imported LNG, such as the planned thermal powerplant in Long An with a combined capacity of 2,800MW.[7]

This transition from a fossil fuel-based economy to a greener economy carries great importance for Vietnam's overall economic growth strategy, the cost of living which is directly tied to the cost of energy, environmental sustainability, most notably air pollution, and healthcare costs. Furthermore, this transition to renewable energy is critical for regions like the Mekong River Delta. The region is Vietnam's rice basket and its largest supplier of aquaculture products, both of which are threatened by pollutant emissions and excess heat from thermal powerplants. This paper presents several arguments outlining the opportunities as well as the challenges in developing a robust energy sector in the Mekong Delta, based on experience learned from the recent solar rush, and policy implications for the further development of the abundant solar and wind resources.

## THE 2019 SOLAR RUSH

Vietnam surprised the world with an unexpected massive expansion of its domestic solar power market in 2019, during which more than 4.5GW of solar generation capacity was installed and certified to be commercially operational in the first six months of that year.[8] According to the last National Power Development Plan (PDP VII revised in March 2016),[9] Vietnam was aiming to increase its renewable energy share of power production substantially to 850MW installed capacity by 2020, 4,000MW by 2025, and 12GW by 2030. These targets, however, have already been exceeded with the trial Feed-in-Tariff (FiT) in 2017, which lasted till June 2019. There was 26GW in total capacity registered in 2019 from 110 solar and wind projects. We expect 7,900MW of solar power projects to be installed by the end of 2020, with an additional 17,000MW on the waitlist. Most projects are in southcentral provinces and some in the Mekong Delta, to take advantage of high solar irradiation and a preferential FiT.

The controversial issue surrounding the 2019 solar rush in Vietnam concerns the FiT and the Power Purchase Agreement (PPA). For solar project developers and financing institutions, the currently structured PPA is not bankable. The bankability issue in fact reflects the position of the Vietnamese government – that, in return for the high FiT offered

during the trial period, investors have to be willing to accept a degree of risk in their projects. Much of the debate over providing certainty to the PPA was immediately met with pushback from the government.[10] Therefore, it is best to view this so-called trial period as a test of the market and domestic responses. Despite unabating enthusiasm about renewable energy and investment opportunities, investors should avoid interpreting short-term responses to a once-off policy as having long-term implications. The future FiT is widely believed to be significantly lower and a transition to an auctioning scheme is expected within a few years.

A new FiT, or a transition to an auctioning mechanism is expected to result in a much lower price, and will perhaps provide incentives for EVN and investors to reach common ground on an improved PPA. The latest proposal has set the FiT for solar at 7.09 US cents/kWh, and 7.69 US cents/kWh for floating solar. The FiT for rooftop solar is pegged at 8.38 US cents/kWh, valid for 20 years.[11] The government has been working with development partners to design a bidding mechanism, although the bidding mechanism is not expected to be operational by 2020. Due to the fluidity of the current situation and expected delays due to the coronavirus pandemic, it is difficult to put a timeline on the next phase – be it a new, lower FiT introduced after 2021 or a transition to an auctioning mechanism.

However, a new FiT that does not provide the critical foundations necessary for sustainable renewable energy development would cause another rush, with project developers and domestic brokers competing through back channels to get their projects included in the energy development master plan. In fact, this has already happened. Even with a new lower FiT of 7.09 US cents/kWh, the market for solar projects in 2020 has been restricted to projects that have already signed PPAs and are able to complete construction in 2020. Projects not meeting this deadline will perhaps have to go through an auction mechanism.

## RENEWABLE ENERGY IN ECONOMIC DEVELOPMENT

It is also important to look at the demand side of renewable energy, such as how EVN perceives the role of variable renewable energy (VRE) in the energy mix, the extent to which EVN can safely integrate renewable energy without causing system instability and cascade failures, and the overall fiscal impact of high-level VRE integration on retail pricing. Solar and wind resources also need other supporting services in LNG, energy efficiency, economic restructuring, and climate change policy. Vietnam could use less energy per unit of GDP with greater energy efficiencies. It could also become cleaner by using more renewables. A mechanism that offers stronger purchase contracts to investors and lending institutions, even with the added cost of grid service (transmission and grid stabilisation), would bring the levelised cost of electricity to 4-5 US cents/kWh, as in India. Compared to the unsubsidised financial cost of coal at 7-8 US cents/kWh, solar and wind could replace gas or coal at a much lower economic cost to the society.[12]

The renewable energy sector should be considered a part of the economy and economic development strategy. There will be winners and losers as we make the transition from a conventional centralised power system to a distributed energy system with a high level of VRE. The private sector is expected to play a crucial part in the energy mix, through investment in solar and wind, energy storage, and implementation of energy efficiency initiatives. There are also large players in the LNG sector, in building transmission grids and in the provision of energy services. We expect that when the market becomes more

mature, with an appropriate auction mechanism, the price of renewable electricity will drop further, and the terms of the PPA will be improved to speed up the financing process.

What are the implications for job creation, income distribution, fiscal policies or government revenue, as well as the socio-economic and environmental impacts under different energy development scenarios? What are the implications of a bigger renewable share in the energy mix? A critical component of energy sector reform is electricity price – what is the full system cost, and how much should it cost for end users? Also, given the extensive cross-subsidies in Vietnam, what are the implications for end users? We know that electricity growth and elasticity is very high in Vietnam – how can we align developments in the renewable sector with broader issues such as pricing reform, energy efficiency, and demand-side management?

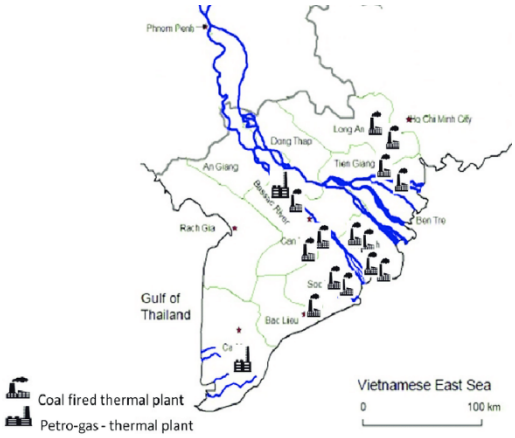
Perhaps some of these questions would be answered in the next National Power Development Plan, the PDP8, to be released by end 2020.

## MEKONG RIVER DELTA: OPPORTUNITIES AND CHALLENGES FOR ENERGY DEVELOPMENT

The Mekong River Delta (MRD) could be the next hotspot for investors in the energy sector. The MRD currently has a generation capacity of approximately 5,000MW, with most major powerplants located in Ca Mau, Can Tho, Bac Lieu, and Tra Vinh.[13] Since the commission of the Duyen Hai thermal powerplant cluster in Tra Vinh, the region's power supply has exceeded local demand. Given limited manufacturing activities and a lower level of living standards, the per capita electricity consumption in the MRD is only 70 per cent of the country's average. However, as industrial development in some provinces such as Long An, Can Tho, and Kien Giang start to thrive, accompanied by a rise in living standards, forecasts indicate that the region's total electricity demand will more than double from 25.6 billion kWh to over 65 billion kWh by 2030. Consequently, the MRD will require a large amount of investment capital to build energy supply infrastructure, transmission systems, and grid management.

**Figure 2: According to the revised Power Development Planning 7, the Mekong River Delta from now to 2030 would have 14 coal powerplants with a total capacity of 18 GW**

| No | Names of coal thermal plants | Total capacity (MW) | Coal sources | Locations | Water used (Mil. m³/day) |
|---|---|---|---|---|---|
| 1 | Duyen Hai I | 1,200 | Quang Ninh | Tra Vinh | 16.5 |
| 2 | Duyen Hai II | 1,200 | Import | | |
| 3 | Duyen Hai III | 1,200 | Quang Ninh | | |
| 4 | Duyen Hai IV extended | 660 | Import | | |
| 5 | Song Hau I | 1,200 | Import | Hau Giang | 12.4 |
| 6 | Song Hau II | 2,000 | Import | | |
| 7 | Long Phu I | 1,200 | Import | Soc Trang | 16.7 |
| 8 | Long Phu II | 1,320 | Import | | |
| 9 | Long Phu III | 1,800 | Import | | |
| 10 | Long An I | 1,200 | Import | Long An | 10.8 |
| 11 | Long An II | 1,600 | Import | | |
| 12 | Tan Phuoc I | 1,200 | Import | Tien Giang | 9.3 |
| 13 | Tan Phuoc II | 1,200 | Import | | |
| 14 | Bac Lieu | 1,200 | Import | Bac Lieu | 4.6 |




Source: Le Anh Tuan, Energy development in Vietnam's Mekong river delta: a 'green' or 'grey' outlook? (2018)

The MRD is endowed with significant renewable resources (solar, wind, and biomass) ideal for the development of an energy industry cluster. Annual solar irradiation averages 1,400-1,500 kWh/m$^2$/year, particularly in Long An, Tien Giang, Ben Tre, and An Giang provinces.[14] In addition, five coastal provinces have significant wind energy potential, with wind velocity along the coast reaching 6.5-7m/s.[15] The region also has a huge supply of crop residues for biofuel production. The delta is in a convenient location to develop a gas energy market, taking advantage of the nearby Cuu Long and Nam Con Son oil fields and Malay-Tho Chu gas field. The Vietnamese government has plans for two gas terminals and Block B pipelines for the O Mon thermal power project for the 2021-2025 period.[16] In addition, there are also serious talks between the government and foreign companies on a gas power project to be built in Bac Lieu, with a total capacity of 3.2GW using LNG imported from the United States.

Nonetheless, there remains significant challenges to develop a full-fledged energy sector in this region. Power projects are capital-intensive, with commercial-scale solar projects requiring approximately US$1 million/MW. Onshore wind power would require a total investment of approximately US$1.5 million/MW, while offshore wind power costs upward of US$4 million/MW. International financing is crucial for energy projects due to the high domestic interest rates of 10 per cent per annum or even higher, on top of a relatively short loan period of 10 years or less. Those with access to international financing may only pay 7 per cent or less per year, and often with a longer repayment period. To circumvent these financial constraints, some Chinese EPC contractors offer the option of a one-off payment after a project is certified ready for operation, particularly targeting small domestic renewable energy developers, to alleviate the financial burden. However, this approach is only viable for small to moderate-sized projects, and there may be concerns about project quality and certification.

Underlying these financial constraints is the inability of domestic developers to borrow due to various weaknesses of the standardised PPA used by EVN. The PPA, as currently structured, exempts EVN from various legal responsibilities such as curtailment due to lack

of transmission capacity or vague technical requirements. Consequently, many solar projects built during the "solar rush", to take advantage of the lucrative 9.35 US cents/kWh FiT, have experienced significant curtailments, some up to 60 per cent of the planned capacity.[17] Many have also incurred large financial losses. Limiting to the solar hub in Ninh Thuan alone, the financial loss due to transmission bottlenecks had swelled to US$22 million in 2019.[18]

There are also questions about opportunities for domestic labour in the energy supply chain. Given the little manufacturing activity related to energy taking place in Vietnam, there are only limited gains from low value-added activities employing low-skilled labour, such as equipment assembly and construction. Most projects import equipment from China, Germany, India, and the United States, provided by international contractors such as GE, CTV (France), and HCE (Germany) working alongside some large Vietnamese contractors such as PCC5, PVPC, TechGel, Lilama, and Atad. These contractors often hire local subcontractors for less complicated tasks, using a large number of low-skilled labourers during the construction phase. Local firms are able to manufacture simple mechanical and low-value structures, such as the frame assembly for solar panels and wind power base brackets. When a project is ready for commercial operation, operators and management personnel usually are highly trained international experts, while Vietnamese staff are locally trained and low-paid. A solar project between 50-200MW capacity normally employs 20 workers, and fewer in wind farms.

The MRD also does not have a strong vocational education and university system to supply highly trained personnel. Currently, Can Tho University (CTU) is the only regional university in the MRD to provide a curriculum in mechanical and electrical engineering, although it is not the university's specialisation. Most universities and technical training centres are concentrated in the Southeast and in Ho Chi Minh City, the industrial centre of the country. Therefore, there should be coordination between training institutions and energy sector development planning authorities to match labour skills with job opportunities created by the market. The region also needs significant investment in infrastructure such as road and water transport. Road transport infrastructure in the MRD currently lags far behind the rest of the country. Its expressways, in particular, are few and unsuitable for transporting oversized and heavy equipment. Its waterway network, which plays a critical role in the agricultural sector, has also largely failed to serve as a connection between the delta and the country's production hub in the Southeast.

The MRD's transmission system also requires local upgrades and new lines to connect generation sites to consumption centres. A remarkable number of renewable energy projects was commissioned and connected to the grid in 2019. However, the adverse consequences of rushing to build many projects without sufficient transmission capacity have become increasingly evident. Building the transmission network has been slow in recent years – a transmission project may take two to three years, sometimes even longer if significant land acquisition is involved. The current Electricity Law restricts private investors from building and operating power transmission projects, while public investment has been severely limited. This dilemma has discouraged potential renewable energy investors due to ongoing transmission bottlenecks, resulting in significant curtailments and large financial losses in many solar projects. Private investment is expected to play a significant role once the Electricity Law is revised to accommodate an increasing number of private investors joining the energy market following the liberalisation of the wholesale and retail electricity market.

This process has been on-going for many years, with the full transition to a competitive electricity retail market by 2024.

## FINAL REMARKS

Vietnam has great potential and many favourable conditions to develop a robust renewable energy sector. On the one hand, under the right conditions, the private sector could lead a quick transition toward a cleaner energy mix through investments in solar and wind energy, LNG powerplants, energy storage, transmission grids, and the implementation of energy efficient initiatives. But to do so, Vietnam must overcome many barriers, from policy obstacles to economic and technological challenges.

The Vietnamese government must remove numerous policy obstacles with regard to the current PPA design, which does not guarantee investors' rights, and mitigate risks to investors and financial institutions. Well-known shortcomings include curtailment risks, exchange rate risks, *force majeure*, and lack of international arbitration, among the other concerns related to the project approval process, land acquisition, and allegations of wrongdoings by public officials. On the other hand, renewable energy should be seen as part of the country's economic development strategy. However, more analysis is needed on the sector's impact on job creation, income distribution, government fiscal policy, as well as on the socio-economic and environmental impacts of alternative energy development scenarios.

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