Market Conditions and Change for Low-Carbon Electrictity Transition in Vietnam

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Introduction

In the context of a transition from a planned to a market economy, industrialization and urbanization processes over the last two decades have resulted in rapidly increasing electricity demand in Vietnam. The challenges of greater energy security, enhancing high-voltage transmission lines, and reducing transmission and distribution losses imply an improvement in the current system.

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Considerations related to energy transition by developing renewable resources constitute part of this context. Moreover, the will to provide electricity for all remote areas by 2020 means an extended use of local renewable energy sources in off-grid electrification.

During the last few years, several factors have contributed to emphasize the need for lower carbon emissions and opened a "window of opportunity."[1] The country has abundant resources to produce clean energy[2] and central authorities seem committed to climate change mitigation policies. Indeed, a number of policies and regulations have been issued in this perspective such as the National Strategy on Climate Change (2011) and the Green Growth Strategy of Vietnam.[3]

In early 2016, the government approved the adjustments of the 7th Vietnam Power Development Planning (PDP7-A) for the period 2011-2020 with an outlook up to 2030.[4] Due to a projected average gross domestic product (GDP) growth rate of 1.5 percent lower than in the PDP7, the total electricity generation requirements would be reduced about 20 percent and 18 percent by 2020 and 2030, respectively. In addition, low-carbon technologies would play a more important role compared to the original version of the plan. Hydropower sources remain the largest share in the total renewable power capacity and their part slightly increases. Solar energy, which was not given any quantitative projection in the PDP7, should rise from the current negligible level to about 0.5 percent of total generation mix by 2020, 1.6 percent by 2025, and 3.3 percent by 2030. Conversely, wind power has received less attention in PDP7-A and its part would be slightly lower than previous projections (PDP7 fixed the goal of 0.7 percent of the total generating capacity in 2020 and 2.4 percent in 2030).[5] In parallel, a legal framework friendly to foreign investors has been created and some incentives and preferential measures for renewables have been implemented.

Why, then, despite these undoubtedly favorable conditions, projections concerning the evolution of electricity power supply in the coming years show a remarkable structural stability and a largely dominant share of fossil fuels?[6] If current trends continue, the production of electricity will necessitate more and

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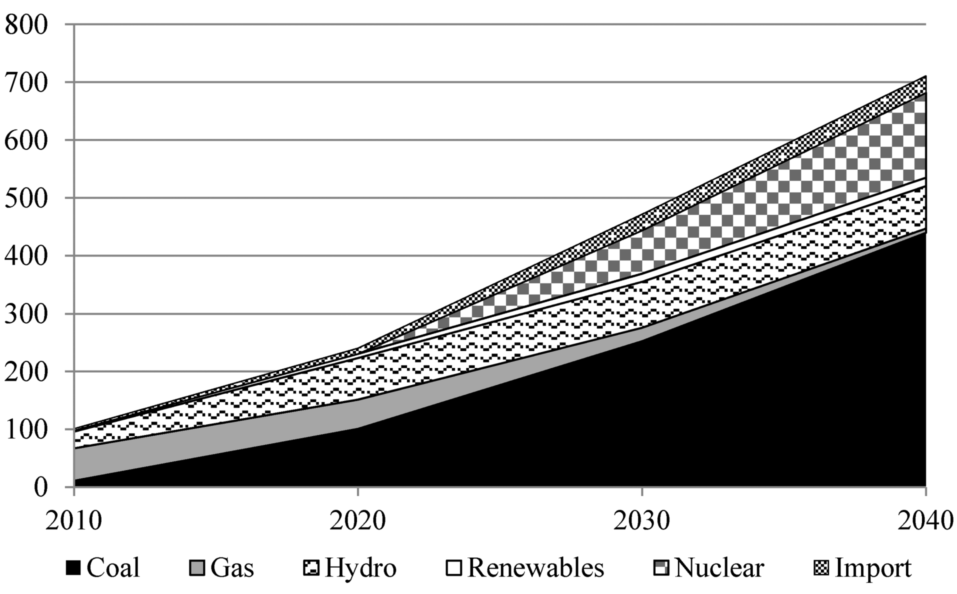
more fossil resources to cope with demand and the very term of low-carbon transition could be rendered meaningless (see figure 1). By 2030, coal-fired power stations are expected to account for 53.2 percent of installed capacity in Vietnam, up from the current 34.4 percent. The development of technologies to capture and store carbon-dioxide (CO_2) emissions from fossil fuel plants could attenuate the climate change impact, but the fact is that Vietnam's electricity power system will become more dependent on coal-fired power.[7]

Up to now, most studies of the energy transition in Vietnam have focused on technological issues such as energy efficiency and carbon capture and storage,[8] or on the macro-level political process, prospects, and targets.[9] These are important contributions but pay little attention to the role played by the actors directly involved in the energy/electricity sector and to the institutional/structural framework of their interactions.

Our work aims to shed some light on the mesoeconomic aspects of the low-carbon transition process in Vietnam, analyzing the market conditions, the interests of the key stakeholders, and the institutional framework of their interactions inside the electricity sector. Such an approach helps to better understand the constraints

Figure 1
VIETNAM: PROJECTIONS OF ELECTRICITY POWER SUPPLY BY PRIMARY ENERGY RESOURCES, 2010-2040
(in terawatt hours—TWh)



Source: Data from Institute of Energy, *Master Plan for Renewable Power Development in Vietnam* (Hanoi: Institute of Energy, 2011) combined and projected by the authors.

that weigh on the transition to low-carbon electricity. On this basis, an analytical framework is proposed to monitor the path of change.

Beyond the lessons regarding transition to low-carbon electricity in Vietnam, this article contributes more broadly to understanding the role of the institutional structure of the electricity market and the impact of interactions between key stakeholders. The methodology deployed to monitor this process through the trend of some quantitative variables that translate the stakeholders' expectations can be applied in other cases of energy transition.

The article begins with the theoretical framework on which our contribution stands. Then, the institutional and structural characteristics of the electricity market are outlined. The following section presents the key players and discusses their interests, constraints, and motivations. Next, an analytical grid is proposed to apprehend the change path. The stakeholders' asymmetric relations are evaluated and some appropriate quantitative indicators (focal variables) are identified that reflect the different stages of the transition and the balance of power between the major stakeholders. Finally, some conclusions and policy implications are addressed.

Theoretical Framework

The methodology and ideas expressed here draw on a number of studies on institutional/evolutionary political economy of economic change and climate change in particular. Making the hypothesis that no major energy crisis occurs during the next few years, the transition in the Vietnamese electricity supply should be of an evolutionary rather than a revolutionary nature. In general, transitions have been described as social transformation processes over an extended period of time.[10] R. Nelson and S. Winter put forward the cumulative nature of economic change, combining "the 'inheritance' of acquired characteristics and the timely appearance of variation under the stimulus of adversity."[11] This process is characterized by interactions and imperfect learning through which selection occurs.[12] As governance structures shape up asymmetries regarding the access to and allocation of resources,[13] change is related to institutional innovation, which entails reforming the formal rules but also the rearrangement of power, interests, and ideologies.[14] It may be inhibited, tempered, or locked-in by the vested interests holding power and political leverage.[15] Indeed, stakeholders' reactions to change are based on a self-regarding cost–benefit analysis,[16] taking into consideration the institutional settings within which they operate.[17] As S. Harty puts forward, principal initiators of change comprise the stakeholders who are negatively affected by the present framework.[18]

Several studies regarding the evolution of the electricity sector in various countries and periods support the above propositions,[19] while recent research work in the field of climate change and energy transition addresses the question of power and the role of politics.[20] According to F. Kern and A. Smith, energy transitions risk capture by the incumbent energy regimes.[21] T. Tanner and J. Allouche stress that initiatives related to climate change are not apolitical and linear policy-making processes, encompassing interactions between the state and non-state actors.[22] They suggest a three lenses approach (ideas, power, and resources), arguing that power is predominant in the negotiation phase and resource, institutional capacity, and governance in the implementation phase. B. Rabe puts forward that formal engagement in the international realm of policy is not a good indicator of domestic policy development or emissions reductions.[23] Also, U. Brandt and G. Svendsen point out that the climate change policy is determined by the relative strength of stakeholder groups.[24] Concerning Vietnam in particular, F. Fortier argues that the adopted strategy reflects and finally reinforces existing power relations.[25]

Based on these contributions, we consider transition to low-carbon electricity in Vietnam as a cumulative endogenous process. This process is characterized by strong path dependencies related to political, social, economic, and technical constraints that are at the origin of the structures and rules influencing stakeholders' strategies in this field. The interaction of multiple, and potentially divergent, interests for the distribution of economic rents may enhance or, conversely, mitigate past trends by shaping new paths.

In fact, the characteristics of the Vietnamese electricity sector are rooted in the systemic features of the national economy, which involve concentration of political power, hierarchical dependencies, and a weak civil society, on the one hand, and gradual decentralization of economic management, together with widespread informal networking, on the other. These are well known attributes of an administrative economy.[26] Players with significant bargaining power can influence the definition and implementation of policies and, thus, block reforms or delay their effects. Private interests and informal relationships may diminish any desire for change and have a greater impact on the system's evolution than the settled objectives.

Concerning the Vietnamese electricity sector, its regulation mechanisms and governance reflect the balance of power between key stakeholders as it emerged historically and, at the same time, the impact of their attitudes regarding the transition toward low-carbon electricity. We show that the current institutional framework and market structure do not provide sufficiently powerful incentives for the development of renewables, while complex interwoven interests motivate some key players to pursue the development of fossil-based power plants. This situation may explain the gap between settled goals and actual trends and suggests a capture by the current energy supply pattern. As a consequence, the political will of policy makers without a change in the stakeholders' interests would be a necessary but probably insufficient condition for a low-carbon electricity transition.

In this sense, the effective implementation and consolidation of an alternative pattern of electricity supply implies “actions to remove the barriers”[27] and “social and political innovation,”[28] which means a fundamental transformation of the stakeholders’ positions and relations, thus creating groups of winners and losers. Given the conflicting nature of the game, some initiating actors are needed who anticipate positive outcomes related to a low-carbon electricity supply model and have sufficient power and leverage to redefine the rules of the game, therefore modifying the institutional framework and enabling the creation of new structural interdependencies inside the electricity system. The move will be promoted by stakeholders perceiving an opportunity to gain and anticipating an improvement of their positions through investment in renewable energies and will encounter opposition from those who derive substantial benefits from the existing conditions.

N. Fligstein and D. McAdam stress the importance of so-called “challenger actors” who act against existing structures.[29] Initiators of change may occupy a peripheral position in the current system[30] and would have to build up a favorable balance of power in order to overcome resistance and influence the mechanisms through which selection occurs (namely, market structure, bargaining, and political leverage). Ultimately, either the innovative players remain isolated or they dominate by weakening the opposing parties and by drawing them into the path of change. Throughout this interactive game, only once key stakeholders see the economic viability and the benefits of a new pattern of electricity production will they consider its consolidation. Actually, they focus on some observable indicators revealing their potential gains and losses, and thus influencing their attitudes and strategies. Resources such as feed-in tariffs, subsidies, and external funding could facilitate change by diminishing the uncertainty of innovative stakeholders and enhancing the possibility to compensate (at least partially) the potential losers. The trend in such focal variables designates the stages of the transition process.

Structure and Functioning of the Electricity Market[31]

The “Vietnam Competitive Generation Market” (VCGM): The entire Vietnamese electricity sector operates under the authority of the Ministry of Industry and Trade (MOIT), which is in charge of law, regulations, policies, development strategies, master plans, and annual plans related to the energy sector. The ministry submits these legal documents to the Prime Minister for issuance or approval. The General Directorate of Energy (GDE) is responsible for overall energy planning and policy, but not for day-to-day management, and ERAV (Electricity Regulatory Authority of Vietnam) is the country’s regulatory agency supervising the power market and planning, tariff regulation, and licensing. Electricity of Vietnam (EVN) was established in 1995 as a fully integrated state monopoly company and unique operator with various missions: managing the production, transmission and distribution activities; achieving better economic and technical results; and ensuring the safety, continuity, and reliability of the national electricity system.

In 2004, the electricity law approved by the National Assembly laid a foundation for a more open sector structure. It asserted that the state monopoly should be limited to power transmission, national load dispatch, and strategically important large power plants, leaving power distribution and non-strategic power generation to private operators. As a consequence, some state-owned enterprises (SOEs) and independent power producers (IPPs) as well as build, operate, and transfer power plants (BOTs) have entered the sector since 2005 (figure 2).

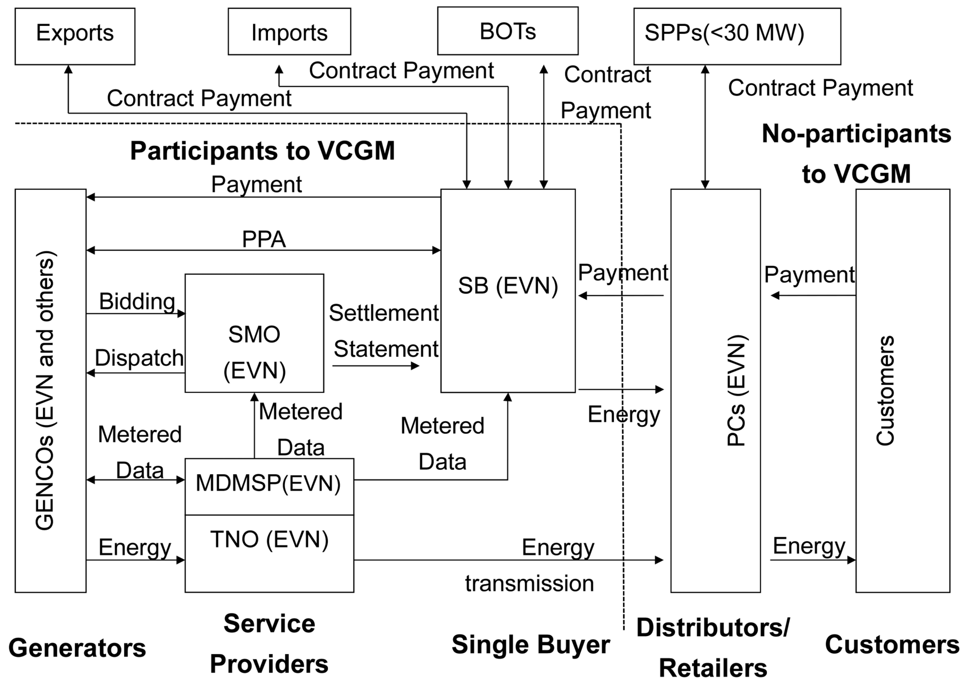
In July 2011, the MOIT decided to implement the Pilot "Vietnam Competitive Generation Market" (VCGM), which became operational one year later. Currently, all integrated or independent domestic power producers, as well as foreign suppliers, sell their electricity to a single-buyer (the Electric Power Trading Company-EPTC, an EVN subsidiary) under long-term power purchase agreements (PPAs) or on the competitive market (figure 2) where national grid-connected power plants with installed capacity of 30 megawatts (MW) and above can participate.[32] A network linking plants and EPTC has been set up to update market information and estimate potential demand and supply.

The single-buyer (EVN) sells the purchased electricity to its own power distribution companies (PCs). The latter do not participate in the competitive market and can also buy electricity from small local producers, not grid-connected, and with a power capacity of less than 30 MW. EPTC arranges contracts with generators and distribution companies in order to engender business profits, but also to match supply and demand across the whole power system. Among plants eligible to join the market by selling their electricity to EPTC, those offering lower prices are given priority.

BOTs are not allowed to sell electricity in the VCGM; neither are the large hydroelectric plants (e.g., Son La, Hoa Binh, or Ialy Hydro) with multiple activities (electricity generation, downstream water supply, flood control, and irrigation), which continue to arbitrate between power generation and the satisfaction of the other social needs they assume.[33] During the pilot phase, the total power capacity controlled by VCGM accounted for approximately 61 percent of total installed capacity. Initially, only 48 of the 73 eligible plants were allowed to bid on this market directly, but their number increased to 55 power plants a year after.

Generation utilities offer their available power at a price that can be fixed between Vietnamese dong (VND) 0 per kilowatt hour (kWh) and the ceiling price imposed by the MOIT. Considering variables such as the bidding prices, power load forecasting, and technical constraints, the National Load Dispatch Center-NLDC (another EVN subsidiary) dispatches generating units with the main goal of

Figure 2
WHOLESALE MARKET PARTICIPANTS AND OPERATION[a]



[a]GENCOs = Electricity Generation Companies; BOTs = Build-Operate-Transfer Power Plants; SPPs = Small Power Plants; PPA = Power Purchase Agreement; SMO = System and Market Operator (National Load Dispatch Center - NLDC); MDMSP = Metering Data Management Service Provider (Information Technology Center); TNO = Power Transmission Service Provider (National Power Transmission Company - NPTC); SB = Single Buyer (Electricity Power Trading Company - EPTC); and PCs = Distribution Power Companies.

minimizing the cost of power purchased for each transaction period. During the first year, 90 to 95 percent of a plant's output is purchased at a price fixed in a long-term contract and the remaining portion at the spot market price. In order to favor competition among producers, the fixed-price portion must decrease gradually over the following years but, as the current market regulation stipulates, it cannot be less than 60 percent. Power generators participating in the wholesale market are also responsible for the cost of the ancillary services related to market operation, transmission, and distribution of electricity. Indeed, NLDC (also called the *System and Market Operator*) determines the necessary services to ensure the security of the power system and sets their price in order to cover costs. The National Power Transmission Company (NPTC - *TNO*), established in 2008, operates as a limited liability company owned by EVN.[34] It is responsible for the 500 kilovolt (kV) and 220 kV transmission systems in the power markets.

The functioning of the electricity market is also influenced by the retail electricity price, which is regulated by the government according to the customers' profiles. Set at a very low level—in 2014, the average retail price was approximately VND 1,058 per kWh (5.4 U.S. cents per kWh)—it makes return on investment problematic and implies a need for subsidies to ensure the activities of the various operators, especially those who might be involved in renewable resources. There are growing calls to end subsidies to the power industry and to increase the retail tariff to a level enabling the investment required for building new capacities. These suggestions for subsidy removal coincide, to some extent, with the government's orientations. However, apart from its social impact, a reform of electricity retail prices while maintaining the current market structure would merely amplify the distortions,[35] while being unable to create a sufficient incentive framework for investing in renewable energies.

Counter-Incentives for Renewables: The present structure and regulation of the electricity market, together with technical and economic constraints, are causing serious disincentives for investment in renewable energies.

Today, renewable energy generation costs are higher than fossil energy costs. The average construction and annual operational and maintenance (O&M) costs for an onshore 1-MW wind power plant are evaluated at about U.S. $2 million and U.S. $35,000, respectively.[36] For new coal- and gas-fired power plants in Vietnam, the investment cost varies from U.S. $0.8 to $1.5 million per MW installed and the O&M costs per year are about 3.5 percent of the investment cost.[37]

Other difficulties are added to the higher initial cost disadvantage. While transmission grids of fossil fuel power generation projects are financed by the government, the renewable electricity sellers must bear the costs of investment, operation, and maintenance of lines, and step-up transformer stations, if any, from their power plant to the connection point with the distribution companies.[38] At the same time, the single-buyer has no obligation to buy electricity produced by renewable sources at a price covering its real cost and taking into account its full social benefits. So, in the framework of 20-year contracts, EPTC pays 7.8 U.S. cents per kWh to onshore and 9.8 U.S. cents per kWh to offshore wind plants. At this price,[39] and given the supplementary cost necessary to be connected to the national grid, renewable energy plants still suffer heavy losses.

Following Circular No. 37/2011/QD-TTg, EPTC gets an incentive of VND 207 to purchase electricity produced by wind plants (which means approximately 1 U.S. cent per kWh purchased from grid-connected plants). This measure resulted in the registration of 48 new wind power projects with total capacity of 4.9 gigawatts (GW) by late 2012 and early 2013. Actually, only three of them are really operational representing a total capacity of 52 MW, given that the break-even point for onshore wind power projects using updated technology is estimated at approximately 10 to 11 U.S. cents per kWh.[40]

Last but not least, government and local authorities' inability to manage issues related to renewable power projects has caused delays in the development of this type of electricity generation. Indeed, procedures for establishing and operating renewable energy plants are complex and several authorities intervene at different points of time. Effective coordination and clarification of responsibilities is required to reduce the existing fiscal and technical barriers but government officials often lack adequate experience in implementing incentive policies to support investment in the renewable energies.[41] In parallel, provincial and local authorities have not the human resources, knowledge, and capabilities, nor the appropriate incentives to manage and maintain the long-term operation of the plants.[42]

Several policy options proposed by both international and local experts[43] are under consideration such as granting low interest loans—up to one-third of the total investment cost—to wind power projects, increasing the subsidies given to the single-buyer for electricity purchased from wind power plants, exempting of the 10-percent tax applied to imported turbines, and encouraging direct involvement by state-owned energy companies in wind power projects. It is interesting to note that more effective incentives for biomass and solid waste power projects were introduced in 2014.[44] The single-buyer is now required to purchase all electricity generated from combined "heat and power" projects using biomass at a price integrating the "avoided cost," i.e. the cost of building a conventional power plant and the corresponding distribution infrastructure with the same purpose and results as the concerned biomass project.[45] Moreover, projects using solid wastes benefit from duties exemption on imported fixed assets and reduced taxes.

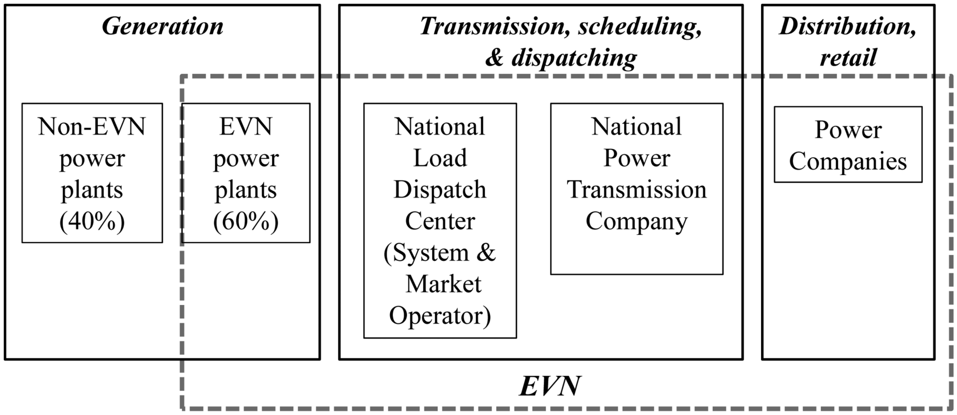
Such policies show that effective incentives for the development of renewable energies are possible. Yet, their large-scale implementation would imply a fundamental change in Vietnam's electricity market involving a new balance of power and an improved bargaining position for local and foreign players investing in renewable energies.

The Key Players in the Electricity Market of Vietnam

Electricity of Vietnam (EVN)—The Dominant Actor: Electricity of Vietnam (EVN) is the historical operator. In 2006, it was transformed into a private holding company controlling numerous strategic business entities involved in power distribution as independent accounting units (profit centers), and in generation/transmission activities as dependent non-revenue accounting units (cost centers). In April 2007, an equatization plan aimed to partially privatize most of the operating units involved in power generation and distribution, with EVN keeping at least 51 percent of the capital. In the same year, EVN founded the Electric Power Trading Company (EPTC), which is the single-buyer on the wholesale market. Its current structure includes three large hydro power plants, the national load dispatch center (A0), which controls and operates the country's electricity grid, the power project management units, and the power information center.

EVN is also actively involved in policy issues through the Institute of Energy, which is tasked with preparing the Master Plans (MPs) for power development. MPs present detailed goals for the coming ten years and provisional forecasts for another ten years afterward. Demand forecasts provide the basis for the required investments and projects, with expected commissioning dates. The governance and institutional structure of the energy sector, parallel to EVN's involvement in policy issues enables significant political leverage. Indeed, some experts point out a collusion of interests between the Ministry, the regulating agencies, and the operator, noting the EVN's influence on tariff policies[46] and its role as pitcher of political careers for some of its top executives.[47]

Figure 3
ELECTRICITY GENERATION, TRANSMISSION, AND DISTRIBUTION IN VIETNAM



By the end of 2013, EVN's power plants accounted for up to 60 percent (19 of 31 GW) of total installed power capacity (figure 3).[48] In that same year, EVN's power plants generated 57.5 TWh, accounting for 45 percent of the country's total electricity generation and imports.[49] Even if a number of independent projects are being implemented, the Herfindahl-Hirschman index indicating the diversity of generation capacity by ownership only slightly increased from 3,956 to 4,052, between 2003 and 2013.[50] Also, because of its position as single-buyer in the wholesale electricity market, EVN benefits from high bargaining power for fixing prices, volumes, and grid-connection conditions. At the same time, the main distribution network is organized around nine of EVN's fully owned regional subsidiaries. Its vertical integration favors discretionary behavior toward its suppliers, giving priority to its own power plants or to partners with which it has privileged relationships.[51] Clearly, EVN is the dominant actor in the electricity sector.

As a result of cost constraints and market structure, investment in renewables is not an EVN's priority. In the framework of the 7th Master Plan, up to 2025, EVN would invest in less than 2 GW of renewable power while its total new power capacity would be more than 22 GW, accounting for 38.3 percent of total new installed capacity in the country during the period 2011-2025.[52] In parallel, the constraint to implement low-cost power projects because of the low retail tariffs pushes EVN to prefer low-quality equipment, leading to delays and unreliable startup. Such conditions not only postpone the sound development of Vietnam's power system, increasing the real direct and indirect costs, but also are unfavorable to renewable power projects.

Moreover, the large-scale development of renewable energies presents inconveniences for EVN as it involves the loss of economic rents, the entry of new players reducing its bargaining power, and the reform of the sector's governance thus affecting its political leverage. Faced with the risk of a weakening of its position, EVN might be tempted to use its technical, economic, and political advantages to delay the low-carbon transition process.[53]

Newcomers and Challengers: Along with the *open door* policy and the comprehensive renovation of the public sector, the Vietnamese state has welcomed investments by some state-owned enterprises (SOEs) from other economic sectors and new actors (IPPs and BOTs) in order to share the burden of providing electricity services, particularly in the rural and mountainous regions.

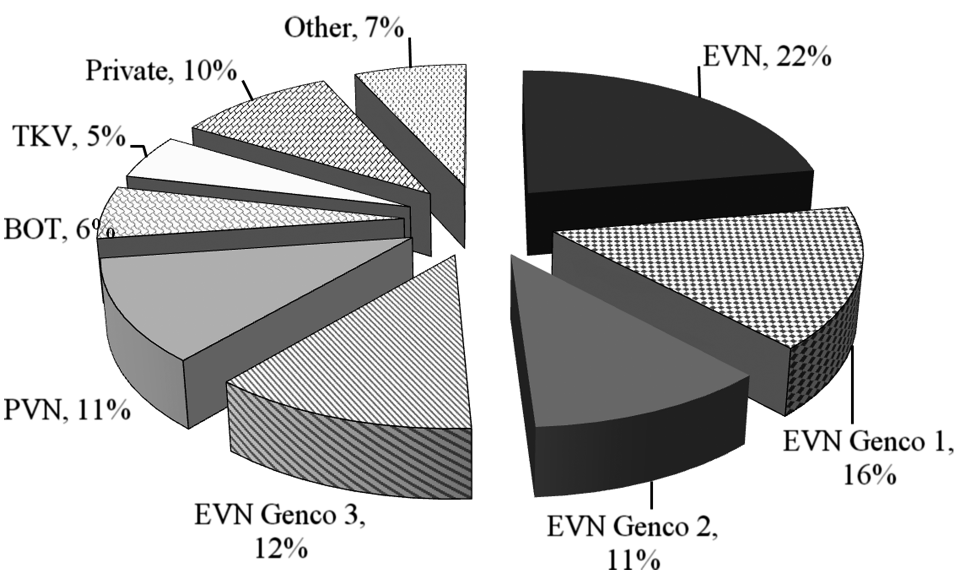
State-owned companies such as Vietnam National Coal-Mineral Industries Group (Vinacomin) and Vietnam Oil and Gas Corporation (PetroVietnam-PVPower), turn out to be important players in the electricity market. With annual electricity generation up to 10 TWh, they covered about 10 percent of the national power demand in 2012.[54] In fact, PetroVietnam is becoming one of the biggest IPP investors, participating in the construction of the Ca Mau 1&2 power plants with total capacity of 1.5 GW, commissioned in 2007 and 2008. Moreover, this company completed a gas/power/fertilizer complex at Nhon Trach with ultimate capacity of 1.95 GW. In 2013, SOEs represent 16 percent and other IPP/BOT schemes 23 percent of total installed capacity. Several other independent power projects are planned or being implemented (figure 4).

In addition, some rural communities own and operate low-voltage networks through which EVN's distribution companies sell electricity to end users. Also, major customers in industrial zones may be supplied directly by IPPs or BOTs such as the Hiep Phuoc power plant, owned by the Central Trading and Development Group (Taiwan), which supplies the Tan Thuan processing and export zone near Ho Chi Minh City. By the end of 2012, power plants owned by foreign investors accounted for about 8 percent of total installed power capacity.[55]

These local and foreign newcomers wish to sell the electricity they produce at higher prices. From this point of view, their interests may conflict with EVN that can impose its tariff conditions in the wholesale market. At the same time, facing similar cost constraints, many of them do not pursue, either, renewable-friendly strategies.

Meanwhile, some foreign investors are important new players for renewables as well. Despite the lack of financial appeal, they are seeking cooperation with Vietnam in this field with the support of their home governments.[56] With projects

Figure 4
POWER GENERATION CAPACITY SHARE IN THE VIETNAMESE ELECTRICITY MARKET BY OWNERSHIP, 2013[a] (in percent)



[a] EVN Genco: EVN's subsidiary; PVN: PetroVietnam; and TKV:Vinacomin.

that rely on foreign assistance, they mitigate the economic risks and create niches that are favorable to the development of renewable energies. Thus, many U.S. agencies have committed to renewable energy development in Vietnam, as shown by a clean energy project prepared by the Agency for International Development (USAID), and a contract signed in 2013 between General Electric and Cong Ly Co for the supply of wind turbines to the Bac Lieu wind farm project in southern Vietnam. This project represents an investment of VND 5.2 trillion (U.S. $246 million) and a designed capacity of 99.1 MW generated by 62 wind turbines. The wind farm has so far generated a total of 16 MW. In early 2014, the U.S. government announced plans to cooperate with Vietnam in wind power, providing technical assistance and sharing experience through visits by experts. In parallel, the Vietnamese-German project "Support for the Development of Renewable Energy in Vietnam" aims to improve the regulatory framework for renewable energy and to increase the professional and organizational capacities of key institutions. Vietnam and the German technical cooperation agency GTZ have announced a scheme for planning wind power over four years with financial support of up to 3.6 million euros, as compared to the project's total investment of 3.7 million euros.[57] The main goals are to study and measure the potential of wind power, implement feasibility studies of wind power projects, and complete a development plan for the decades to come. Moreover, the project experts have advised the MOIT to introduce incentives for grid-connected biomass and biogas power generation. Renewable energy is also one of France's and Denmark's priority cooperation areas with Vietnam through technology transfer and financial support.

In addition, in order to minimize project viability barriers to the proliferation of renewable energy, Vietnam and the World Bank's Carbon Partnership Facility (CPF) have signed an emission reduction purchase agreement. The CPF, along with participants as Sweden, Norway, and Spain, would buy the first three million metric tons of carbon credits generated through small hydropower development under the World Bank-funded Renewable Energy Development Project (REDP), creating a revenue stream for the projects that can encourage more private investment in renewable energy. The REDP could finance 15 to 25 additional subprojects, each requiring investment worth U.S. $5 to 20 million.

Foreign investors in renewable energies occupy a marginal position in the current electricity system. However, they can count on the support of their governments, which means external financial resources, conditioned by the commitment of the Vietnamese government in climate change mitigation policies. So they have some levers to initiate an evolution in the rules and structure of the electricity market. If they manage to find a convergence of interests with those of other local players (SOEs, IPPs, and BOTs) and form alliances with them to obtain more favorable pricing conditions and/or more subsidies for renewable energy, they would be able to play a catalytic role in the transition to low-carbon electricity.

The Transition to Low-Carbon Electricity as an Interactive Change Process

In the previous section, the characteristics of the key players and their positions in the structure and functioning of the electricity market in Vietnam have been drawn up. We have distinguished three main groups:

- The fossil-oriented local actors (*e*)—namely, EVN, together with its subsidiaries and various allies—feebly committed to low-carbon electricity transition, which may weaken their positions in the system.
- The foreign investors involved in renewable energies (*f*) and seeking to promote their interests in Vietnam.
- The State-Owned Enterprises (*s*), which are newcomers in the energy sector, seeking opportunities for further development.

Now, we can model the interactions between these groups whose importance in terms of the evolution of the process toward low-carbon electricity generation depends on their respective available resources, organizational capabilities, bargaining power, forecasting ability, and political leverage. We could visualize their relationships by pairs of actors' interactions $(e,f), (e,s), (f,s)$.

It is possible for the actors to form a hierarchical configuration as, for instance, $e > f > s$. Indeed, taking into account their positions and relationships as they were presented in the previous sections, it seems reasonable to suppose that a hierarchy does exist within the Vietnamese electricity market. EVN (*e*) occupies a dominant position and the powerful interwoven interests it represents seem opposed to those of foreign actors involved in the production of electricity from renewable resources (*f*). These foreign actors—while in a relatively weak position at present—could potentially dispose of enough bargaining power to initiate change, based both on their government's support and assistance and on Vietnamese government's commitment to climate change mitigation policies. The other State-Owned Enterprises (*s*) objectively have some common interests with the group (*f*) since they also wish to sell the electricity they produce at higher prices. Large SOEs usually play an important role in political decision-making but cost constraints do not motivate them to invest in renewables. Moreover, as deeply rooted in the relations and institutions of the Vietnamese economic system, they do not seem adept, nor willing, to undertake a fundamental change of the electricity market framework by themselves. Bearing in mind that they are able to act in an important role as their options could contribute to the creation of a critical mass shifting the balance of power to the benefit of low-carbon transition—or not—their strategies will largely depend on the evolution of the interplay between (*e*) and (*f*), So, in the current phase, the relations at a pair level (*e*, *f*) would largely influence the relationships at the level of the other pairs of actors, which could be regarded as derivative, i.e., dependent on the relationships between e and f:

$$(e, f) > (e, s), \text{ and } (e, f) > (f, s).$$

Focusing on the interplay of the pair (e, f), we argue that during the energy transition, players observe and interpret the information received from some visible indicators (focal variables), which are signs of their potential profits and losses, or measure their risk and uncertainty (ω_1, ω_2, … ω_n). Such indicators both influence their anticipations and appraise their ability to influence the rules of the game. Feed-in tariffs, subsidies to the electricity companies, coal prices paid by energy producers, or import duties for fossil sources can be considered focal variables, indicating incentives and counter-incentives for investment in renewable resources.[58] Thus, players' perceptions would be a function of the set Ω comprised of the focal variables ($\Omega = \omega_1, \omega_2, \ldots \omega_n$) affecting their strategies with regard to the energy transition (ET) process.

Obviously, each focal variable has neither the same meaning nor the same importance to various stakeholders. Thus, the increase of the feed-in tariff will be perceived positively by the group (f) and negatively by (e), while subsidies to the single-buyer will be perceived positively by both groups yet being especially important for (e). Therefore, the focal variables would have different signs and coefficients, depending on the group of stakeholders:

$$\Omega = (\pm)a\ \omega_1, (\pm)b\ \omega_2, \ldots (\pm)z\ \omega_{\mathrm{n}},$$

and $\Omega e \neq \Omega f \neq \Omega s$ (where Ωi is the set of the weighted focal variables scrutinized by the group i).

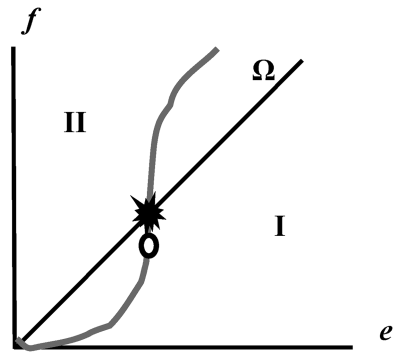
If we consider that $p_e^{(e,f)}$ is the perception by group e of its position in the pair (e,f), and $p_f^{(e,f)}$ is the perception by group f of its position in the same pair, we have:

$$p_e{}^{(e,f)} = [ET/\Omega e], \text{ and } p_f{}^{(e,f)} = [ET\ /\ \Omega f\,] \cdot$$

We can illustrate this method with the case of onshore wind power plants, assuming that Ω is comprised of the feed-in tariff and the subsidies to the single-buyer, which are two major variables indicating the balance of power inside the pair (e, f). On the one hand, the wholesale price of purchasing electricity from independent producers (ω_1) is an indicator of the ability to earn profits by producing energy from renewable sources, and indicates opportunities and risks for the actors involved. On the other hand, subsidies given to the single-buyer (ω_2) can be considered as compensation for its ensuing losses due to the change of the electricity production pattern and the increasing share of renewable energies.

In figure 5, the bisector represents the path of Ω *(income, risk, uncertainty)*, corresponding to a hypothetical equilibrium between the two groups of actors. Quadrant I shows dominance of fossil-oriented players (e), while in quadrant II renewable-oriented players (f) dominate.

Figure 5
FOCAL VARIABLES AND CHANGE PATH[a]



[a] Quadrant I: Feed-in tariff paid to wind energy producers (onshore) is less than 11 U.S. cents per kWh ➔ fossil energy-oriented players dominate. Quadrant II: Feed-in tariff paid to wind energy producers (onshore) is higher than 11 U.S. cents per kWh ➔ renewable energy-oriented players improve their position. ✸ = Feed-in tariff paid to wind energy producers (onshore) is equal to 11 U.S. cents per kWh ➔ balance of power switching point. O = Current point. Source: According to N. Nenovsky and Y. Rizopoulos, "Measuring the Institutional Change of the Monetary Regime in a Political Economy Perspective," SSRN Scholarly Paper No. ID 665145. Rochester, NY, Social Science Research Network, 2004.

As noted earlier, we assume that a major energy crisis—which could be a catalyst by changing significantly the gains, losses, and perceptions of different stakeholders—is rather unlikely. Therefore, a gradually increasing part of wind generation depends on its economic viability. Nowadays, the single-buyer (EVN) has to buy the produced electricity within the framework of 20-year contracts at a feed-in tariff of 7.8 U.S. cents per kWh. This price is far from matching costs and benefits and insufficient to cover production and grid connection costs suffered by players who invest in wind energy. According to various estimates, these costs plus a small margin amount to an average price of approximately 11 U.S. cents per kWh. Below that price, there is no economic incentive for such investment, the conditions necessary for the development of wind energy are not stabilized, and the balance of power is clearly to the advantage of the producers having an interest in investing in fossil resources (Quadrant I). Any increase of the feed-in tariff denotes an improvement of the wind energy producers' position concerning the distribution of economic rents, knowing that this trajectory is far from linear. A wholesale price of 11 U.S. cents per kWh would indicate a balance of power switching point. Any further increase in this tariff would be a sign of a context favorable for wind energy producers (Quadrant II).

Inevitably, such an evolution will not be appreciated by the single-buyer (EVN). The losses of economic rents that represents can motivate blocking strategies and, considering its dominant position, the end result might be far from the desired effect. It therefore seems unrealistic to anticipate a more renewable-friendly strategy on the part of EVN without compensation, even partially, of the losses induced by a higher feed-in tariff. This implies an increase in subsidies enjoyed by the single-buyer to purchase wind energy at 3 to 4 U.S. cents per kWh.[59]

Conclusions and Policy Implications

By focusing on the interests of the key players as well as on the conditions and institutional framework of the electricity market, we presented the mechanisms that could strengthen players' commitment to renewable resources and impact fossil-oriented strategies. At present, powerful actors such as EVN do not spontaneously favor the development of renewable energies, although this goal is consistent with the priorities of the government. The formation of a critical mass of stakeholders committed to renewable energies, convinced of the benefits that this pathway could represent for them and having sufficient economic and political leverage, seems a necessary condition for low-carbon electricity transition. This process depends greatly on interdependent strategies inside the sector and implies a fundamental transformation of the stakeholders' positions and relations. The simplified method proposed here could facilitate monitoring change and refocus attention on relevant policies. Indeed, some focal variables, as feed-in tariff and subsidies, influence expectations, orient investment strategies, and reflect the balance of power between the main groups of actors involved in the electricity market.

Given the features of the electricity system, the central role of the wholesale market's interrelations and regulation mechanisms during the current phase is highlighted. In the medium term, the evolution of its structure would be a crucial factor in order to attain a more balanced relationship between the various stakeholders. In particular, the opening of the market to new companies having the right to buy and sell electricity would decrease the power of influence of the dominant players and help create a more favorable environment for renewable energy. At the moment, not all power plants are eligible to participate in the competitive power market, such as BOTs and small-scale power plants, although some experts have suggested giving them this possibility. This could be the first step. However, the resistance of insiders and the government's concerns about energy security are not favorable to an abrupt and radical restructuring of the market.

Three conditions may ensure the consolidation of an alternative electricity generation pattern, encourage institutional entrepreneurs, and overcome carbon lock-in. Along with the gradual entry of new players in the competitive market, the strengthening of stakeholders committed to low-carbon transition will entail an increase in the feed-in tariff paid to suppliers of energy produced from renewable sources so that this activity becomes profitable, combined with an increase in subsidies enjoyed by the single-buyer to offset its losses due to the growing share of renewable resources in electricity production.

The rationale for providing financial incentives to renewable electricity is the positive externalities it represents while its competitiveness and economic viability is not assured yet. Indeed, with the exception of hydroelectricity, investment and operational costs are much higher for renewables than for conventional coal- or gas-fueled electricity generation. Such incentives are intended to apply in a relatively short period until renewable energies become commercially sustainable. However, the Vietnamese government is facing a major dilemma: either it increases the financial support with the significant burden on the national budget that involves, or it maintains the current level of subsidies and accepts a slow development of renewable energies. Additional resources could be obtained by taxing producers using fossil fuels and/or by higher retail prices. Yet, such measures can both increase the resistance of traditional players and have an undesirable economic and social impact. So, it is a finely defined set of measures that can ensure the overall balance, while promoting the development of renewables. As settlements depend on the interactive game whose main constituents have been presented here, it is reasonable to assume that international assistance and innovative financing modalities will play a decisive role.

This work sheds further light on the factors that determine the transition to low-carbon electricity in Vietnam. However, several limitations should be noted given the complex multilevel/multifactor character of the process. Indeed, in-depth knowledge of the vertical (government to enterprise) and horizontal (enterprise to enterprise) bargaining processes or of the way foreign stakeholders intervene and interact with local actors could usefully complete the analytical grid developed here. Also, the identified groups of actors are assumed to be relatively homogeneous and characterized by converging strategies. This assumption must be validated by field studies because important differences may exist within each group. Moreover, focusing on onshore wind power alone as an illustration of the conditions influencing the low-carbon transition may imply a biased perception. The method to monitor the change process could be further improved by integrating more detailed data on electricity selling prices as well as incentives and counter-incentives for all renewable and fossil resources.

Such limits open paths for future research by investigating interaction patterns inside the energy sector, including a formal structural analysis of actors' interrelations that takes into account their political leverage concerning the definition of energy policies and development plans, and elaborating a more global framework that integrates technical and economic indicators for all fossil and renewable energies.

NOTES

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It enjoys a high level of independence with its own accounts, management, and board of directors, but is still under EVN's authority.

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[44]The Prime Minister of Vietnam, Decision No. 1539/QD-TTg on approval of list of Project "Master plan on wind power development in Vietnam" funded by official development assistance from the German Government, 2014; The Prime Minister of Vietnam, Decision on support mechanism for the development of power generation projects using solid waste(s) in Vietnam, 2014; and The Prime Minister of Vietnam, Decision on the support mechanism for the development of biomass power projects in Vietnam, 2014.

[45]The purchase price is VND 2,114 per kWh (10.05 U.S. cents per kWh) for power generation projects using solid wastes, and VND 1,532 per kWh (7.28 U.S. cents per kWh) for power generation projects using combusted gas collected from solid waste landfills.

[46]As an example, the MOIT proposed (2014) to fix the purchasing price for electricity produced in small hydro power stations for a period of 20 years, knowing that in the context of increasing inflation rates and faced with a single buyer, such an evolution could negatively affect them.

[47]T. Phan, "EVN Develop the Electricity Tariffs for Whom?" *Vietstock*, 2015.

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[51]In 2013, EVN decided to buy about 2.45 percent of total electricity demand from China, at prices much higher than those paid to local producers. Also, Chinese contractors have been major partners of EVN in building new power plants.

[52]Institute of Energy, *The 7th Power Development Plan* (Hanoi: Institute of Energy, 2011).

[53]M. Wang and J. Zhao show that under the monopoly extraction of a non-renewable resource, if the renewable substitute is capacity constrained, the resource price will first continuously increase until the renewable substitute becomes competitive. Then the monopolist will stave off the renewable substitute for a certain period of time while keeping the resource price flat at the renewable's marginal cost (M. Wang and J. Zhao, "Monopoly Extraction of a Nonrenewable Resource Facing Capacity Constrained Renewable Competition," *Economics Letters*, vol. 120, no. 3 (2013), pp. 503–08).

[54]National Load Dispatch Center, *Annual Report*, 2012.

[55]Ibid.

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[57]The Prime Minister of Vietnam, Decision No. 1539/QD-TTg on approval of list of Project "Master plan on wind power development in Vietnam" funded by official development assistance from the German government, op. cit.

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Appendix

POLITICAL AND TECHNICAL MILESTONES OF THE ELECTRIC POWER SECTOR IN VIETNAM

Political Milestones	Date	Technical Milestones
	1954	31.5 MW, 53 GWh/year (Northern part)
Department of Electricity, Ministry of Industry and Trade	1955	
	1958	60 MW, first 35 kV transmission/ distribution systems
General Department of Electricity, Ministry and Water Resources and Electricity	1961	
Department of Electricity, Ministry of Heavy Industry	1962	
	1963	Uong Bi Power Plant of 48 MW, first 110 kV transmission/ distribution grids
Northern Electric Power Company, Ministry of Electricity and Coal	1969	
	1971	Thac Ba Hydro Power Plant of 108 MW
Central Electric Power Company	1975	
Southern Electric Power Company	1976	
	1979	220 kV transmission/distribution grids
Ministry of Electricity	1981	
	1988	Hoa Binh Hydro Power Company of 1920 MW
	1992	The first North-South 500 kV transmission grids

(continued)

Appendix (continued)
POLITICAL AND TECHNICAL MILESTONES OF THE ELECTRIC POWER SECTOR IN VIETNAM

Political Milestones	**Date**	**Technical Milestones**
National Load Dispatch Center (A0)	1994	
Electricity of Vietnam (state-owned company)	1995	
First Electricity Law	2004	
Electricity Regulatory Authority of Vietnam (ERAV)	2005	The second North-South 500 kV transmission grid
Roadmap to Electricity Market Electricity of Vietnam (EVN) is transformed to a holding (Vietnam Electricity Group)	2006	
Ministry of Industry and Trade (MOIT) Electric Power Trading Company (EVN)	2007	
National Power Transmission (EVN)	2008	
	2011	Competitive generation power market trial
General Directorate of Energy (GDE/MOIT)	2012	The first wind farm at the industrial level
	2013	The first offshore wind farm