Adaptation of aggregators and balance responsible parties to Vietnam

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Danish Energy Agency

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Disclaimer

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Executive summary

With reference to the Development Engagement 2 – Capacity Development for Renewable Energy Integration into the Power System, under the Danish Energy Partnership Programme in Vietnam (DEPP II), this report investigated the possible adaption of aggregators and balance responsible parties to Vietnam.

Vietnam is poised to introduce considerable amounts of renewable energy into its electricity system in the coming years, putting pressure on balancing and ancillary services. Concurrently, the demand-side is expected to undergo changes, including a growing share of Electric Vehicles, in addition to a yearly growth in demand of between 8,52% and 9,36% up to 2030.

Implementing already decided legislative initiatives to foster markets and establishing the necessary institutional and technical infrastructure, will be key to ensure a cost-effective and smooth growth trajectory for the Vietnam electrical system. Part of this will be finding the right way to engage many more actors in the economy to help provide balancing and ancillary services. The Danish experience with balancing responsible parties and aggregators can provide inspiration and input to the road forward.

The roles and responsibilities of market actors in the Danish electricity market with a focus on Balance Responsible Parties (BRP), Balance Service providers (BSP) and Aggregators is first presented. The tasks, products, business model and how to become a BRP or aggregator is explained, as are imbalance settlements and compensation mechanisms. Lastly, benefits and drawbacks of the BRP model are discussed, including its future development.

The Vietnamese potential for market-based balancing and aggregation is analysed based on an overview over the current characteristics and barriers of the generation and wholesale markets in this regard. Recent policy developments, pilot programmes and research initiatives point to potentials for improving the role of the customer in maintaining balance of the power system, given implementation of the right framework conditions.

Taking into account the difference in operating conditions of Denmark and Vietnam, a number of recommendations are proposed, most notably the following:

• Provide incentive mechanisms for ancillary services to ensure flexible operation of the power system as the share of renewable energy sources rises

• Increase the number of units directly participating in the electricity market such as BRPs, aggregators and VPPs

• Develop metering, communication, and information technology infrastructure according to an appropriate roadmap to lay the ground for the introduction of BRPs and aggregators

• Conduct studies to identify the types of ancillary services that BRP and aggregators may provide in the future and evaluate the potential and possible effects of the BRP model in Vietnam

• Implement the BRP model starting with the renewable energy producers, who naturally produce imbalances

1. Introduction

This report sets out to introduce the current Danish perspective and experience with balancing the electricity market using BRPs and with establishing a framework for engaging smaller consumer units in this effort through aggregators. At the same time an overview is presented over the current characteristics and barriers of the Vietnamese generation and wholesale markets as regards the potential for market-based balancing and aggregation.

In the third part of the report a series of recommendations are elaborated, based on considering the Vietnamese potentials and barriers in the light of the Danish experiences.

In an annex a number of concrete Danish examples of aggregators and Balance Responsible Parties are briefly presented.

2. Roles and responsibilities of market actors in Denmark

2.1 Overview: Balance Responsible Parties and Aggregators

2.1.1 What are their roles and how do they interact

The overall responsibility for participation in the electricity market in Europe is defined in two roles in the common European electricity market regulation[1]. The roles are Balance Responsible Party (BRP) and a Balance Service Provider (BSP). A variety of practical approaches for implementation is seen across Europe[2]. Originally, the role of BSP and BRP was seen as the same in the Nordic electricity market and the BSP was introduced as part of the European electricity market harmonization. Introducing the role of BSP in the Nordic Imbalance Settlement happened by splitting the current responsibilities of the BRP into two. The focus for each is:

- BRP – responsible for imbalances
- BSP – delivering balancing energy and capacity services

In the last five years a new role has appeared as aggregator[3] . At the moment there is only a minor difference between a BRP and an aggregator, but in the future, we look into more differences between them[4]. For now, the difference between a BRP and an aggregator is which

[1] See article 16 and 17 in the Electricity Balancing Guideline: Electricity Balancing (entsoe.eu)
[2] See e.g. the overview in: https://www.usef.energy/app/uploads/2021/03/08032021-White-paper-Flexibility-Deployment-in-Europe-version-1.0-3.pdf
[3] It is expected to have the role as aggregator defined, when the Electricity Balancing Guideline will be updated in the next 1-2 years, see this for more information: EUI RSCAS Working Paper 2021/53 The regulatory framework for independent aggregators
[4] For more information on future role of aggregator see this document from the four Nordic TSO's: unlocking-flexibility---nordic-tso-discussion-paper-on-third-party-aggregation.pdf (statnett.no)

ancillary services the aggregator can sell and which the BRP can deliver. Over the next couple of years, however, they are expected to be split and when that is done, the BRP will only sell energy, whereas an aggregator will sell flexibility in the balancing market.

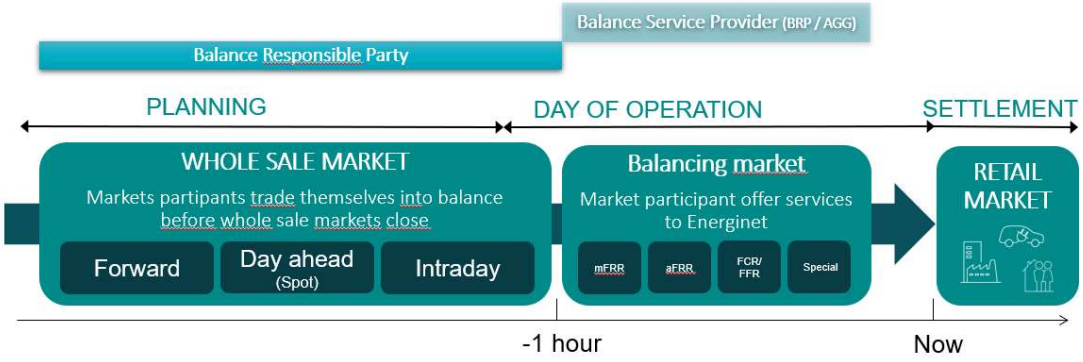

Figure 1. One Electricity market – Many Markets

As the figure above shows, the electricity market in Denmark and Europe consists of the wholesale market and the balancing market. In the wholesale market, the BRP is operates and use the Day ahead and Intraday on the power exchange to sell/buy electricity and balance their portfolio of production and/or consumption. In the balancing market, the TSO is responsible for the short term balancing and has established three overall balancing markets and buys the needed balancing services. The BRP is often active in all balancing markets while the BSP and aggregator can for now operate independently in the FCR/FFR markets with frequency services.

Until one hour before the operating hour, the BRP is trying to prepare to be in balance by buying what they think is needed in order to keep their portfolio in balance in the operational hour. Then one hour before the operational hour and until the operational hour, it is the TSO which, through the balancing markets and frequency service markets, can buy the necessary services from BRP and BSP and the aggregator

In figure 2 below, the different actors and their relations to the different parts of the electricity market is seen. One thing to note from this figure is central role of the BRP and BSP. The aggregator will come in between the producers/consumers and the BRP and the BSP and will in the future also have a direct link to the market. Please note that BRP, BSP and aggregators are roles and the same entity can acts as both BSP, BRP and aggregator, but it can also be different companies cooperating or competing.

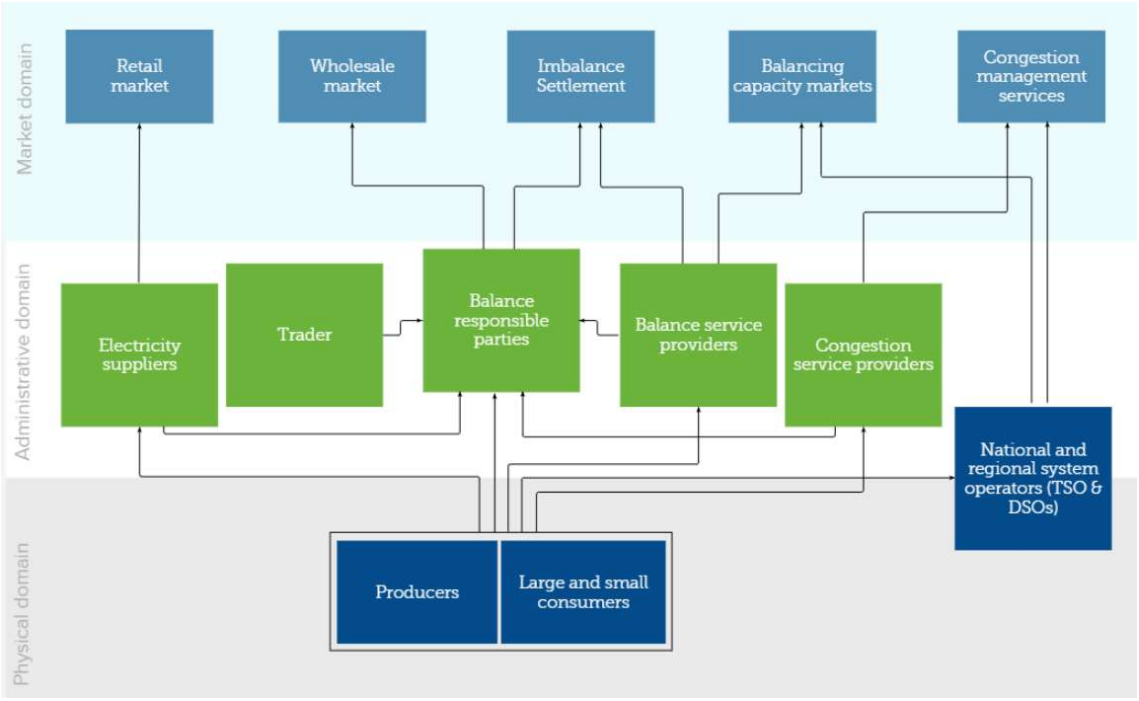

Figure 2. The roles and relations in the European electricity market

2.1.2 What are the advantages and disadvantages of a BRP model

There are both some advantages and disadvantages to the European BRP model with the most important mentioned below.

On the advantage side, we see that the BRP model helps new companies into the electricity market and the BRP supports balancing and flexibility. This happens through forecasts and the use of the Intraday market to reduce imbalances at the time of delivery. The BRP helps for example flexible consumption to get into the balancing market and increases competition for delivery of balancing services. The effect is relatively lower costs for the TSO for balancing. Furthermore, the BRP model helps the TSO to maintain the balance of the grid and establishes contact between the TSO and the generator/consumer. Further, the European electricity market regulation and Danish implementation is rather complex and, the BRP helps explaining this to the consumers/generators in the market.

And for the disadvantages, the BRP model may create monopoly-like situations. If a big BRP is representing a large share of market capacity or consumption, this BRP will have strong market power and can use this to affect the market. It is therefore important to have competition between the BRPs in the market to avoid monopoly. Also of importance is a strong regulator which monitors the electricity market and can prevent misuse of dominant market positions.

2.1.3 What are the advantages and disadvantages of an aggregator model

As for the BRP model, there are some advantages and some disadvantages to the aggregator model. As explained in detail below, with an aggregator model the small units will be pooled together by an aggregator. This model then makes it possible for more small units to participate in the balancing market, which in turn creates more competition and volume. This is an advantage for both costs and security of supply. As for disadvantages, having many small units in the market is a disadvantage because it will increase complexity. When there are many small units participating in the market, communication tools need to be good, because only this way the units in the same portfolio will be able to act at the same time. The largest advantage of the model it that it makes it possible to group more units.

A specific challenge is found in proving an activation from a portfolio with many small units. There is no requirement for actual measurements from each unit. Here it is enough to have one actual measurement and then assume similar units will react the same way. This increases the complexity due to the lack of control of whether the units are in fact delivering as promised.

2.2 Balance Responsible Parties (BRPs)

The main role for the BRP is to buy and sell electricity on behalf of electricity suppliers and producers. To be able to buy and sell the electricity they are obligated to send in schedules to Energinet (TSO) every day with their expectations of how much electricity they expect will be produced and consumed from their customers the next day. There is no obligation to be in balance between actual production and consumption and sold/bought volumes in the market. If the BRP has an imbalance they will have to pay the imbalance price for the imbalance when settled and this gives an incentive to try to balance their portfolio as well as possible. There is no requirement for trade BRPs to send in schedules. Energinet as TSO compares the overall schedules, trading plans with forecasted and actual generation/demand, which shows if there are some imbalances. These imbalances will then be balanced by Energinet. The cost for this will be invoiced to the BRP, which is responsible for the imbalance. The BRP is able to handle all the administrative work and legal issues so the consumer/producer can have full focus on their producing and distributing electricity and leave the market bidding and balancing to the BRP.

2.2.1 The tasks

For each generation- and demand-metering point as well as all trade with physical electricity there must be an electricity supplier. This electricity supplier needs to be a BRP, or have a BRP, and through the BRP fulfill the requirements about the balance responsibility for each metering point connected to the grid. Each end-user is responsible for the imbalances he makes in the market, which is why they must have a BRP to handle these imbalances. This is legally decided in the European electricity directives and the electricity market grid codes. The BRP needs to

have made an agreement about balance responsibility with Energinet (the Danish TSO) and "Imbalance Settlement Agreement" with the balance settlement responsible[5].

The BRP is financially responsible for deviations between submitted trading plans and actually generation/demand for the metering point which the BRP is responsible for, as well as the costs for buying ancillary services, which Energinet as system responsible has defined and bought to maintain the balance. Energinet is buying the energy balancing services, but sends the bill to the BRPs which has created the imbalance, which was the reason Energinet had to use energy balancing services to balance the system. Energinet also buys frequency services and capacity reserves for balancing and a number of other ancillary services. The costs for these services are covered by the system operation tariff paid by the consumers.

Balance Responsible Party for demand

The BRP holds the balance responsibility for demand. The BRP for demand also holds responsibility for agreements on the physical electricity trading related to demand for the metering points for which the BRP for demand is responsible.

Balance Responsible Party for generation

The BRP holding balance responsibility for generation. The BRP for generation also holds responsibility for agreements on the physical electricity trading related to generation for the metering points for which the BRP for generation is responsible.

Example: A power plant has a BRP that makes sure their generation is sold on the market, and this BRP send in plans and bids to the platforms and the TSO. The BRP strives to reduce the costs for imbalances between day ahead and delivery by improving its forecasts and using the intraday market or own portfolio imbalances.

Balance Responsible Party for trade

A BRP exclusively holding balance responsibility for physical electricity trading (a trader). This means that this type of BRP does not represent any physical asset. A BRP is always this type but can also decide to be demand and generation. The BRP trader creates liquidity in the electricity market and indirectly ensures an efficient price signal.

2.2.2 The BRP business model

The main business model for the BRP is to optimize the electricity market process for the consumer or generator. This can be done through special services to specific segments and productions types, ie. Forecasts for wind and solar production, balancing services for flexible generation, low costs for suppliers through efficient it-systems. For all three types of BRP

[5] The Nordic TSO's have outsourced the settlement to the TSO owned private company, eSett: eSett | Nordic Imbalance Settlement | We settle, together!

(generation, supply and trade) deep insights in the market functions, analytical skills and regulatory understanding is necessary.

For Energinet and the TSOs in Europe, the BRPs are important for the overall balancing of the system from day-to-day in the wholesale market and hour-to-hour in the balancing market and for reducing the need for central planning and complexity in a system with an increasing share of renewables. Energinet can focus on real-time balancing and frequency services and does not need to do central planning.

2.2.3 The products

The main product of the BRP is bidding and selling in the wholesale market for generators and suppliers. They can differentiate themselves on different forecast services, optimization of production, long term electricity price hedging and also as the facilitator of long term power purchase agreements and green certificates from renewables.

As a TSO, Energinet has the need of several special products, which are called ancillary services. Ancillary services is a concept of the electricity generators and demands, which are used to maintain the balance and stability of the power system. These ancillary services are bought by Energinet though agreements between Energinet and the BRP. When BRPs and aggregators separate, the BRP will still be able to sell ancillary services, but if the BRP loses the right to bid in for the physical asset to an aggregator, then they will lose revenue. They can be activated either automatic or manually depending on which ancillary service it is. The main reason for having these products is to maintain the balance and stability of the power system.

Denmark is split into two parts because each part is connected to different synchronous areas. West Denmark (DK1) is connected to the European area and East Denmark (DK2) is connected to the Nordic area.

In Denmark, five different types of ancillary services are found. The system could actually be balanced just by having one fast ancillary service. Most power systems can, however, by having a wider portfolio of ancillary services increase flexibility and keep expenses for balancing down. In the table below the five different products in Denmark are listed and shown for each part of Denmark.

Table 1. Ancillary services for each part of Denmark

Western Denmark (DK1)	**Eastern Denmark (DK2)**
-	*FFR* (Fast Frequency Reserve)
FCR (Frequency Containment Reserve)	*FCR-N* (Frequency containment reserve for Normal operation) *FCR-D* (Frequency containment reserve for disturbances)

aFRR (Automatic Frequency restoration reserve)	*aFRR* (Automatic Frequency restoration reserve)
mFRR (Manual Frequency Restoration Reserve)	*mFRR* (Manual Frequency Restoration Reserve)

In Denmark, proactive operational planning is used. This is made possible by robust prognoses for generation and demand. Using this way of planning makes it possible to use the slow and manual reserves more, resulting in cheaper balancing of the system.

Figure 3 below shows a more specified overview of ancillary services in Denmark. Technical specifications are shown, such as maximum of time before the ancillary service should be activated, minimum bid size, whether it is a symmetric or asymmetric product etc.

Figure 3. Technical specifications for ancillary services in Denmark

2.2.4 The customers

The customers of the BRPs are the electricity suppliers for either generation (the customer owns a generation assets) or demand (the customer is the electricity supplier to the end user). Thus, all customers and producers must belong to a BRP. On the consumption side, the BRP does not sell electricity directly to the consumers, as the BRPs customer is not the consumer but the electricity supplier, who sells electricity to the consumer.

2.2.5 Who can become a BRP

A BRP is a company, which have made an agreement with a TSO. The BRP is an independent private company and isn't owned by the state or the DSO/TSO.

More precisely, a BRP is defined as a company that has a valid Imbalance Settlement Agreement with eSett and a valid Balance Agreement with a TSO and manages a Balance Obligation on its own behalf as a producer, consumer, or trader of electricity or on the behalf of other producers, consumers, or traders of electricity.

2.2.6 eSett in the Nordic imbalance settlement

To participate in the Nordic imbalance settlement, the BRP need to obtain certain banking services from banks that eSett has approved as settlement banks. Each BRP needs to open a settlement account in one of the preapproved settlement banks and sign the "Pledged Cash Account Agreement" in cooperation with the settlement bank.

eSett provides imbalance settlement services to electricity market participants in Denmark, Finland, Norway, and Sweden. eSett carries out the imbalance settlement on behalf of their customers effectively and reliably, so the market participants can focus on their core business. Here Energinet ensures that the balance is guaranteed. eSett calculates imbalances for each BRP and makes sure each party is paid and invoiced correctly.

2.2.7 Rules, regulations, and sample documents

The rules/conditions for becoming a BRP in Denmark, are available at Energinet's homepage and can be found in English[6]). For a BRP to be approved, the BRP must meet the following requirements set by Energinet:

I. The BRP must have entered the "Agreement on balance responsibility"
II. The BRP must be registered for VAT in Denmark or another EU member state or EEA country
III. The BRP must, if necessary, provide adequate security for its obligations according to the rules set out in chapter 4.2 Security (in the Regulation C1)
IV. The BRP must have completed a test approved by Energinet of its communications with Energinet according to the rules set out in the Regulations F1: "EDI (Electronic Data Interchange) communication with the DataHub in the electricity market" and Regulation F: "EDI communication"
    - If a BRP wants to be a BRP for trading, they can skip this point about communication with Energinet (IV), as they only need a set-up with the market platform and eSett (The company handling Energinet's imbalance settlement).
V. The BRP must submit the required master data electronically to Energinet through the form "Master data for balance responsible parties" which is available at Energinets homepage (www.energinet.dk)

[6] How to become a balance responsible party (energinet.dk) and https://en.energinet.dk/Electricity/Rules-and-Regulations/Archive-Market-Regulations

In addition, an “Imbalance settlement agreement” must be concluded between eSett (explained below) and each BRP. It needs to be signed by the BRP before they can start their operations as a participant in the Nordics. Participating as a BRP in the electricity market settled by eSett also requires a valid “Balance Agreement” between the BRP and the respective TSO in the market where the participant is active. The market participants can request the agreement from eSett which will handle the signing process on behalf of the TSO.

2.3 Aggregators

As trades in the electricity markets most often involve larger volumes than, for example, a single household can offer, there is a need to pool capacity from flexible units such as households if they are to deliver flexibility and participate in the balancing markets. In order for e.g. owners of electric cars or a local community to pool their capacity, they would need an aggregator. An aggregator is an entity which brings together (or aggregates) a set of units to deliver upward or downward regulation capacity in the electricity market.

2.3.1 The tasks

The aggregator's function is to pool electricity supply and/or demand and sell this capacity in the electricity markets. Currently, this must take place together with a BRP and/or BSP. An aggregator's capacity could be, for example, 1000 electric vehicles or 200 household heat pumps. The aggregator works by spotting when the price of electricity is high and then disconnecting the unnecessary demand of the consumers in his portfolio or similarly increasing their demand when electricity prices are low. This is called downward or upward regulation of demand.

On the figure below an example of a case where there is a need for activating the energy balancing service mFRR is shown. In the case, a large wind turbine is not delivering as expected, due to e.g. a change in forecast or an unexpected technical outage. The system then needs more energy due to the wind turbine not delivering as expected. In this very simple example it is assumed that there is no other imbalance in the system. To get the system back in balance, Energinet sends a request for up regulation of mFRR in the market.

To cover this request, an independent aggregator wins the bid for supplying the up regulation of mFRR. This procedure of sending a request for up regulation is relatively fast. For mFRR the time limit is 15 minutes until they should be all up and running and full delivery. From Energinet asks them to deliver, they have 15 minutes to deliver full. The independent aggregator turns off charging for a number of electrical vehicles equaling the need for up regulating.

When the delivery has ended, the aggregator sends the data to the DataHub at Energinet. These data are summed up by DataHub per BRP per retailer and then DataHub distributes it to

eSett for settlement. eSett corrects and compensates the relevant BRP and settles both the BRP and the aggregator. eSett does the settlement for Energinet. Overall, Energinet is responsible for the imbalance settlement procedure, but has outsourced the procedure eSett.

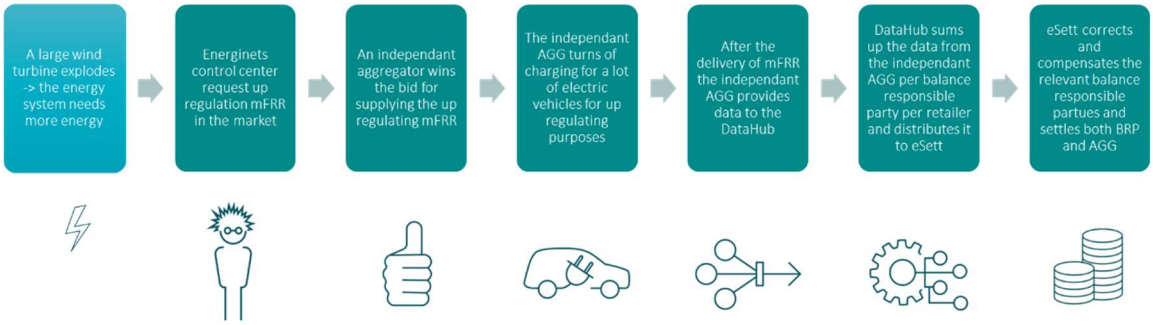

Figure 4. A case where there is a need for activated mFRR

2.3.2 The Aggregator business model

The goal for Energinet with the model is to implement independent aggregators with as little impact of the BRP as possible.

Since the aggregator role is relatively new in Denmark, there are different business models being discussed (please also see footnote nr. 3):

- Now all aggregators have a BRP, but in the future they are expected to sell ancillary services to the TSO directly. The aggregator will be able to deliver the energy ancillary services to Energinet without responsibility for the energy part – they will only deliver the flexibility. The reason for this is EU regulation that order TSOs to implement the aggregator role. The intention is that the aggregator will help the system, due to more small units/plants being able to participate easier in the market and deliver more volume and competition, especially in situations with high demand, where limited volume for flexibility from generators is available.
- Helping the BRP to balance at the last moment. The BRPs are thinking of letting the aggregator control the units, which the BRP are responsible for, as the aggregator will control the units across them, whereas the BRPs are good at trading.
- Spot-price optimization for consumers/producers. The aggregator makes agreements with the end-user and then controls their units to price optimize.

2.3.3 The products

The aggregator can be said to have three possible ways of operating:

1. Price optimize. The main focus for the aggregator is to minimize the electricity bill for the end-user.

2. Balance optimize. Here the aggregator helps the BRP to balance the electricity system in the best way.
3. Deliver ancillary services. The aggregator is participating in the ancillary service market and will deliver ancillary services to Energinet.

Typically, an aggregator will engage in value stacking, where the customer is provided with several services adding up to an attractive offer.

2.3.4 The customers

As there are three different ways the aggregator can operate and there are also three different customers of the aggregator: 1) the end-user, 2) the BRP, and 3) the TSO.

E.g. for the end-user when the aggregator aims to price optimize, the customer is the end user. From the customers perspective aggregating demand makes sense since it allows them to save money on their electricity bills by being flexible. At the same time, consumers are helping the system to stay green - this also benefits consumers, as it allows Energinet to maintain the security of supply that characterizes the Danish electricity system.

Currently, there are no specific examples of how the customer could be the BRP, but it is plausible that the customer could be the BRP because the aggregator could help the BRP balancing the system. The same goes for the TSO, where specific examples are lacking, however, it is plausible that the aggregator could help the TSO balancing the electrical system.

Demand-side response is not reserved for private households or electric vehicle owners - on the contrary. It may be a municipality that moves the water treatment program at swimming pools to a time with generation surplus in the system - or a cold store where products are frozen at such low levels that it is possible to reduce the demand for cooling, when the demand for electricity exceeds the supply. In that way, demand-side response also helps to balance electricity market forces and keep prices low.

2.3.5 Who can become an aggregator

An aggregator is a person, business or technology which brings together (or aggregates) a set of related products, in this case upward or downward regulation capacity in the electricity market. An electricity market aggregator pools flexible electricity consumers and sells the timing of demand in the electricity market.

Everyone can become an aggregator, but there are some who are more obvious than others. A company, which already has an IT- communication system would have a higher potential of becoming an aggregator, as communication is central to the aggregator function. If this company has e.g. an application, which can control something, maybe light, they will have the potential for expanding the application to become an aggregator.

2.3.6 Compensation mechanisms

The compensation mechanism will first become a part of the market when the independent aggregator is introduced. Today, the way it works today is that the BRP and BSP must be the same company. In the near future, however, the concept of independent aggregator will be introduced in the Danish market. Then, BRP and BSP no longer need to be the same company. At this point in time, the need for compensation will arise.

The way the aggregator earns money depends on the situation, for example if they sell ancillary services, they will share the income with the owner of the unit they sold the ancillary service for. If the aggregator is helping a BRP they will get a fixed payment for the service which they provided for the BRP. And when they are doing spot-price optimization they will either get a part of the savings or they will sell ancillary services, where they will earn money as explained in the first part of the section.

The correction and compensation for an aggregator is as followed:

- The aggregated activations that cause imbalances are send to eSett and is included in the imbalance settlement per balance responsible party per retailer
- Imbalances causing imbalancing fees are corrected for BSP-activations
- Trade imbalances caused by BSP-activations are settled with the spot prices instead of the normal imbalance price.
- All relevant data is distributed to both the balance responsible party as well as the independent aggregator

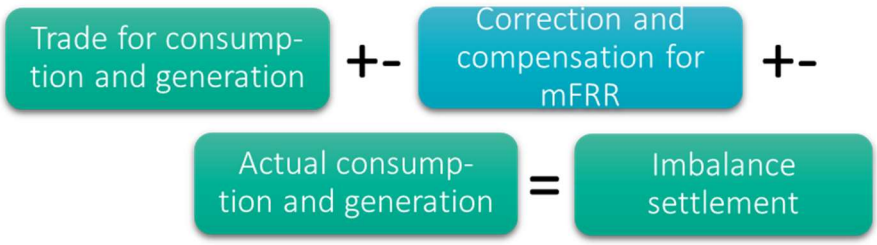

Figure 5. Calculating the Imbalance price

From figure 5 above we know that the Imbalance price is mFRR. When up regulating (more generation / less demand) the imbalance price is higher than the spot price. When down regulating (less generation / more demand) the imbalance price is lower than the spot price. The difference between the spot price and the imbalance price is the payment for being flexible.

Consequently, the BRP is settled with the change in energy delivered caused by the independent aggregator at spot price and the independent aggregator is settled with the difference between the imbalance price and the spot price.

2.3.7 Rules, regulations and sample documents

For the aggregator role we have “Aggregeringsbekendtgørelsen”[7] (in Danish) and the ordinary agreement rules, if the aggregator concludes an agreement with the end-user. Overall, the rules/guidelines are similar to those for electricity suppliers. This secondary legislation for aggregators (“Aggregeringsbekendtgørelsen” BEK nr 2250 af 29/12/2020) obligates Energinet to implement a compensation and correction model for independent aggregators. Here are listed three of the important points from the legislation:

- *”Correction of imbalance may involve the balance responsible parties who are directly affected by activation of consumption or generation performed by an aggregator.”*
- *”… pays … or is paid financial compensation by an electricity trading company if these companies are directly affected by activated consumption or generation.”*
- *”…the financial compensation is strictly limited to cover costs caused by activated consumption or generation.”*

[7] Aggregeringsbekendtgørelsen (retsinformation.dk)

3. The Vietnamese potential for market-based balancing and aggregation

3.1 Status on Vietnamese electricity markets

3.1.1 Vietnam Competitive Generation Market (VCGM)

On July 1, 2012, the VCGM began full commercial operation. The VCGM's goal was to define the rules and procedures for a single-buyer, cost-based electricity market, to begin unbundling and restructuring EVN, and to develop the systems and infrastructure required to enable the operation of an electricity market. The VCGM's main objective was to encourage competition in generation while essentially maintaining the existing arrangements for Power Corporations (PCs) and customers. This was accomplished by having a single buyer, the Electricity Power Trading Corporation (EPTC), purchase all power from generators and provide power to PCs under the Bulk Supply Tariff, with PCs selling power to end users based on national standard retail tariffs.

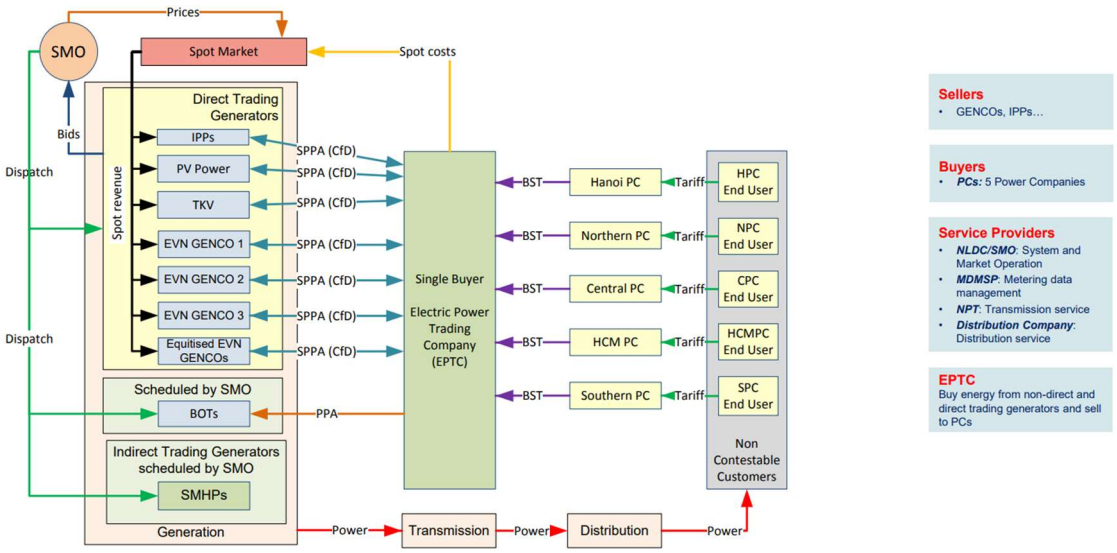

Figure 6.Outline of VCGN Trading Arrangements

Not all generators have competed in this market; around 50% of installed capacity is not traded directly in the VCGM, which only covers those categorized as Direct Trading Generators or DTGs. Direct Trading Generators trade with EPTC through a Standardised Power Purchase Agreement (SPPA) or a CFD contract and can participate in the Spot Market and receive the Spot Price. A contract for differences (CFD) is a financial derivative trading arrangement in which the discrepancies in settlement between the open and closing trade prices are settled in cash. Such agreement can protect the benefit of directly participating generators in the VCGM under disadvantage scenario, even though it can reduce the maximum profit under advantageous circumstances. The System and Market Operation (SMO) schedules Indirect Trading Generators (ITGs), which also administers Strategic Multipurpose Hydropower Plants, which are likewise

classified as ITGs. The BOT (Buy-Operate-Transfer) plants, on the other hand, interact in the VCGM through a Power Purchase Agreement (PPA) contract and are independent of spot market price, resulting in the fact that the BOTs can receive a stable revenue throughout the life of the project before handing over to the government.

Even though the VCGM has enabled competitiveness in the generation market, it does not provide freedom for neither distribution companies nor end-customers since they do not have the opportunity to choose the buyer. Furthermore, VCGM does not provide incentives or economic benefits to ITGs, which are responsible for voltage and frequency regulation mission. Amid the development of renewable energy, such an electricity market design can lead to a decrease in system flexibility, since non-EVN generators are unlikely to participate in flexibility operation without proper incentives and financial benefit from the market mechanism. In order to liberalize the electricity market and bring additional benefits to generators that participate in special operations, a new market mechanism is necessary.

3.1.2 Vietnam Wholesale Electricity Market (VWEM)

Based on the VCGM, the establishment of the Vietnam Wholesale Electricity Market (VWEM) was proposed in 2015 based on Decision No.8266/QĐ-BCT dated 10/08/2015 approved by Ministry of Industrial and Trades (MOIT). The proposed VWEM trading arrangements intended to have PCs contract directly with generators, thus changing the role of the Single Buyer (EVNEPTC) in the market. The VWEM also enables wholesalers to enter the market and contract with generators before selling to PCs (i.e., contract with PCs). The MOIT-approved VWEM design allows eligible consumers to contract directly with generators or PCs other than their present PC. It is, however, important to note that even though VWEM has been deployed, the current status of the market is still incomplete. An eligible customer is either an existing or new customer who is connected (or intends to connect) to the transmission network and thus must be considered for inclusion in the wholesale market. Transmission charges would apply to eligible customers. At this point, all other customers would be considered part of the retail market and could only be served by the relevant PC.

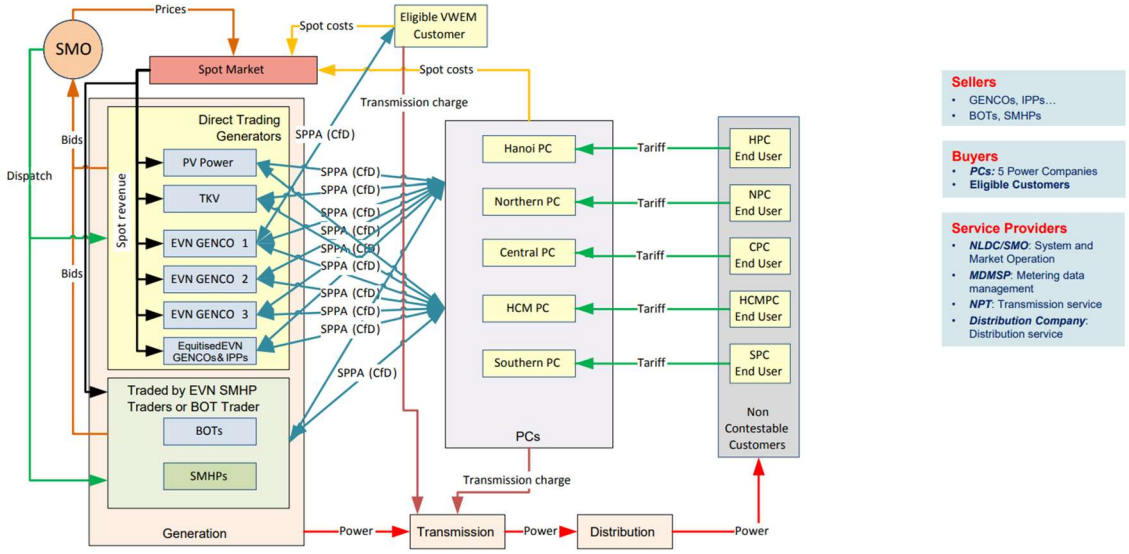

Figure 7. Outline of VWEM Trading Arrangements

Spot Market

The current VWEM spot market is based on a Cost-based Pool mechanism, in which the quotation of thermal power plants is based on consumption rate, fuel price and unit classification coefficient. For hydropower plants this is based on hydrological parameters. Generation units have to prepare the quotation for 48 transaction cycles of day D and submit to NLDC in day D-1. This mechanism can ensure that power plants do not suffer a loss in production if the amount of electricity sold is greater than or equal to the unit's estimated plan, stabilize the electricity price and prevent power generation corporations from cornering the market. Some noteworthy drawbacks should be taken into consideration, including difficulty in electricity price monitoring, the fact that power generation companies can generate invoices at a higher cost than they actually have, as well as the existence of the easily corrupted request-for-grant mechanism when approving the construction and procurement investment plans of the generating units. When the market is ready, it should move to a Price-based Pool mechanism.

Ancillary Services

At the moment, only frequency regulation service is enabled in the spot market through a co-optimization mechanism, currently only applied for Multipurpose Hydropower Plants. Some other ancillary services handled through unique contract include voltage regulation, quick start, black start and reserve. It is important, however, to note that the ancillary services mechanism in Vietnam's electricity market is underdeveloped at the moment, especially for non-EVN generation units, resulting in many unnecessary operational difficulties.

Contract Mechanism

The target for contract mechanisms in the electricity market is to stabilize electricity price, reduce risk, prevent market cornering and support the development of new generation sources. In the current VWEM, there are CFD contracts (for new power plants that first join the electricity market when VWEM is available), Vesting contracts (for old plants that have joined the market during VCGM days and also BOTs and small hydropower plants, the idea being to optimally redistribute the old CFD contract signed between old plants and EPTC to new CFD contracts with the new group of wholesale buyers), and a Centralized forward contract trading mechanism (specifically designed to deal with the difference (excess or deficiency) between the signed contract output and the load demand of the electricity purchasing unit or the actual generating capacity of the generating unit). Currently, no retail-oriented contract mechanisms have been put into practice.

Payment Mechanism

Payment in the spot market will be handled by the Department of Electricity Market, National Load Dispatch Center. Other payments, such as through contract, are performed directly between buyers and sellers.

Compensation Mechanism

The reason for compensation is to cross-compensate for not only differences in electricity distribution costs of power utilities but also for difference in customer structure, to ensure a fair benefit for power corporations and large customers. In the current stage, the implementation of cross-compensating between Power Corporations will be implemented through the electricity selling price mechanism between EVN (EPTC) and the Power Corporation in accordance with the regulations of the Ministry of Industry and Trade. In the long term, it is necessary to study in more detail the formation of a cross-compensation fund (or equivalent mechanism) soon to accurately reflect the principle and nature of the cross-compensation mechanism.

This new design of the electricity market enables BOTs and ITGs to participate in the spot market, resolving the issues stated in the previous subsections and bring balance to the electricity market. The wholesale market has been liberalized, with the capability of individual power corporations and eligible VWEM customers to buy electricity directly from the sources through a CfD contract. As mentioned above, the current VWEM market has not been completed, especially regarding ancillary services, settlement and price mechanism. The trading interval has been reduced from 60 minutes to 30 minutes, but the dispatch interval has yet to meet the 5 minutes value. Development of VWEM is now behind schedule, as the market was supposed to be fully delivered in 2021. The target for Vietnam's electricity market is the Vietnam Retail Electricity Market (VREM), which is still in the design phase and all contract mechanisms at retail level are only under research and have not been tested in practical application.

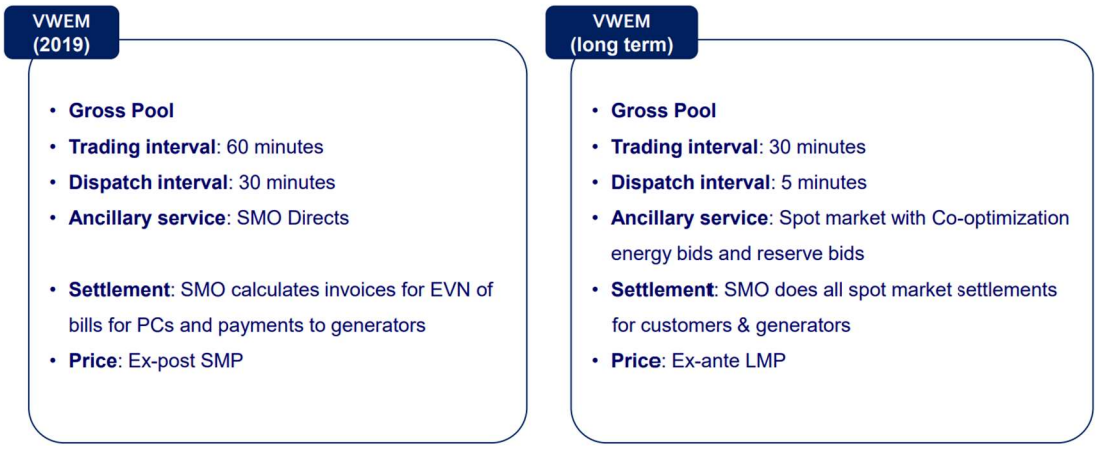

Figure 8. Plan for VWEM development

3.1.3 Status of Vietnam Electricity Market Participants

The participation in VWEM can be either directly or indirectly, depending on the role of participants (sellers or buyers), as well as the capacity and purpose of participants (for sellers/generation units). Direct participant can join the spot market without the need for intermediary representative units.

Generation Units

- Participate directly in the Electricity Market: GENCO1, GENCO2, GENCO3 and PVPOWER are among the largest direct participants in VWEM.
    - All generation units with installed capacity larger than 30MW connected to the national grid except for special units that are specified to participate indirectly
    - Power plants with installed capacity smaller than 30MW that are connected to 110kV+ power system and have sufficient infrastructures can choose to participate in the electricity market directly
    - Non-hydropower renewable energy plants larger than 30MW can also choose to participate directly
- Indirectly Participate in Electricity Market:
    - BOTs and Small Hydropower Plants
    - Industrial plants that only sell part of its generated power to the grid
    - Small non-hydropower renewables
    - Constrained Gas Turbine
    - Imported Electricity from Foreign Sources.

Electricity Buyers

Currently, the buyers are 5 Power Corporations under EVN, namely EVN HANOI, EVN HCMC, EVN SPC, EVN CPC, EVN NPC and a wholesale entity called EPTC, whose role as a buyer has existed since the VCGM days.

Service Providers

Service Providers are in charge of their corresponding service and is responsible for collecting service fees as well as performing special contracts within its authority with other participants in VWEM.

- Power System and Electricity Market Operation: National Load Dispatch Centre (NLDC/A0) and regional dispatch centers (A1-A2-A3).
- Transmission Grid Operation: National Power Transmission Corporation (EVN NPT)
- Distribution Grid Operation: 5 Power Corporations mentioned above

3.1.4 Current Obstacles & Difficulties

The proportion of sources participating in the electricity market is low and tends to decrease: After 10 years of operation, the number of plants participating in the electricity market has increased more than 3 times. Nevertheless, the proportion of producers directly participating in the electricity market to the total installed capacity system is still low (currently 39.3%). In the coming years, as most of the power sources being put into operation are from BOT sources, the proportion of directly participating power plants will tend to decrease. The low proportion of producers participating in the electricity market may lead to the following problems:

- The electricity price in the electricity market has not properly reflected the marginal cost of the system.
- An increase in complexity of the market optimization problem: Because less than 40% of the sources participate in the power market, the next day's mobilization schedule must be separated into 2 steps (step 1: calculate calculation and charting for indirect sources participating in the market; step 2: schedule mobilization according to the quotation), causing difficulties in the overall cost optimization problem of the whole system.

Some electricity market mechanisms under Decision 8266 have not been implemented: VWEM design has been developed since 2015 according to Decision 8266. However, some Mechanisms of the wholesale market that have not yet been implemented include:

- In the spot market: Strategic multi-purpose hydro power (SMHPs) and BOTs have not directly participated in the electricity market, therefore a co-optimization mechanism between the energy market and ancillary services has not yet been implemented.

- The mechanism for ancillary services, in general, is extremely lacking and is not sufficient to ensure the development of a flexible power system and electricity market amid the development of renewable energy. For example: there is no incentives for thermal power plants to increase their flexibility and participate in frequency regulation service.
- For other mechanism: There is no mechanism for parties to freely choose partners signing bilateral contracts, there is no mechanism for the parties to transact and exchange Qc (according to CFD contract).

IT infrastructure serving the electricity market is still very limited

- The next-day and next-cycle mobilization scheduling software has approached its limit: Market Clearing (MC) has been in place since 2004 and has now revealed many limitations and may be considered to be incapable of meeting the upcoming requirements of electricity market operation.
- There is no unified electricity market operation monitoring infrastructure.
- Limitations in the ability to predict the load when the proportion of renewable energy sources increases, especially rooftop solar power sources.

The Vietnam Retail Electricity Market (VREM) has yet to mature and is not ready to be applied. This can hinder the development of many mechanisms that can only be applied in the retail market such as Demand Side Management (DSM) / Demand Response (DR), Virtual Power Plant, etc.

3.2 Balancing

3.2.1 Status on balancing

The System and Market Operator (SMO) uses ancillary services under the terms of a forward contract to maintain the balance of the system. For example, when a power plant is currently generating lower capacity than scheduled, SMO will dispatch some units to provide Frequency Restoration Reserve (FRR) services to maintain the balance of the power system. Ancillary service expenses are included in the price of electricity for end-users.

In case the buyer causes an imbalance and in case the transaction is unbalanced (it should be clarified after balancing, which party must bear the cost). Thus BRPs are not yet present in the Vietnamese market.

3.2.2 Potentials for BRPs

The introduction of the BRP model into the Vietnam electricity market not only opens opportunities for growth of the electricity sector but also benefits the participants. In Vietnam's current power sector structure, power generation coperation units such as GENCOs might fill the role of BRPs and could seek profits through cross-balancing each other in the spot market. The EVNNPT transmission unit, power purchasing companies such as EVNEPTC or 5 PCs could act as BRP for trade. Large power plants in Vietnam could play the role of BRP for generation.

Benefit for the market

The core condition for becoming BRP is that the entity must be financially responsible. This implies that, if the requirements for financial responsibility, technical constraints, and legal conditions are satisfied, not only generator owners or electrical suppliers but even banks may qualify to become BRPs. The market will become more competitive by having many participants, helping prevent misuse of market power.

Benefit for the operator

Maintaining balance for the power system is mainly done by SMO, which can help ensure more security for the power system. At the same time, SMO also proactively ensures that the cost of mobilizing ancillary services is within the scope of SMO. This may be true in the early stages when the wholesale electricity market is being developed with a small number of market participants. However, in the scenario where Vietnam's electricity market is gradually transitioning to a retail model, meaning more parties and related transactions are taking place, SMOs must bear increasing risks in ensuring the balance of the system. The BRP model is a timely and appropriate solution to reduce the burden on SMOs.

Benefit for the power supply

When an imbalance occurs, the BRPs have the potential to offset each other through transactions in the electricity market. This opens up opportunities for new business models and new market shares for power suppliers, thereby attracting more capital to invest in new power sources. Power plants that have the advantage of flexible operation to support system balancing will get better profits, thereby promoting investment in improving technology.

Benefit for the end-user

With a more competitive market and with SMO operating the electricity market more optimally as a result of the operation of BRPs, leading customers are able to reduce their electricity purchase costs and be provided with better service.

While introducing BRPs into the power system, it is necessary to carefully consider the special operating characteristics of the Vietnamese power system along with barriers in the implementation of the current BRP model. Section 3.2.3 below lists the key obstacles.

3.2.3 Barriers

Currently, the concept of BRP is still very new in Vietnam's electricity market and is not widely understood among stakeholders. The main role for the BRP is to buy and sell electricity on behalf of electricity suppliers and producers - a type of entity that does not currently exist in the Vietnamese market. In order to apply the BRP model to suit the specific operating conditions of the power system, the following barriers need to be addressed:

Absence of a legal foundation for BRP as a new market participant

A legal framework that includes the presence of the BRP is needed, such as a decision and circulars issued by MOIT. In addition, how the role of the parties currently participating in the Vietnamese electricity market will change, needs to be carefully considered. This consideration should include how to fulfill the core criteria for developing a safe, competitive, and sustainable electricity market.

Comprehensive studies on the potential and possible effects of the BRP model are lacking: The potential of units that are expected to become BRP has not been thoroughly studied on a wide basis. Due to the substantial variations in system structure, power and load structure, and variety of areas of Vietnam, studies should must be carried out to determine the size and number of BRPs that might arise in Vietnam.

The infrastructure for information and communication is still insufficient: To operate consistently and robustly with the involvement of BRPs, more metering stations and communication infrastructure are required. These infrastructures must be developed reasonably simultaneously and have the capacity for future growth.

Financial incentives or investment sources for building infrastructure is lacking: Capital investment should be taken into account in accordance with the current circumstances in Vietnam in order to construct an appropriate infrastructure system for the long-term deployment of BRPs in the future. Additionally, financial assistance for units implementing BRPs in the early phases should be considered.

The above issues need to be carefully considered based on implementation experience in different regions of the world and the operating characteristics of Vietnam's power system. Some ideas are given on the roadmap for the future implementation of the BRPs model mentioned in section 3.2.4. below.

3.2.4 Roads forward

Currently, there are units in charge of selling electricity such as GENCOs, units in charge of buying like EVNEPTC, but no unit has the function of managing and operating both selling and buying functions like the BRP in Denmark. But if the function is separate for BRP for generation and BRP for trade, then the above units are equivalent. However, it should be noted that the BRP is an independent private company and isn’t owned by the state or the DSO/TSO, while all the EVNEPTC, PCs, GENCOs in Vietnam are state-own entities.

The higher the proportion of renewable energy the electricity system, the more important the need for long-term, medium-, and short-term balance. Here the role of BRP becomes necessary and can ensure many functions of a robust energy system (and reliable, environmentally sustainable and affordable and accessible).

BRPs in Vietnam will need to work closely with NLDC to coordinate in ancillary services to help maintain the balance and stability of the system. The types of ancillary that would be employed should also be clearly defined from MOIT with appropriate financial and operational mechanisms. Currently, five types of ancillary services can be referenced from the Danish TSO.

3.3 Aggregation

3.3.1 Status on aggregation

It should be noted that Vietnam is still in the process of switching from a wholesale power market model to a retail electricity market model. As a result, there is no market to mobilize end customers' flexible potential. However, there will be a retail market in the near future where customers can make money by selling their flexibility to the market through aggregators.

3.3.2 Potentials for Aggregators

Even though there isn't yet a retail power market, the aggregator model nevertheless is promising. In Vietnam's electricity market, there are currently many end users who can provide flexibility for the operation of the power system. As a result, aggregators have the chance to make money by combining user capacity and delivering their services in the wholesale electricity market or the ancillary service market (not yet available in Vietnam).

In order to address future capacity shortages, shift load from costly peak times, and meet a rising demand for ancillary services, Vietnam is becoming more and more interested in Demand Response (DR) programs. This heightened interest is evident in recent DR policy decisions and guideline documents, as well as in the variety of ongoing DR studies and research initiatives.

MOIT has released policy proclamations establishing a National Demand-Side Management Program with a DR component in response to ongoing worries about rapid demand growth and a probable lack of generation capacity:

- PM Decision No.279/QD-TTg (March 8, 2018): Approving the National Program on DSM for Vietnam power system in 2018 – 2020 period and orientation to 2030;
- MOIT Decision No.175/QD-BCT (January 28, 2019): Approving the implementation plan and roadmap for the DR programs;
- MOIT Decision 54/QD-DTDL (June 12, 2019): Decision on issuing the procedure for implementing DR programs;
- Circular No.23/2017/TT-BCT (June 29, 2017): On the order of electric load adjustment. Makes dispatching centers responsible to assess the need to adjust the load patterns of regional and local power system.

Following the recommendations in Decision No. 54 / QD-DTL, Vietnam implemented a second DR pilot in 2019 with the assistance of ERAV. The experiment, which incorporated DR events and signed up clients on a voluntary basis without any discernible incentives, involved all five

PCs. The pilot gave less attention to the commercial components of DR implementation and more attention to the administrative and technical aspects. Nearly 4,000 clients were invited, according to ERAV. More than 75% agreed to participate in the experimental scheme, which could reduce demand by 1,550 MW overall.

Many DR-related research, development, and studies are being conducted in Vietnam, including:

- EVN's Business Department Energy Efficiency Unit: DSM and DR related initatives include: Load research studies, identifying new business models for demand aggregators, addressing legal and regulatory barriers to new business models, and building the capabilities of Power Service Companies established in each of the five PCs;
- ADB-funded consultancy in support of ERAV and EVN's implementation of PM Decision No. 279/QD-TTg and MOIT Decision No. 175/QD-BCT: ADB is supporting a DR Potential for EVN and ERAV in 2020 and 2022, identifying blocks of potential DR that could be mobilized to fill in the forecast gaps between supply and demand, and showed benefits and costs of activating DR and allowing incentive payments for DR.
- GIZ has provided funding to a Canadian company to analyze and recommend legislative frameworks for DR, investigate prospective DR business models, and suggest financial and incentive frameworks for DR projects in Vietnam, including Curtailable Load Program (CLP) and Emergency Demand Response Program (EDRP).
- Institute of Energy (unit of MOIT) is working with EVN and MOIT on several issues important to realizing the potential of DR in Vietnam including: Examining international experience concerning alternative DR model and applicability in Vietnam's power sector context, DR valuation study, and Tariff studies – in cooperation with Hanoi University of Science and Technology.

Recent policy decisions, achievements of pilot programs, and research initiatives have put Vietnam in a position to quickly advance its DR and DM efforts in line with ambitious goals stated in VNEEP3: By 2020, 300 MW, later 600 MW are expected to be reached.

In the context of the power system's lack of reserve capacity, while commercial load continuously keeps a high growth rate (about 10% per year), the system faces the risk of overload, affecting many customers directly. Deploying DR to reduce the peak load is an option to ensure the reliability of power supply while avoiding large investment costs for new sources and avoiding an increase in electricity prices for customers.

Under the future development trend of the DR program, the Aggregator can play an important role in the implementation of DR in Vietnam. Along with the development of the ancillary service market, there likely is a positive business case for the aggregators in the Vietnamese electricity market. As the number of electric vehicles rises, the participation of DR is particularly important in the future formation of the electricity market.

3.3.3 Barriers

The aggregator can benefit the consumers by lowering their overall cost of energy and the give the system operator more flexibility options to balance the system and ensure generation adequacy. The following crucial challenges must be resolved before aggregators can be introduced into the Vietnamese power market:

Legal Framework barriers

Financial mechanisms and policies to encourage customers to participate in DR programs are lacking. A Government policy exists but financial mechanisms on electricity price and financial support to encourage customers to join DR programs have not yet been implemented.

Market model barriers

In order for customers to be able to provide their flexibility, it is necessary to develop the retail electricity market with PCs acting as Distribution System Operators (DSOs). Along with his is the need to develop of the ancillary service market in Vietnam electricity market, where aggregators can find profits for themselves. The current operating mechanism of the electricity market does not enable the participation of an aggregator.

Aggregators' role requires additional regulation

The Aggregator is a new market role that can be taken by existing market parties (suppliers) and new entrants. Therefore, new regulations are needed to define the role and operation of market participants. The current policy framework documents have not considered this issue.

Infrastructure barriers

Smart meters (to provide real-time power consumption), home gateways and smart appliances for energy management, are needed to enable aggregators to operate. Software and algorithms for aggregation and calculating the optimal operation of each unit as well as real-time communication between the aggregator and the hardware system are requirements that cannot be met by the current system and may delay the arrival of the aggregator.

Social awareness barriers

EVN promotes only voluntary non-commercial DR programs with no remuneration mechanism, thus being less attractive for consumers who are difficult to persuade. Media and press agencies have not yet started to coordinate with state management agencies at all levels to intensify the publicity on the DR program. The failure or limited success of pilot projects in Ho Chi Minh City in the past may undermine stakeholders' confidence in DR in the future.

3.3.4 Roads forward

It is necessary to complete the implementation of the competitive retail electricity market in accordance with the orientation and the Vietnam electricity market roadmap.

MOIT needs to enact mechanisms for NLDC to allow DR aggregators greater than 30MW to be implemented. This would help to form many DR units, both some independent of EVN and some belonging to EVN.

The mechanism that allows DR aggregators should allow for better equipping of facilities and generating profits of DRs involved in regulating demand. Along with the completion of the fully electricity market, DRs at the distribution grid level can also participate in the balancing power market and ancillary services.

4. Recommendations

4.1 Introduction

Based on the barriers indentified in this report, the following recommendations for change are proposed in order to increase the flexibility of the power system by introducing the roles of BRP and aggregator in Vietnam's electricity market.

It should be noted, when considering the possibility of introducing the roles of BRP and aggregator, that Vietnam's operating conditions are different in the sense that it so far has used hydropower to help balance the system, while the country is not connected to neighbors to the same degree as Denmark in the Nordics.

There are many experiences from Denmark/Europe to be considered and a first step is to identify the most valuable to the Vietnamese context. Overall, the value from aggregators and BRPs are to reduce imbalances, increase the volume of flexibility and provide expected lower costs for balancing and lower balancing needs.

The recommendations are focused on both short term actions and larger long term regulatory changes.

4.2. Legal Framework barriers

The development of programs that need to gather small customers, typically DR programs, directly affects the potential and development of the aggregator in the Vietnamese power system. Therefore, it is necessary to put in place appropriate financial mechanisms and support policies to encourage customers to participate in the DR program.

Aggregators can be new players while existing power market players such as utility companies also have the potential to become BRPs. Therefore, it is necessary to develop new regulatory circulars that define the roles and operations of market participants. A first step is to define roles and inform stakeholders about the possibilities.

Developing a common regulation and standard for the price compensation mechanism that takes into account the presence of power supply units, BRPs, and aggregators will be central.

4.3 Market barriers

In order to help exploit the potential of providing customers with operational flexibility, it is necessary to develop a retail electricity market model. Through this, the aggregator role can help expand customer participation in the electricity market.

In the short term, ancillary services can be purchased through a centralized bid in the electricity market, helping to create profitable opportunities for aggregators.

The first step is to identify the types of ancillary services that BRP and aggregators may provide in the future. Implementing the BRP model could start with the renewable energy producers. The BRP model could create large value by taking the responsibility for balancing the operation of renewable energy, which naturally produces imbalances. The BRP can balance the imbalances across technologies and plants in a portfolio and reduce the need for balancing for the TSO. When this experience and insight is established, the BRP will be an important participant in the electricity system and especially for the balance of the electricity system.

Aggregators can play an important role in the DR development in Vietnam. Along with the development of the ancillary service markets such as frequency control, peak load shaving, energy shift etc., introducing aggregation of EV charging can be gainful for the Vietnamese electricity market. With the potential growth in electric vehicles, the formation of an electric market with the participation of DR Aggregators is essential for Vietnam.

Some mechanisms of the wholesale market have not been implemented

- Develop a co-optimization mechanism between the energy market and the ancillary service market.
- Provide incentive mechanisms for ancillary services, in which the development of resources is ensured to ensure flexible operation of the power system as the share of renewable energy sources rises.
- Promote a mechanism to help market participants freely choose partners to sign bilateral contracts for consumption and production
- Implement negative prices in both day ahead and balancing markets to incentivize down regulation from renewables and consumption.

The Vietnam Retail Electricity Market (VREM) is not yet ready to be applied

- Provide the legal basis for the BRP and amend current circulars and regulations for power market participants, taking into account the existence of the BRP.
- Based on the conditions in Vietnam, conduct studies to evaluate the potential and possible effects of the BRP model. Research on potential BRP players in Vietnam's

electricity market to determine the size and number of BRPs that could be involved in the future.

- Develop metering, communication, and information technology infrastructure according to an appropriate roadmap in order to gradually introduce the BRP model into Vietnam's electricity market. Infrastructure investment needs to be done synchronously and lay the foundation for future developments.

The low proportion of factories participating in the electricity market

- Increase the number of units directly participating in the electricity market through the introduction of potential new actors such as BRPs, aggregators, and VPPs. Along with that, a suitable market structure should be built for the above new factors.
- The operation scheduling for power units directly and not directly involved in the electricity market should ensure a good reflection of the marginal cost of the system and avoid unfairness to factories directly participating in the market.
- In the coming years, putting BOT sources into operation will make calculating the optimal cost for the entire system difficult. We need to review and propose a new computational model suitable for this problem.

Importance of having many BRPs in the market to avoid monopoly

- Develop an appropriate legal framework and economic mechanisms to attract different sectors of the economy to act as BRP.
- Create a framework where BRPs are active across all geographical locations to ensure fairness and efficiency in the electricity market, ensure the technical conditions for operation, and bring benefits to the participants in the market.
- Conduct research and pilot implementation to evaluate the most realistic basis for the above solutions.
- Ensure market monitoring by an independent regulatory entity

4.4 Infrastructure barriers

Build information and communication infrastructure to ensure real-time communication between aggregators and power system operators, as well as BRPs.

Increased complexity due to many small units

- Invest in and develop powerful and reliable computing tools as well as training, thereby improving operation ability for users of new calculation tools.

- Increase investment sources and speed up the construction of information and communication infrastructure.
- Invest in building a metering system to provide real-time power consumption data. Develop software and algorithms for the aggregator side.
- Provide support policies to encourage customers to invest in smart devices that help change power consumption quickly, thereby reducing the service delivery time of the aggregators.

4.5 Social awareness barriers

Implement communication campaigns to change people's perceptions of electricity use and their role in the future power system.

Implement more commercial DR pilot programs to attract customers and increase the uptake of aggregators by consumers.

Abbreviations

[ABR] Explanation

[ABR] Explanation

D2.3.3: Report: Adaptation of aggregators and balance responsible parties to Vietnam

Roles and responsibilities of market actors in Denmark will be described, as well as concrete experiences within demand response facilitation. The Vietnamese market will be analysed and the integration of actors such as aggregators and balance responsible parties will be assessed. The product will be a report on the topic written by LC with the support of Energinet and the DEA.

References

[1] R. Bray and B. Woodman, “Barriers to Independent Aggregators in Europe.”

[2] “USEF: WORKSTREAM ON AGGREGATOR IMPLEMENTATION MODELS Recommended practices and key considerations for a regulatory framework and market design on explicit Demand Response.”

Appendix