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PROSUMERS IN TRANSFORMING ELECTRICITY MARKETS:

POLICY ACTION SUGGESTIONS FOR REMOVING BARRIERS

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PROSUMERS IN TRANSFORMING ELECTRICITY MARKETS: POLICY ACTION SUGGESTIONS FOR REMOVING BARRIERS

This research report is a policy paper related to the SESP-project's WP7 (Customer Insight Platform). The aim of the paper is to lift up key barriers and obstacles different prosumers phase when entering in the electricity markets. To overcome these barriers new legislative and regulative policy actions are suggested.

1. INTRODUCTION

Energy sector is facing a significant change. The IPCC's (Intergovernmental Panel on Climate Change) climate report tells that the energy field, among the others, is in crucial part to cut the greenhouse gas emissions thus trying to keep the global warming in 1,5 Celsius degrees comparing to the pre-industrial level. (IPCC 2018). Energy sector makes almost 80 % of the greenhouse gasses in the European Union (European Parliament 2018), thus there is a need for new energy solutions. Simultaneously renewable energy technologies are developing and making energy production that builds on volatile weather more affordable and more appealing (IRENA 2018).

In addition to big energy utilities, also different companies and households are increasingly interested to invest in their own energy generation and storage units (FinSolar 2018). This will change the whole field fundamentally and will affect to how the energy and electricity is produced, transferred and consumed. Because the demand and supply of electricity must be in balance, the weather-based energy require flexibility and adjustable reserve electricity in the energy system (Partanen, Viljainen, Lassila, Honkapuro, Salovaara, Annala, Makkonen 2014). These problems in the electricity systems need to be resolved in the markets in order to maintain the security and retain the continuous of the needed electricity (Fingrid 2018).

Microgrids and local energy markets make the utilization of different distributed energy resources possible, allows flexibility to the grid and eases the challenges caused by the volatile production. Thereby future consumers may evolve to prosumers and be an essential part of the electricity grid with active participation in the energy markets. As some prosumers can offer their generated surplus electricity, others can offer flexibility to the grids through, for instance demand response services or energy storage services. With demand side management it is possible to use the grid more effectively as it makes possible to shave the peaks in the demand and relieve congestions in the grid.

2. ROLE OF LOCAL ENERGY MARKETS

There is not one specific definition for microgrids. Basically, they are a limited group of multiple low or medium voltage distribution generations, load and storage units operating as a self-coordinated system. In the future local energy markets and microgrids are an essential part of self-healing smart grids as they can reduce outages with islanding capability. They consist of interconnected distributed renewable and traditional energy sources and are often connected to the distribution grid at a point of common coupling thus for the Distribution system operator (DSO) perspective they occur as a single, flexible and controllable entity. Microgrids are the main components of local energy markets and enables the opportunity for peer-to-peer energy trading. (Zhang, Wu, Zhou, Cheng & Long 2018).

To function, microgrids require distributed energy resources (DER). For companies and households, the ability to sell surplus electricity and receive benefits from their own DER equipment is one of the most important features of the microgrids and local energy markets. The way in which these prosumers are enabled to get compensations affects significantly how profitable it is to invest on their own DER. Hence, it is very important to develop well-functioning regulation that allows stakeholders to use, invest and benefit from microgrids and DER. As the majority of DER equipment consist of renewable resources such as wind turbines (WT) and photovoltaic-systems (PV), microgrids also increases by themselves the use of emission free energy production. This is why public policies should support local offer of customer centric services, rather than discourage it.

3. KEY BARRIERS IN ELECTRICITY MARKETS

As the microgrids provide a lot of benefits and new opportunities, they still have some obstacles and challenges that need to be solved with developing regulatory.

The majority of regulatory challenges occur due to the interconnection rules of distribution grid and microgrid and issues with bi-directional power flow. The major problem is the absence of clear regulation considering local energy markets. There might be conflicts between who owns and manages the distribution infrastructure in microgrid networks. Especially when microgrid intersects with local distribution network. (Mendes, Nylund, Annala, Honkapuro, Kilkki, Segerstam 2018). Also, every country has its' own legislation which naturally causes differences and challenges for the microgrid design as EU aims to increase the use of interconnected generation inside the EU. Legislation can limit the economic attractiveness with unfavorable taxation, subsidies or limited compensations. The problems with the regulation of bi-directional flows causes challenges to

the ability to feed surplus power to the main grid, which naturally affects the utilization of smart networks and local markets.

There are also problems considering the regulation of the ownership and furthermore maintenance responsibilities of the generation units that serve a whole community but are only installed to some households. Furthermore, there might occur difficulties to define who owns the distributed generation capacity. Microgrids often need additional infrastructure that might cross publicly or privately owned property, thus there need to be a clear regulation for electrical supply installation (Wouters 2015).

To gain enough DER for the microgrid, it must be profitable for prosumers to invest to the generation gear. Hence there must be an appropriate regulation considering the selling of prosumers' surplus electricity to the grid or trading it with other users. One major issue is due to the taxation. In Finland, when buying, the price of electricity is a combination between electric power, electricity taxes, value added taxes and transmission services. When prosumer sells the surplus electricity, one gets only the price of electric power. Hence, the financial benefits of selling the surplus is only around 30% compared to the cost of buying. For prosumer's point of view, this makes the investment for micro-production equipment more unprofitable and undesirable. In legal aspect, it is already possible to compensate also the transmission service costs. However, electricity taxation is a bit more problematic because the excise duty on energy products is largely harmonized within the European Union. This sets the boundary conditions under which a member state must impose its electricity taxation. However, it could be possible as member state could apply for a national derogation, which is permitted by the first paragraph of Article 19 of the Energy Tax Directive. Value added taxation is not possible to compensate in net billing, because the law explicitly prohibits the sale of prices and taxes in sales and barter situations (Aapio 2017).

Many energy projects have to go through long administrative procedures and the time from planning through approval and permission to final product might prolong. Instability and sudden changes in policies creates an additional risk for investors. For example, the uncertainty who pays for connecting DER to the distribution network and for possible grid reinforcements. (Ali, Li, Hussain, He, Williams, Memon 2017)

For housing companies' regulation allows the utilization of small-scale generation only for property electricity. This means that the residents cannot save electricity or utilize emission-free generation compared to companies, farms and other households. In Finland there is almost 90 000

housing companies with 142 000 different buildings that could have own small-scale emission free generation. The current regulation causes that housing company's own generation that goes through the housing company's electricity meter to the residents is treated in regulatory point of view similarly as electricity from the distribution network. Thus, savings with taxes and transmission are lost. To enable small-scale utilization in housing companies, the residents should act as small producers through their shareholdings in the joint power plant. (Auvinen & Honkapuro 2018).

There is also difference how the prosumers production is measured and compensated in Finland. Not all meters can compensate the surplus electricity behind different phase where the demand is. This leads to that there might be, for example, 2kWh surplus on phase one fed to the grid at the same time when phase two is still buying the same amount of energy from the grid because the meter cannot compensate the phases with each other's. Hence, the benefits can be radically different depending on where the prosumer lives and what kind of meter the local DSO provides. (Auvinen 2019).

In Finland, companies are encouraged to invest on small-scale production with investment subsidies. However, some energy incentive industries are also subsided with smaller energy taxation that leads to cheaper electricity that makes investments for own energy production equipment less appealing.

Many technologies are still much subsided which distorts the development of the markets. In Finland, governmental subsidies have disturbed the energy markets and decreased the price of electricity. This has led to that many traditional production plants, such as combined heat and power (CHP) plants, which had many good qualities for flexible and adjustable production, have gone unprofitable and shut down (Energia Uutiset 2018). On the other hand, new technology might not be so easy to sell without the subsidies thus would not get enough resources to develop further to cost-effective version. As some energy incentive industries are subsided with cheaper electricity, it makes investments for their own DER less appealing. However, in the long run technologies must be cost-effective without any incentives.

4. ACTION PROPOSALS

To enable better utilization of microgrids, and further to enhance the use of distributed, renewable and more secure generation, the regulatory framework should focus on the above-mentioned barriers. Here, two main initiatives can be lift up.

4.1. Regulatory to enhance DER procurement

To function microgrids need different kinds of distributed energy resources (DER), thus the regulatory should enhance the procurement of the generation equipment.

To encourage companies and households to make investments for own generation equipment, the investments should be made attractive. It is very important to develop a well-functioning regulation that allows stakeholders to use, invest and benefit from microgrids and DER. This can be done without subsidies by developing the framework. Prosumers should be allowed to trade the surplus electricity with other grid users and receive monetary benefits from it. At the moment, there are no reasons to invest in technology that would produce surplus energy as the compensation is not beneficial compared to energy that will be used in the real-estate. The benefits could be increased, thus making larger systems more reasonable with revising the above-mentioned taxation and compensation barriers.

There are a lot of unused potential that could be encouraged to invest for DER. Regulatory framework should be created in a way that it ensures all actors the same compensation, thus making the investment worthwhile for everyone. Especially, this is important since the consumers cannot change their DSO provider.

For housing companies the legislation should allow the computational distribution of small-scale generation within the property network to be used by shareholders for their own electricity trading periods. The length of the balance period is currently one hour and, in the future, will be 15 minutes. The amendment to the measurement regulation may allow the invoicing and balance settlement of small producers to be based on computational data. This would enable the building of internal energy communities within real estate networks with the help of smart metering data and computer software. This would open a huge potential for more emission free DER in the grid.

To encourage energy intensive companies to invest for renewable energy resources and energy saving actions, the existing subsidies should be revised to encourage the largest energy consumers to invest in their own electricity production.

4.2. Regulatory to utilize bi-directional flows and islanding

To implement microgrids, well-designed regulatory frameworks are essential. The frameworks should provide guidance, integration and interconnection rules to the distribution network. To reach microgrids full potential, the problems with the regulation of bi-directional flows should be solved. These problems cause challenges to the ability to feed surplus power to the main grid which naturally affects the utilization of smart networks and local markets.

Customers' load control can inflict conflicts of interest. The flexibility customers can offer could be utilized for balancing power markets or ancillary services market or use to maximize utilization of local generation capacity. Thus, the responsibilities and rights need to be clearly defined between the balance responsibility parties including if third-party intermediary is controlling the loads (Mendes et al 2018). Islanding is often prohibited due to the voltage stability problems and to ensure safe operation, To utilize the microgrid with its full potential, regulators need to develop regulatory frameworks that facilitate compliance with bi-directionality requirements, particularly at the point of common coupling (Wouters 2015; Soshinskaya et al 2014).

5. CONCLUSIONS

At the moment, electricity markets are changing rapidly, and this change is enabled by new technology that makes small-scale generation cheaper and available almost for everyone. Consequently, there is a pressure for more and more distributed energy production and power inputs in to grid. This transition empowered by the use of distributed energy resources (DER), centralized production and delivery challenges the extant legislations and regulations.

In this paper, we have discussed the main barriers hindering or even preventing new actors to enter to electricity markets in Finland. To conclude, the future production, transfer, consumption and revenues logics in energy sector calls for larger paradigmatic changes. Accordingly, majors shift in mindsets are needed to change attitudes and practices, but especially creating new regulative actions, especially, to facilitate consumers, households and housing companies' possibilities to enter to energy markets. Legislation should provide new business opportunities for new actors, thus changing existing companies' roles and business models (e.g. DSO, and energy companies). If

Finland wants to be a forerunner in energy transition, and in this way supporting actions to prevent climate change, we need to ensure that the large potential of prosumers in energy production can easily be engaged in the electricity market. However, this calls for new regulatory frameworks that strive for more flexible and open energy markets.

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