Investment in renewable energy: practical case in Estonia

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Abstract. The purpose of this paper is to describe how government could support the green initiatives using various policies. In this report was considered the example of Estonia and how this European country implies a feed-in tariff model. The subsidy solicitation was described and compared to the real project of solar panel construction. Current paper could be beneficial for those who would like to gain more theoretical understanding how countries increase the interest in renewable energy investing among local citizens.

1 Introduction

Estonia as a member of European Union is committed to raise the share of renewable energy production and consumption for a number of reasons. Obviously, the most important of these reasons are the reduction of environmental pollution to decrease greenhouse gases. Support for renewable energy is due not only to green initiatives, but also to the goals set by the European Union. The goal of the European Union is to ensure that the share of renewable energy in all EU member countries is up to 27% of final energy consumption by 2030 [1].

Raised production and consumption of renewable energy can help to enhance energy efficiency, production and consumption capability, security, innovation and technological development.

Renewable energy is not an issue in itself - it should be seen as the strategic choices of electricity generation in Estonia. The vision for the development of the Estonian electricity market states that in the production of electricity, the economy will be supported by resource efficiency, including the use of waste from energy sources that are no longer feasible. In addition, the share of renewable sources in fuel and energy production will expand. In this regard, subsidies for electricity production are exceptional and need-based to ensure critical production capacity, and market mechanisms are the main initiators of investment pursuit.

Estonia's renewable energy potential is primarily manifested in bioenergy based on cogeneration of electricity and heat, in wind energy and in green gas (biomethane) production, which is used everywhere where natural gas is used today. Small-scale hydropower and solar energy are being developed.

The aim of this paper is to analyze the role of the government in supporting green initiatives on the example of real entity based in Estonia.

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2 Renewable energy sources policies

There are different support mechanisms that government can adopt and use. These techniques are differed by three main categories that are either price based or quantity based: feed-in tariffs, bidding processes and tradable green certificate schemes [2, 3].

The results obtained by different countries implied that feed-in tariffs is the best technique. This tariff allows private and commercial entities to become a seller of environmentally clean electricity to their domestic energy market. The price is set by energy provider. Thus, private entrepreneurs, start operating, for example, solar or wind power stations near their homes and they not only consume the generated electricity, but also sell surplus to the state [4].

2.1 Policies in Estonia

Nowadays, most of the European countries are opted feed-in tariff model. Premium tariffs are applied in Spain, the Czech Republic, and Slovenia, Estonia the Netherlands, Denmark (for onshore wind energy) and Italy (for PV) [5]. Estonia applies the same tariff and also allocate subsidies for constructing and purchasing renewable energy sources.

Wind energy is accounted for 37.7% of all renewable energy, due to favorable wind conditions, the 143 GWh produced this year were one-third higher than the same period last year. In the second quarter, Elering (the main electricity supplier) paid 6.2 million euros of subsidies in the field of wind energy production, 30% more than in annual comparison [1].

Regards to solar potential, the number of subsidy holders of solar batteries continues to grow rapidly; more than 750 producers - both private individuals' enterprises, produce electricity from solar panels [1].

In the second quarter of this year, solar panels were produced and 2.2 GWh were transferred to the network. Thanks to the added solar batteries, this figure has grown by approximately half in the annual comparison. Since the micro producers themselves consume most of the produced solar energy, roughly the total amount of energy produced by solar panels can be 4-5 times higher than the volume that received the subsidy. Total Elering paid in the second quarter for 317 GWh of electricity 17 million euros subsidies in favour of renewable energy. In the annual comparison, the amount of subsidies increased by 23% [1].

An important step in building a solar panel system with a network connection is to connect to a local energy network so that excess renewable energy can be sold to the local authorities at a stock price. In addition to this, for all the electricity that goes into the general network, the producer of renewable energy receives subsidies from "Elering", which in the year of 2017 was 5.37 cents / kWh.

2.2 Solar panel subsidy solicitation

Since the practical example is based on solar panels installation here will be explained the main terms of getting the solar panel subsidy.

An application for a subsidy can be submitted according to the form approved by KredEx. KredEx is a financing institution helping Estonian enterprises develop quicker and expand more safely to foreign markets, offering loans, venture capital, credit insurance with state guarantee. The application form along with additional documents has to be uploaded to KredEx via Internet and digitally signed.

The applicant has to be a publicly-legal and private-legal entity registered in Estonia. To receive a subsidy for solar panel installation, the building must be owned by the applicant, and to be built on a legal basis and entered in the building register.

Subsidies can cover:

- expenses for designing the installation of equipment for energy production;
- expenses for the purchase of equipment for energy production;
- expenses for the installation of equipment for energy production.

The size of the subsidy is up to 30% corresponding to the terms of providing assistance for the costs of subsidized activities, but not more than 30,000 euros per applicant. The subsidy will be issued until the allocated budget funds are run short [6].

Granting subsidies is aimed at increasing the share of energy produced from renewable sources, or in a particular case, from solar energy, in the energy balance, and thus to reduce the amount of pollutants emitted from energy producing systems. Traditional electric generators work mainly on fossil fuels. Solar energy is considered to be one of the most powerful use of renewable energy resources.

3 Solar panel efficiency

Solar energy is perspective direction and the cost of solar energy at the present time is few cents per kWh in comparison with others types of electricity sources. Moreover, the price will be decreasing further with the implementation of new technologies, such as titanium oxide cells [7]. With a maximum laboratory efficiency of 32% and average efficiency of 15-20%, it is necessary to restore as much energy as possible from the solar energy system.

This includes reducing losses of inverter, memory and light. Collection of light depends on the angle of incidence of a light source that provides power (i.e., sun) to the surface of the solar cells, and the closer to the perpendicular, the more power [8].

Estonia is a country in the northeast of Europe, on the east coast of the Baltic Sea. It have borders with Russia, Latvia. In the north it is washed by the Gulf of Finland, in the west by the Baltic Sea. Since Estonia is located at the great geographical latitude, the duration of a light day in summer and winter varies considerably. The annual duration of sunshine in Estonia varies between 1600 and 1900 hours (this is less than half of the maximum possible duration of sunshine), while it is more on the coast and islands, and in regions remote from the sea - less. It can be said that at some degree it is risky to invest in solar panels in Estonia because of small amount of sunny days during the year. However, there are some practical implications when the entity gets the energy for itself and sell the rest to the state at market price.

3.1 Case study

The possibility to get the subsidy from government had appeared recently (end of 2017), however, there are already legal entities who would like to invest money in solar panels. In this paper is considered the example of housing that is located in Johvi, Estonia (Photo 1). Worth to note, due to governmental initiatives the number of businesses that work on installation and providing solar panels raised dramatically. One of this company is EVAS B&P AS who moreover supports the client with subsidy solicitation. The company installed a solar power plant with a capacity of 9 kW for 120 m^2 apartment house. During the design and construction the financial aid was received from Kredex at a rate of 30% cost spent on building and processing solar power station documents. The heating system was also automated to reduce power consumption. All relevant technical data is provided in Table 1 [9].

Fig. 1. Considered housing

Table 1. Technical data

Characteristic	Value
Power plant power	9.18 kW
Panels	Maysun Solar 270W Poly (38 pcs.)
Inverter	Fronius 10.0-3 - M 10 kW
Coordinates of the installation of panels	Azimuth 1400, the solar panel angle 600
Coverage panels area	56.1 m^2
Capacity	~ 7400 kWt/year

Important to note from the table below that the inverter has WLAN or Ethernet internet connection. Current inverter allows to receive real-time data regarding to solar panel efficiency. The information extracted from website (Pic. 2.) [10] shows current power, energy balance throughout the chosen period, CO_2 savings and earnings (considering selling power to grid). The integrated analytics allow to examine how profitable it is to install solar panels and consider all figures depend on the month or year. The data can be seen at the web-site [9] and also through mobile application. Since the proprietor of this building allows to open the data from its inverter everyone can study all relevant information regarding solar panel plant usage.

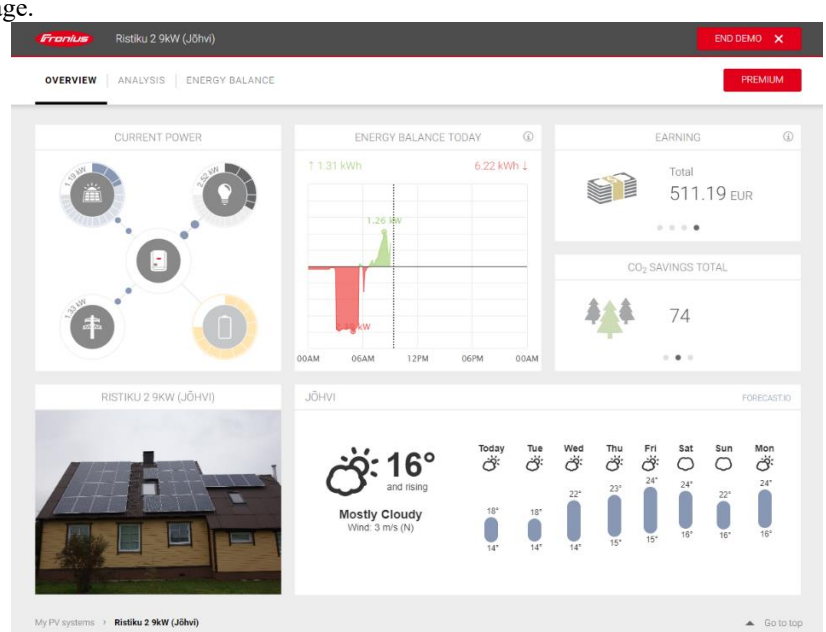

Fig. 2. Fronius Dashboard

Integrated inverter allows to control the production of energy at actual time. In order to assess the efficiency of solar panels at this location at Figure 3 can be seen the level of production for the 2018. In the month of May total of 1594 kWh was generated and 1523 kWh was sold to the local energy network. It shows that for consumption this household had enough energy and it was reasonable to handle the rest at market price. In general for this year the proprietor is selling the energy on a permanent basis.

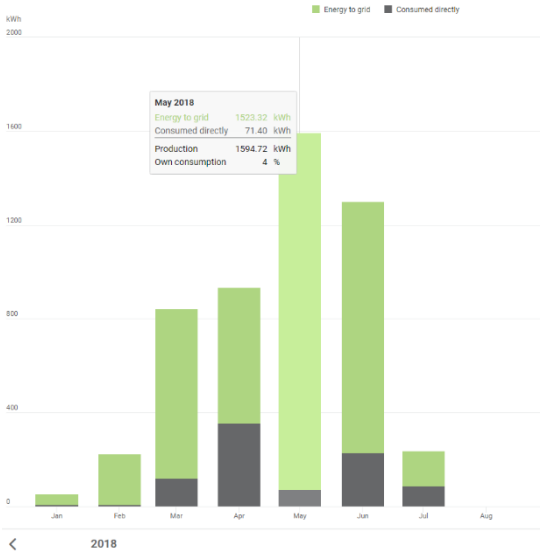

Fig. 3. Production balance

Retracing to the subsidy model the government wish to control the entities who received the subsidy in the past to avoid fraud. The integrated inverter and relevant software makes it easier to do that without contacting the person. The proprietor just give the link to the corresponding civil servant.

Conclusion

In this paper an example of investing in renewable energy sources was examined. Considering case of Estonia, a country that does not possess a large number of sunny days during whole year, it can be seen that people would like to invest their savings in alternative energy. Due to the fact that there are various benefits such as subsidies, compensation for construction, as well as the possibility to sell surplus energy to the local energy network and earn extra money.

The household in city Johvi, Estonia served as a real model how physical entity decided to invest funds in solar panel construction using governmental support by way of subsidy. In the result the proprietor is capable to earn money on selling the power leftover to energy grid and at the same time reducing the utility bills.

For the future research can be suggested to examine negative effects of using solar panels at North because of possible climatic conditions during the winter. Moreover, it is reasonable to make a detailed financial report including expenses and income figures in order to fully see the picture of investment in renewable energy sources.

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