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A CIVIC CROWDINVESTING INTO RENEWABLE ENERGY SOURCES: LOCAL SELF-GOVERNMENT PERSPECTIVE

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ABSTRACT

Crowdfunding is a collective effort of many individuals who network, usually online, and pool their resources to support efforts initiated by other people or organizations. Crowdfunding has various forms, including donations, microloans and ownership shares. This paper presents an experience report of local self-government in City of Križevci, Croatia, in conducting a civic crowdinvesting project in May 2018, aimed to set up an integrated photovoltaic power plant with the power of 30 kW. One of the City's strategic goals for the next ten years is to achieve energy independence of public administration and institutions, as well as to popularize solar power plants as renewable energy sources affordable to citizens and acceptable to environment. The project named "Sunny Roofs of Križevci" was based on citizen investments in renewable energy sources with the microloan principle. In September 2018, the power plant was set on the roof of the administrative building of the Development Center and Technological Park Križevci. Loans to investors will return with 4.5% of interest over a period of 10 years, from the income generated by electricity production of the plant. This was the first project micro-financed by citizens in the field of renewable energy sources in Croatia.

KEYWORDS: crowdinvesting, solar power plant, microloans, local community, ICT

1. INTRODUCTION

Crowdfunding is a process of collecting some amounts of capital from a large number of individuals and companies in order to finance a wide variety of social causes, new and innovative business ideas and enterprises. Funds are collected via websites usually running a crowdfunding platform backed by social networks in order to inform donors (backers) about the crowdfunding campaigns [1]. Crowdfunding has various forms, including donations,

microloans and ownership shares. When the money is being borrowed from lenders (or investors) in order to implement some business idea or an investment project, this is called crowdinvesting. Sometimes it is called debt-crowdfunding [2]. The investors make a loan with the expectation to get paid back the principal plus interest. When the investors are citizens, this is called civic crowdinvesting.

This paper presents an experience report of local self-government in City of Križevci, Croatia, in conducting a civic crowdinvesting project in May 2018, aimed to set up an integrated photovoltaic power plant with the power of 30 kW. The structure of this paper is the following: chapter 2 is presenting the social and business context of the work, and chapter 3 provides the description of the "Sunny Roofs of Križevci" project. Outcomes and lessons learned are given in chapter 4, followed by the conclusion in chapter 5.

2. CONTEXT OF THE WORK

The City of Križevci has a strategic position being close to all regional centers in northern part of Croatia: Koprivnica, Bjelovar and Varaždin, as well as developing like a satellite city near Zagreb. It has been important cultural, economic, and military center of the County of Križevci from the 12th century until the year of 1921, and has a history-long tradition of artisanship and investing in entrepreneurship.

2.1. THE CITY OF KRIŽEVCI

Križevci is a small city with a population of around 21 thousand (half of it lives in the city itself), located 57 kilometers from Croatian capital, Zagreb. It is the oldest city and the second largest city in the Koprivnica-Križevci County, spreading across an area of 263.72 square kilometers. It lies at 146 meters above sea level, situated at the southern foot of the Kalnik hill (elevation: 642 meters). The City of Križevci belongs to the 20% of the poorest cities in Croatia, according to the city budget per capita income [4], and the surrounding municipalities by the development index are in the third (Sveti Petar Orehovec and Gornja Rijeka) and second (Kalnik and Sveti Ivan Žabno) quarters of below-average ranking of local self-government units in Croatia. In addition, the Koprivnica-Križevci County is in the first half of the below-average ranking of regional self-government units by the same index [5]. In 2018, the county had over 3.300 unemployed persons according to the Croatian Employment Service statistics.

Belonging to under-developed parts of Croatia, the City of Križevci continuously seeks innovative means to grow its economy, attract investors and make its surroundings a higher quality environment for living and work. By officially joining the Covenant of Mayors on July 12th, 2011, the City of Križevci has undertaken the steps to create Sustainable Energy Action Plan (SEAP), which was delivered in 2012 [6]. Implementation of all defined measures within SEAP by 2020 resulted in decrease of CO2 emissions by 20.81% compared to the base year (2010). According to projections of population and energy consumption growth, without implementation of the measures CO2 emission in 2020 in comparison with base year would have increased for 14.58%. One of the local strategic goals by 2030 is to achieve energy independence of public administration and institutions, as well as to popularize solar power plants as renewable energy sources affordable to citizens and acceptable to environment.

2.2. GREEN ENERGY COOPERATIVE

The initiative to have the first micro-financed project by citizens in the field of renewable energy sources in Croatia as a pilot site in Križevci came from the Green Energy Cooperative (in Croatian: Zelena energetska zadruga – ZEZ), Zagreb that delivered technical and economic elements of the project, and launched a crowdinvesting campaign to raise the needed amount of 30.000 EUR. The cooperative works on designing and managing sustainable projects in energy sector with specific emphasis on the projects in the local community [7].

ZEZ is a renewable energy sources cooperative that deals in planning, development, management and financing of renewable energy sources (RES) and energy efficiency (EE) projects. The cooperative has been founded with the aim of dealing in the local community with special emphasis on sustainable tourism development, agriculture, commercial and public institutions. It was founded by current and former employees of the local companies and organizations working in energy and environmental protection, and it currently has 22 members [7].

Since 2013, they have been putting their efforts to share community energy concept in our country and across borders. In the focus of their work are locally initiated RES&EE projects, aiming to empower local communities through use of local resources. They continually support all energy cooperatives in Croatia, established within the United Nations Development Program (UNDP) energy cooperative development project in 2013. ZEZ is one of Board Members of REScoop.eu – the European Federation of Renewable Energy Cooperatives, a growing network of 1.250 European energy cooperatives and their 1.000.000 citizens who are active in the energy transition. They are also a co-founding member of Cooperative for Ethical Financing, representing more than 1.300 people, companies and local authorities in Croatia [8].

3. DESCRIPTION OF THE "SUNNY ROOFS OF KRIŽEVCI" PROJECT

The context for hosting the first Croatian crowdinvesting initiative for solar energy in Križevci has been given in the case study published by the Green Energy Cooperative [9]: "In Croatia, renewables are developed almost entirely by individual companies and with minimal engagement from citizens, local communities and local authorities. Public interest in RES is quite high, but citizen participation is mostly limited to rooftop solar power systems and cumulative installed solar power accounts for only 6% of all RES in Croatia. The main cause for this current state is the Croatian legislation, which does not look favorably upon active citizen participation in the development of renewable energy. Only big investors have the human and financial capital required to overcome various administrative obstacles. New financing models are needed for RES development to be less dependent on State subsidies. High connection charges often discourage consumers to install small photovoltaic (PV) on their family roofs in order to become a prosumer. Local authorities are willing to invest in RES but they are facing issues such as financing and lack of technical capacities to handle and kick start the projects. A 2015 study by the European Economic and Social Committee (EESC) revealed that, five years after the adoption of the Renewable Energy Directive, national policy documents contain hardly any reference to a consistent strategy aimed at supporting decentralized renewable energy production for the benefit of local communities. It is recommended that local, national and EU policy-makers make civic ownership of renewable energy production and clear priority".

3.1. THE PROJECT ENVIRONMENT

Križevci Development Centre and Technology Park (DCTP) was a major business infrastructure endeavor in 2014-2016, co-financed from the European Union financial instrument, the Operational Programme for Regional Competitiveness 2007-2013. The construction of the four buildings on the premises of the former military barracks in the city center, along with a new administrative building with all of the necessary facilities, has been carried out to support activities of small and medium-size entrepreneurs. It is aimed to raise the level of the competitiveness of the companies in Northwest Croatia based on the "smart" specialization of the region and by upgrading the skills of the inhabitants, to initiate sustainable economic growth and a positive entrepreneurial climate, as well as to increase employment in the wider Križevci area [10].

Being an establishment that stimulates entrepreneurship, innovation and economic development in Križevci, and serving as an incubator for small entrepreneurs in the initial phase of their business development, Križevci DCTP seemed as a very adequate site for piloting a project of civic crowdinvesting into renewable energy sources that will enable energy efficient daily operations of the facilities, as well as cutting costs for the entrepreneurs. The plan was to install a solar PV system of 50 kW on the rooftop of Križevci DCTP's administrative building (as shown in Fig. 1), which will primarily cover the needs of the users of the center in terms of electricity. The city pays the actual electricity consumption, and from the monthly savings, it would return investment to citizen-investors. The energy surplus will be sold to the network. After 10 years, required for the investment to pay off, the system will be transferred into the city's ownership and continues to make savings [9].

Figure 1. Križevci Development Centre and Technology Park, with solar panels on the rooftop (sketch).

3.2. THE PROJECT DIMENSIONS

The project has been developed and implemented by ZEZ and their partners from the City of Križevci. They have been working on technical and economic elements of the project for almost a year, and building the technical specification has been supported by Regional Energy Agency North via feasibility study done as a part of "COMPOSE – Rural Communities engaged with positive energy" project, co-financed by Interreg Mediterranean programme 2014-2020.

The PV power plant is an integrated set of photovoltaic modules and other components designed to transform primary solar energy directly into electricity to ensure the performance of a number of DC and / or AC power consumers, either alone or with a backup source. Based on the analysis it has been concluded that the PV power plant has to have a 30 kW optimum power plant to meet the needs for electricity at the site.

Figure 2. "Sunny Roofs of Križevci" crowdinvesting webpage hosted by the Green Energy Cooperative.

The components of the selected technical solution – PV power plant 30 kW, were as follows: photovoltaic modules (275 Wp, 144 pieces), installed power 39.6 kW; exchanger, output power 30 kW; remote monitoring and monitoring communicator; Power Distribution Cabinet; Solar installation cable, cable distributors, connectors and other connecting equipment; Substructure; lightning rod installation. The electricity consumption data at the location have been collected

from the electricity bills for the period from January 1st, 2017 until December 31st, 2017. The data included high quality presentation of the consumption dynamics in the previous period and served as a basis for predicting future consumption. The PV power plant's production is calculated in specialized software, taking into account all relevant factors [11].

A PV power plant of 30 kW with a specific yearly production at a location of 1.108 kWh / kWp a year would produce a total of 43,882 kWh of electricity. The total electricity consumption at the site is 149.431 kWh, of which 89.561 kWh is in higher (daily) tariff and 59.870 kWh in lower (night) tariff. The solar power plant would meet 49,00% energy requirements in the daily tariff and 29,37% of the total electricity demand [11].

3.3. THE CROWDINESTING CAMPAIGN

The campaign was advertised through online media and social networks and managed via web-form (as shown in Fig. 2) collecting offers from small investors, limited to 1.300 EUR per individual. Very important part of the campaign was a motivational three-minute video [12] presenting the project idea, location, and all stakeholders and supporters, including Greenpeace Croatia, REScoop.eu, Energy Cities, ACT Group and many others.

The campaign resulted in full funding by 53 citizens in only ten days, based on micro-loans model. The average investment was 500 EUR (about 4.000 HRK) and the minimum investment chip was 1000 HRK or about 130 EUR. By the end of September 2018, the power plant was installed, tested and put in operation. The Green Energy Cooperative will return the loans to investors with 4,5% of interest over a period of 10 years, from the income generated by electricity production of the solar power plant on the roof.

4. OUTCOMES AND LESSONS LEARNED

This specific initiative generated a positive impact on climate change and the environment, the local economy, and the community. All the equipment came from Solvis, a Croatian company, and the workers from the Development Center and Technology Park now use their own green energy, setting an example for others and contributing to the city’s sustainability plans. The City of Križevci gave full support to this initiative and is already exploring options for making more public buildings in the city powered by solar energy [13].

Regarding the investors, 30% of them were local citizens from Križevci and surrounding area. It is important to point out that the recorded interest from the larger number of investors was around 500.000 HRK, therefore double the amount aimed by the crowdinvesting campaign [14].

As Business Daily reported [15], the first civic crowdfunded solar power plant in Croatia has been put in operation on September 17th, 2018, presented as pioneering venture successful because of citizens of Križevci and other parts of Croatia, which invested their microloans into renewable energy sources.

After some two-week trial runs and equipment setup, the power plant has been operating non-stop since September 29th, 2018, and producing electrical energy in the first year of operation, as shown in Table 1. The online and real-time overview of power plant's operation can be

observed via the management platform [16], a scalable web-based platform enabling customers to remotely manage their PV plants in all market segments.

Table 1. Electrical energy production in the DCTP power plant from 9/2018 until 9/2019.

Month	**9/2018***	**10/2018**	**11/2018**	**12/2018**	**1/2019**	**2/2019**
Estimated [kWh]	3.866,00	2.866,00	1.416,00	1.028,00	1.341,00	2.102,00
Produced [kWh]	423,28	2.995,70	1.167,92	934,07	859,11	2.368,07
3/2019	**4/2019**	**5/2019**	**6/2019**	**7/2019**	**8/2019**	**9/2019**
3.791,00	4.758,00	5.680,00	5.759,00	5.947,00	5.328,00	3.866,00
4.039,75	4.702,24	4.530,59	6.798,25	6.441,81	5.968,94	3.734,13

** Trial runs from September 17th; official start of operations on September 29th*

4.1. INVESTMENT RISKS

From the beginning of the project, it has been made clear to the citizens that the crowdinvesting in the solar power plant was associated with significant risks and could lead to total or partial loss of investment. The amount of investment made through the crowdfunding platform has not been secured in the deposit insurance system run by the State Deposit Insurance and Bank Rehabilitation Agency under the Deposit Insurance Act or another financial institution.

ZEZ did not guarantee the repayment of the loan in cases of regulatory changes that might affect negatively the use of renewable energy sources as well as the business risks faced by ZEZ [17].

4.2. MEDIA COVERAGE

The crowdinvesting campaign has been covered by all national televisions, daily newspapers and many magazines in Croatia, like Lider, which journalist Ana Gavranić has been awarded first prize for her article on “Sunny Roofs: The Križevci Project Signalizes That It's Time for Solar Profit” at the one of the most important regional journalistic competitions, the Siemens Press Award 2018 [18].

Moreover, only a day after the power plant went into operation, a group of energy experts, NGO representatives and public policy decision makers from Slovenia visited Križevci in order to witness the project implementation and learn from this good practice, as shown in Figure 3. In addition, Energy Portal magazine from Serbia issued a large story [19] about the whole initiative, stressing out that the Cooperative members have encouraged into local community development and creation of green jobs, and have made a positive contribution to the health of people and the natural environment.

Figure 3. The first group of energy experts, NGO representatives and public policy decision makers visiting “Sunny Roofs of Križevci” integrated PV power plant in Križevci, Croatia, in 2019.

4.3. OUTREACH AND IMPACT

Furlan reports in [13] that the success story of the pilot project in the City of Križevci has motivated other Croatian cities as well to implement similar local initiatives – cities like Pazin, Pleternica and Velika Gorica. ZEZ's aim is to make the good practice of the Solar Roofs of Križevci more easily transferable and replicable in other Croatian cities.

Concrete positive effects of the project are expected to show reduction of electricity costs and reduction of negative environmental impacts associated with electricity generation. More precisely, during the 10 years of the project and the use of the power plant it is planned to reduce the CO2 emissions by 412.500,00 tons. After the lease agreement expires and the power plant transfers to the property of the City of Križevci, the power plant would continue to work and thus still have savings and positive climate effects. It is expected that during the 25-year lifetime of a power plant, the total CO2 emissions could be reduced by 1.031.250,00 kg of CO2 equivalent.

5. CONCLUSION

The City of Križevci has defined a strategic goal to become an energy-independent city by 2030. The goal is to set solar panels to public buildings, to renew them energetically and encourage citizens and businesses to use renewable energy sources on their facilities. By implementing this project, Križevci became the first town in Croatia to help citizens participate in the financing of a solar power plant, and the Green Energy Cooperative titled it as “the

beginning of a true energy transition in Croatia" [20]. The City has also been awarded as EU Funds Champion for 2014-2017 and 2015-2018, withdrawing 70 million HRK from EU funds consecutively.

Based on the valuable experience from the first installation site, as well as the whole process of civic crowdinvesting into renewable energy sources, the local self-government has decided to continue with the project by choosing the site for the second installation in the City of Križevci. The roofs of "Franjo Marković" City Library has been assessed as suitable to host another 30 kW powered integrated PV power plant. Therefore, the local self-government along with its partners and citizens is continuing to work towards achieving one of the local strategic goals by 2030 – to achieve energy independence of public administration and institutions, as well as to popularize solar power plants as renewable energy sources affordable to citizens and acceptable to environment.

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