frontiers | Frontiers in Energy Research

ORIGINAL RESEARCH
published: 31 May 2022
doi: 10.3389/fenrg.2022.821706

Community Renewable Energy in the Czech Republic: Value Proposition Perspective

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The community renewable energy offers much potential for sustainable projects differing in terms of regional governance, technology, social, and economic settings. However, the energy sector often lacks a systematic approach to community energy project data, and community projects are based on diversified value proposition designs. This study introduces a new concept of value proposition canvas. Four regional case studies provide essential inputs for the novel community renewable energy value proposition canvas based on the triple bottom line concept. The argument of this study is that energy communities bring together multiple positive local impacts. Moreover, we offer a novel, structured way of looking at its value propositions in the form of triple bottom line value proposition canvas. The study results might serve for the new entrants to the low carbon energy communities and decision-making authorities in energy policy.

Keywords: community renewable energy, renewable energy sources, business model, value proposition canvas, energy transition

OPEN ACCESS

Edited by:
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Reviewed by:
Huaping Sun, Jiangsu University, China
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Specialty section:
This article was submitted to Sustainable Energy Systems and Policies, a section of the journal Frontiers in Energy Research

Received: *24 November 2021*
Accepted: *19 April 2022*
Published: *31 May 2022*

Citation:
Pechancová V, Pavelková D and Saha P (2022) Community Renewable Energy in the Czech Republic: Value Proposition Perspective. Front. Energy Res. 10:821706. doi: 10.3389/fenrg.2022.821706

INTRODUCTION

Energy sector transformation is tightly connected with global changes. Mature societies struggle with economic, technological, political, and social transformations, and local energy systems could provide a potential contribution toward climate objectives. According to Subbarao and Lloyd (2011), many energy projects have been found with active community involvement taking the form of cooperatives. The local community is the most natural and suitable environment for a consumer-prosumer shift in economic, social, and political empowerment.

The European Union's (EU) aspiration to become a global leader in climate change has placed pressure on European policymaking to pursue an ambitious internal climate policy (Solorio and Jörgens, 2020). The EU's climate and energy policy framework was first introduced in 2009, setting its goals in the three areas of energy efficiency, renewable energy, and greenhouse gas emissions reductions. Central and Eastern European countries have been regarded as climate and energy policy laggards objecting to more ambitious EU decarbonization targets (Ćetković and Buzogány, 2019). EU's energy policy is thus one of the most sensitive areas of the Europeanization process (Wach et al., 2021).

The Czech energy sector has been going through a rapid transition in recent years, and effective business models in support of the decarbonization process have been envisaged. One of those mechanisms is represented by local sustainability initiatives in the form of community renewable energy (CRE) projects. However, the CRE projects are tightly connected to the national energy policy in the Czech Republic, and they are based on diversified value proposition designs. Identification of factors influencing the implementation of renewable energy (RE) at the community level in the

Czech Republic is still in its initial phase. There is also a lack of practical insights into local energy business modeling. Hence, considering national socio-technical settings, one-size-fits-all approaches are not the solution. Central and Eastern European countries, including Czechia, which focus on municipal-led RE projects, have different needs compared to countries with strong grassroots' RE cooperative bases such as Germany (Hoicka et al., 2021).

Recent literature review on community energy projects and value creation in CRE projects has led the authors to the following research question: How is the value proposition of selected CRE projects structured and in what way is it created? The aim of the presented research is the conceptualization of community energy value propositions by employing a business model canvas framework, originally elaborated by Osterwalder et al. (2010), respecting the theoretical concept of the triple bottom line, which has been implemented by an increasing number of organizations (Elkington, 2018).

The multiple case study approach to CRE projects is applied, supporting the understanding of the socio-economic complexity of the researched problem. The data for the four case studies were obtained from publicly available sources [Energy Regulatory Office (ERO)] and *via* semi-structured interviews of CRE projects' stakeholders. As a result, a novel approach to the CRE value proposition canvas is proposed.

The remainder of this study is organized as follows: after the comprehensive theoretical review, the research methodology is introduced. The results are presented in the next chapter, followed by a discussion and future perspectives, and the final chapter concludes the paper.

THEORETICAL BACKGROUND

Triple Bottom Line of Community Renewable Energy

Sustainability is often understood as a three-legged stool with economic, environmental, and social legs, and it is relevant to enterprises and societies (Willard, 2012). Elkington (1997) titled the combination of the three dimensions of sustainable development—a triple bottom line (3BL), whereby the economic growth cannot be achieved without considering environmental and social aspects (D'Agostino and Moreno, 2019; Fankhauser et al., 2013). This holistic approach measures the impacts of business or, more generally, any organization on profit, people, and the planet (Tiba et al., 2019). Energy sustainability is an integral part of the concept of an energy trilemma of energy security, sustainable development, and financial effectiveness. Because of having many variations, the recently accepted interpretation is the central point of energy policy and laws, which ideally should balance all three elements (Heffron et al., 2015).

The energy transition challenge toward sustainability is to find appropriate RE systems in terms of concrete technology, territorial "fitting," ownership structures, scale, and actors participating as producers, consumers, prosumers, or any other relation (Frantál and Nováková, 2019). Better opportunities for citizens to participate in the energy transition belong to the features recognized in community energy (Hansen, 2021). Moreover, CRE represents an innovation that aims to create more sustainable energy systems. While there is no consensus as to what the term community energy should mean (Brummer, 2018), according to Walker and Devine-Wright. (2008), different levels of involvement in decision-making and sharing of benefits are significant to CRE projects. Walker (2008) argued that there are various community ownership models, including those established by local governments and local entrepreneurs. However, Petersen (2016) puts more attention to place-based communities such as cities, municipalities, or neighborhoods. Klein and Coffey (2016) made an effort to define community energy with a grassroots focus as a project initiated by a group of people.

With its climate change leadership (Oberthür and Dupont, 2021) and commitment to forming an Energy Union, the EU offers an opportunity for stakeholder engagement and a way to decentralize energy governance (Tosun et al., 2019). Two Europeanization pathways of EU policies are relevant to the RE development: the EU renewables policy, outlined in the renewables directives, and the EU rules on state aid (Boasson et al., 2020). The Clean Energy Package specifically allows actively engaging consumers with the energy sector and introducing two legislative concepts in community energy: i) renewable energy communities as a part of the revised Renewable Energy Directive RED II (Directive, 2018) and ii) citizen energy communities included in the revised Internal Electricity Market Directive (IEMD) (Directive, 2019). Caramizaru and Uihlein (2020) stated that the concepts of citizen energy communities and renewable energy communities contain common conceptual elements such as governance, ownership, control, and purpose. On the other hand, the concepts differ in activities, participants, autonomy, and effective control. The RED II specifically refers to the local renewable energy nature of energy communities, and its aim is "to facilitate the development of renewable energy communities" (RED II Art. 22 para. 4). Lowitzsch et al. (2020) highlighted that both Europe-wide governance models for energy communities concentrate on environmental, economic, or social community benefits rather than profits.

According to Creamer et al. (2018), community energy projects are entangled with the interaction of actors within three contested domains: private sector, state (central or local government), and community. These domains do not have strict boundaries, and there are interactions among them. In some countries, such as the Netherlands, Belgium, and parts of Germany, it is compulsory for the developer to offer a certain share of the prepared RE project to the local community (individuals, municipalities, agricultural companies, and small businesses). National policymakers should be encouraged to promote domestic innovative capabilities and technologies (Sun et al., 2021b), accessibility of green energy technology funds (Zhang et al., 2021), and micro-financing (Sun et al., 2021a). Potentially, spatial spillover effects on supporting

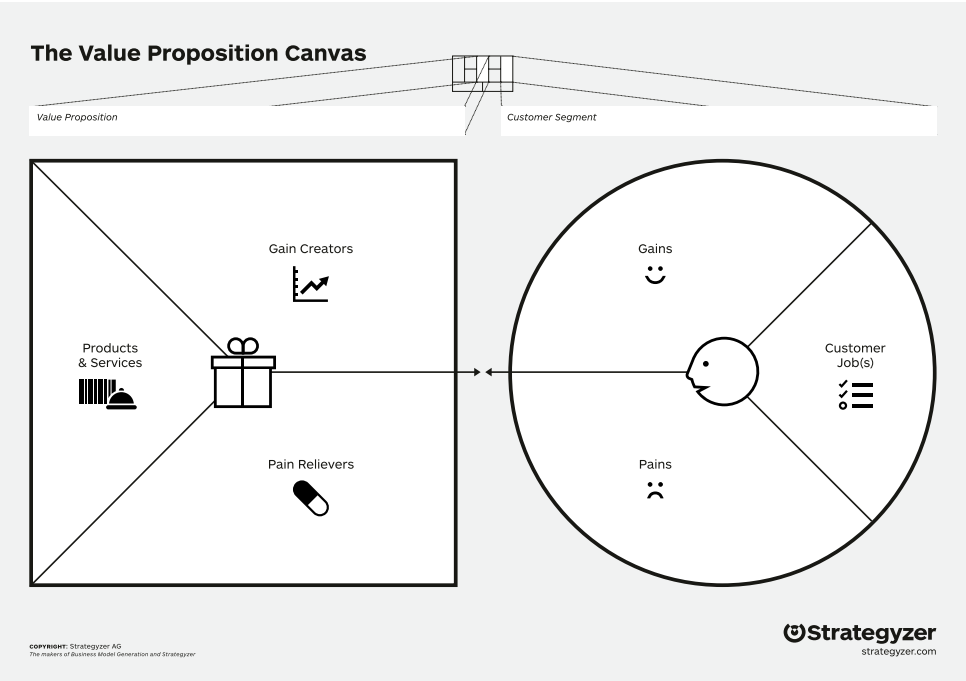


FIGURE 1 | Value proposition canvas and its relation to the business model canvas (based on Osterwalder et al. (2014), Strategyzer.com, and with copyright by Strategyzer AG).

innovation efficiency in other regions could play a role (Fang et al., 2022).

Value Perspective of the Community Renewable Energy Business Models

A widely used definition formulated by Osterwalder and Pigneur (2010) defined a business model (BM) as "the process of how an organisation creates, delivers, and captures value." One of the tools supporting innovation for sustainability in different fields of application is the Business Model Canvas (BMC), elaborated in the works of Osterwalder et al. (2005) and Osterwalder and Pigneur (2010). The BMC is a graphical template consisting of nine building blocks aiming at driving the innovation of any organization, private, public, or non-profit. Osterwalder et al. (2005) elaborated the BMC into the "plug-in" tool value proposition canvas zooming in detail on how the value is created for the customers and giving insights into one's imagination about their customers' thinking. This tool highlights competitive value creation, focusing on the value proposition for customers' activities and resources (**Figure 1**). The authors emphasized the value proposition canvas principle as a value map, which meets the customer's needs. The organization defines how the positive effects of a product/service are created (gain creators) and negative effects diminished (pain relievers).

Due to the flexibility and application strengths of BMC, it remains the most widely used approach for business description. Therefore, it will be used in the scope of this work to conceptualize the CRE projects in the Czech Republic.

While both barriers and drivers have gained attention in the CRE research (Bauwens, 2016; Bauwens et al., 2016; Herbes et al., 2017), systemic research on CRE local values is lacking. In particular, value creation in CRE is still underrepresented, despite studies shedding light on CRE's purpose (Becker et al., 2017), impacts (Berka and Creamer, 2018), and benefits (Hartmann and Apaolaza-Ibáñez, 2012; Berka and Creamer, 2018). Hicks and Ison (2018) distinguished benefits and motivations, indicating that not all motivations are delivered as benefits and vice versa. Although their STEEP framework (social, technical, economic, environmental, and political/policy categories of motivation) builds on a triple bottom line, it also considers technical and policy factors.

CRE projects exhibit diverse activities, institutional forms, goals, and values, which are not always related directly to energy (Seyfang et al., 2014). The value propositions of the energy utility are the products or services offered to the end customer. CRE might differ in the value proposition design compared to for-profit organizations due to the different understanding of value creation and capture. There are also attempts to explore the principles of sustainability-oriented business models, such as the triple bottom layered BMC by Joyce and Paquin (2016), who add two layers to the economic layer: an environmental one with a lifecycle perspective and a social one. Karami and Madlener (2021) concentrated on creating economic, social, and environmental values for

private customers of retail electricity suppliers utilizing BMC in a specific segment.

Although applying the business model concept to CRE is challenging, the process of value creation also applies to communities (Herbes et al., 2017). The presented study aims to shed light on the processes through which CRE projects lead to positive local impacts and minimize negative effects *via* structuring the value propositions into economic, social, and environmental dimensions. Even though CRE research has been already advanced, the study of values and long-term local impacts of CRE beyond energy generation is still needed (Creamer et al., 2019). The business model view and value proposition canvas, together with the 3BL framework, might contribute to the above-mentioned challenges.

Community Renewable Energy in the Czech Context

During the last decades, the Czech Republic has gone through a complete market transition that has impacted the energy sector as well. Several legislative documents for the energy policy adopted in 2000 have built the main pillars.[1]

The Czech energy policy is committed to the RE targets of the European Union (EU). The Czech 2030 target level for RE share on gross final energy consumption is 22%, compared to the EU level target of 32%. Renewable energy sources (RES) are supported by regulatory policy and fiscal incentives. The national RES support is covered by the Act on Supported Energy Sources (Act no. 165/2012).[2] The energy-producing companies with an installed capacity higher than 10 kW are required to have a license, whereby two types of licenses are possible: up to 200 kW and those exceeding 200 kW. The micro-generation units with self-consumption up to 10 kW do not require a license or permit in case electricity is not fed into the grid. The promotion of electricity production is based on the following main regulatory instruments: investment support, subsidies, purchase prices in the form of feed-in tariffs (FiT), green premium payment, which is paid on top of the market price, and tax regulation. RES generation is also exempt from real estate tax.

The feed-in energy policy has been a vital part of national support for renewables, often for the promotion of small-scale renewable energy systems. Within this scheme, distribution system operators or transmission system operators are obliged to purchase the complete amount of electricity generated by RES. In the case of green bonuses, the producer needs to seek a purchasing party on his own, whereby it may be the final consumer or the energy trading company. Since the beginning of 2014, support for new RE plants has been discontinued for several years due to collapsed national energy policy incentives in the whole Central Eastern European region (Sokołowski and Heffron, 2022). The above-mentioned FiT tariffs applied only to residual projects with an authorization issued until October 2013 and small-scale installations.

In the Czech Republic, little research has been done in the field of CRE. For instance, cooperatives that were common in the Czech Republic after 1989 predominantly continue with the activities of socialist cooperatives in the agriculture or house of tenants. According to Malý et al. (2019), municipalities have played a major active role in CRE even though their role has been more of project initiation of energy efficiency measures and less of RES installations so far. However, overall, 130 municipalities own and operate electricity generation plants with a total output of 23.5 MW, whereby the largest share of municipal RES is represented by rooftop solar or PV (Duha, 2020). According to the Hnutí DUHA—Friends of the Earth Czech Republic, there are 34 municipal biomass heating plants and five municipal biogas heating plants in the Czech Republic.

RESEARCH DESIGN

This study aims to propose a novel approach toward the structuring of value proposition and creation of CRE projects, respecting the 3BL sustainability concept. The theoretical framework of the research is built on BM theory and value proposition canvas concerning the sustainability concept of 3BL and the conceptualization and classification of CRE projects as a part of the energy sector transition process (Frantál and Nováková, 2019). In order to understand the complexities of CRE projects, the BMC and value proposition canvas, originally elaborated by Osterwalder and Pigneur (2010), was chosen. The multiple-case study research method was applied on the basis of a combination of a "typical case" and "stratified" purposeful sampling methods (Patton, 2002; Palinkas et al., 2015; Irfan et al., 2022), as it captures major differences without identification of a common pattern.

The selection of case studies was performed as follows. First, projects were selected from the Energy Regulatory Office (ERO) license holder database, consisting of electricity generation license holders involved in electricity production, distribution, and trading. The community engagement is evidenced in the ERO database overwhelmingly in the limited liability companies (LLC), collectives, and municipal projects. LLC was chosen in some municipal projects, as this legal form is most transparent with a relatively simple structure, minimal requirements on capital, and any natural person or legal person might be the company representative, whereby they are visible in the business register. The most diversified institutional structure is attributed to biogas collectives with a not negligible share of involvement of agricultural and landowner collectives. Additional 43 city-based projects were found together with four wind energy municipalities and four hydro energy projects. Second, the projects were clustered according to the following parameters: i) ownership structure, ii) RE technologies, iii) localities, and iv) segments. Afterward, professionals from the energy field were asked for their expert opinion: Chamber of Renewable Energy Sources

[1]Energy Management Act (Act no. 406/2000 Coll., on Energy Management as of 25 October 2000), and Czech Energy Act (Act no. 458/2000 on Business Conditions and on the Exercise of State Administration in the Energy Sectors and on the Amendment to Certain Acts, the Amendment to the Energy Act by Act no. 131/2015 Coll).

[2]Act on Promoted Energy Sources and on the amendment to some laws "POZE" (Act no. 165/2012 Coll. as of 31 January 2021).

and DUHA, Czech Friends of the Earth organization, which resulted in a list of four CRE projects:

A combination of organizational and stakeholder structures with community involvement (municipality, municipal energy service company ESCo, non-profit, municipal association, digital platform);
A variety of RE technologies (solar, PV, and bioenergy);
Geographical spread across the Czech Republic;
Different energy value chain segments such as energy generation, supply, consumption, distribution (electricity and heating networks), and energy services.

Second, semi-structured interviews were conducted with the CRE project representatives of top management. Qualitative data analysis involved finding patterns and themes in the data collected for the evaluation with respect to the project's added value, infrastructure, financial aspects, customers, and stakeholders. The targeted interviews occurred between November 2018 and August 2019, based on personal, telephone, and email conversations with representatives of the CRE projects (mayors, municipality representatives, or project managers). In addition, data related to project descriptions were also enhanced by publicly available data sources, such as project websites. Common patterns from case studies were then clustered into three sustainability dimensions in the municipality CRE value proposition canvas.

The municipal projects build the most visible and active CRE in the Czech Republic. Reflecting this, in 2016, the Czech Community Coalition for promoting RE was started and gathered more than 60 cities and municipalities, associations, and industrial partners. The projects with different characteristics of ownership and management structures are demonstrated by four case studies presented in the following chapter.

COMMUNITY RENEWABLE ENERGY REGIONAL CASE STUDIES

The selected case studies demonstrate the economic, social, and environmental aspects of the CRE in detail and represent different settlements of regional public authorities, municipalities, and local stakeholders, which are active in CRE. The projects with different characteristics between ownership and management structures are demonstrated by the following four CRE case studies:

- Municipal ownership and management
- Municipal ownership and municipal ESCo management
- Combined municipal/not-for-profit (NPO) ownership and management
- Combined municipality union ownership and management.

The following part of the study is devoted to the four case studies: municipality-based ownership and management: Měňany in the Central Bohemian region; municipal ESCo case study with municipal ownership and ESCo management: Kněžice in the Central Bohemian region; municipality organization/NPO case study with combined municipal/NPO ownership and management: Hostětín in the Zlín region; and municipality union ownership and management case study: Dolní Lhota in the Zlín region. The canvas tool is used as a template for qualitative data structuring. Each case study consists of a description of the geographical location, the energy system setup, and finally, the individual value proposition canvas based on the customer needs and tasks, which must be performed.

Municipality-Based Case Study

The village of Měňany belongs to the protected landscape area of Český kras in the Central Bohemian region. The village with 308 inhabitants is located in a valley surrounded by hills causing air pollution to be retained at a time when people mostly used to burn low-quality brown coal and waste.[3] Connection to natural gas infrastructure was therefore considered in 2003. According to the natural gas company, the village was a too small municipality for the natural gas infrastructure investment, and a municipal heating plant was therefore proposed as a solution.

A municipal hot water biomass heating plant with a heat distribution project for the whole village was initiated in 2003 and has been in operation since 2008. The total installed heat output is 1,120 kW with three boilers (2 × 450 kW and 220 kW). The annual fuel consumption is 540 t, and 3,000 GJ heat/a is produced. The fuel used includes sawdust, tree bark, wood chips, and waste from nearby sawmills, either from their municipality resources or bought externally. The village also considered growing sorrel as a biomass source.

The proposal for constructing a biomass boiler house has received almost 100% support from the local council and among the citizens. Except for a few locals, the whole community has been involved in the project: "We encouraged the citizens actively to participate at the publicly held council meetings so that they are involved in the process right from the beginning" (interview with the mayor, 15 July 2019).

In terms of finance, the heat generated by the plant is not only environmentally convenient but also perceived by citizens as cheap, according to the mayor. The total investment of 1.5 mil. EUR was financed by the State Environmental Fund (0.65 mil EUR) and the municipality budget (0, 1 mil EUR), and the municipality had to take a loan (0.76 mil EUR). The ownership and management structures are solely dependent on the municipality itself.

The environmental issues, namely, air quality during the heating season (when the cheapest brown coal or even waste used to be burned), and financial aspects were most relevant to this project. However, increased comfort (i.e., replacement of electric boilers) as an additional benefit for the citizens was mentioned as well. The municipality-based value proposition canvas (**Figure 2**) depicts the product and service part as a municipality-based renewable energy thermal energy supply. The customer jobs include thermal energy consumption for heating and hot water and biomass waste disposal. The value

[3]Měňany (©2020); http://www.menany.eu.

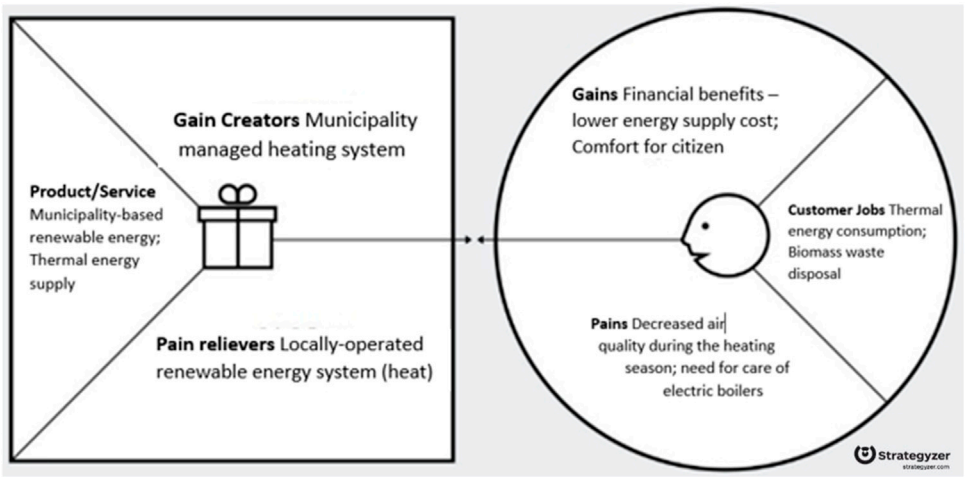


FIGURE 2 | Value proposition canvas (municipality-based) based on Osterwalder et al. (2014), Strategyzer.com, and with copyright by Strategyzer AG.

proposition has been identified as thermal energy affordability at lower cost (economic dimension), assuring comfort for the local citizen (social dimension) and air quality during the heating season (environmental dimension).

Municipal Energy Service Company Case Study

Kněžice at Městec Králové is a village located in the central part of the Czech Republic (Central Bohemian region) in the Nymburk District. The villages in the region are not connected to the natural gas infrastructure, nor is a sewage system available. There are 410 inhabitants living in the central part of the village and approximately 100 people in two distant areas.[4]

The Kněžice energy technology complex is based on a combined heat and power (CHP) unit with a municipal heating plant. The biogas station operates with a CHP electrical output of 330 kW and thermal output of 405 kW. Part of the electricity produced is consumed by their own CHP unit and part for the whole biogas station, and the residual amount (approximately 83%) is delivered to the electricity distribution grid (22 kV). Electricity is sold to an energy company utilizing the green bonus scheme. The electricity for their own consumption is bought from the market. The average annual electricity production is 2,600 MWh/a, the grid delivery is 2,200 MWh/a, and the annual consumption is 2,000 MWh/a. The heat power plant operates with two automatic boilers of 800 kW (straw and sorrel) and 400 kW (wood chips and wood waste) during the heating season (October–April usually).

The biogas station is operated by the municipal ESCo Energetika Kněžice, s.r.o. (Ltd.), which is 100% owned by the municipality and managed by the municipal ESCo. The municipal ESCo is responsible for the technology complex management and related energy services. The municipal authority is the technology complex owner and possesses the decision-making rights in case of crucial project changes, periodical assessment, and monitoring; approves the final report; and communicates the project externally. It is also responsible for personal organization, including ESCo. The financing scheme of the total investment cost of 5.3 mil EUR is based on a combination of national and international public subsidies (3.6 mil EUR) and bank loans (1.7 mil EUR). Avoided cost for the sewage system for wastewater cleaning and biodegradable waste disposal was considered before the project started.

The ESCo-based value proposition (**Figure 3**) can be interpreted as a combination of energy affordability (economic dimension), "back to the roots" philosophy with historical and traditional relation to the local community (social dimension). Local generation and consumption close to the natural environment and processes with better land use are supported (environmental dimension). The customer jobs include domestic hot water and central heating, electricity appliance use (incl. cooking) and lighting, consumption of products, and clean water utilization. The matching products and services result in community-led energy commodity supply (thermal energy supply to end-customers), energy commodity supply (electricity power), electricity generation delivered to the distribution network, and waste management—waste processing and fertilizer production, residual biogas material, and ash from the biomass plant (by-product donated to the local suppliers). The municipality is also very actively involved in the communication with regional and national authorities, non-profit organizations, and academia.

> "We initiated the project together with local activists and municipal government, but the most important success factor in the initial phase was convincing the inhabitants. We organized intensive personal meetings with citizens and municipality representatives, which were needed to explain and discuss arguments for the

[4]Kněžice (©2020); http://www.obec-knezice.cz/.

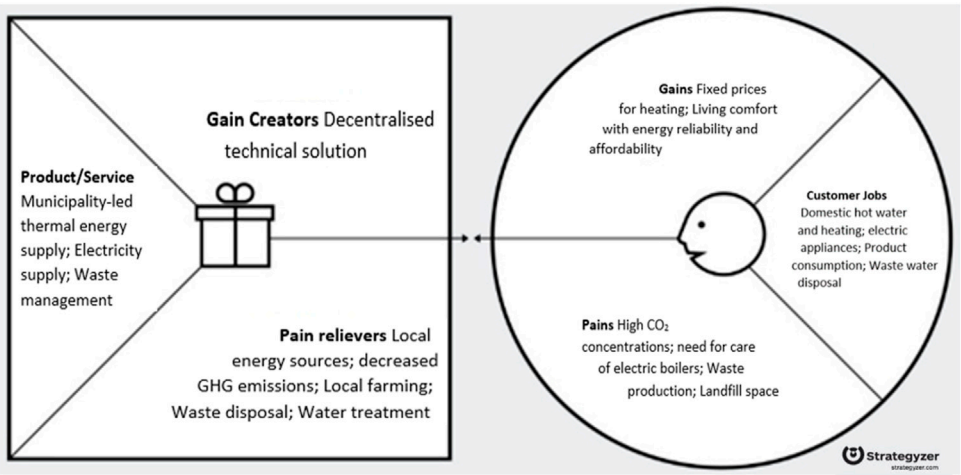


FIGURE 3 | Value proposition canvas (municipal ESCo.) based on Osterwalder et al. (2014), Strategyzer.com, and with copyright by Strategyzer AG.

installation" (interview with the mayor, 26 November 2018).

Municipality: Not-for-Profit Case Study

The third case study is based in Hostětín, a village located in the White Carpathians in the Zlín region. The number of inhabitants in this small village amounts to approximately 240. Hostětín CRE projects are based on sustainable local development activities initiated by the NPO Center Veronica Hostětín (ZO ČSOP Veronica). Initially, a reed bed sewage system was built to treat wastewater with bacteria living on the plant roots (Božková et al., 2013). Later, several other sustainable energy, food production, and agriculture projects were added: the municipal biomass heating plant, public lighting system, the Veronica Centre building passive house, natural garden, and apple juice plant. Solar thermal collectors are located at the local juice plant and Veronica center building, and several PV systems are installed at the juice plant, next to the biomass plant, and at nine family houses.

The municipal biomass heating plant supplies heat almost to the entire village of Hostětín. It has an installed capacity of 732 kW and was put into operation in 2,000. Annual heat energy production amounts to 3,500 GJ. The heat distribution network (2.8 km long) is connected to 83% of the households as customers (70 heat exchanger stations out of 86 buildings in the village). The plant is burning wood chips and waste from sawmills and forests. The municipality is the technology complex owner, responsible for operational and management services. The biomass heating plant is community-owned, as well as 1/4 of the PV panels at the heating plant. The remaining PVs are either private or NPO-owned.

The financing structure corresponds to the public grant structure, which includes investment in part of the boiler, its installation, annual service, and resources for the information campaign. The total investment of 1.4 mil EUR was financed by the State Environmental Fund (0.75 mil EUR for biomass plant infrastructure), the Netherland government *via* the SENTER agency (0.4 mil for biomass plant), and Czech Environmental Agency (0.1 mil EUR for heat distribution network). The remaining 0.08 mil EUR were citizen payments for grid connection. Similar to the previous study case, the financing schemes involved different stakeholders. The collaboration between the municipality representatives, the NPO Veronica Hostětín, and foreign partners was described by the NPO director as one of the most important initial success factors.

The project initiator in the pre-project phase was the municipality office Uherské Hradiště, with their strategy for biomass utilization in the Beskydy region. The NPO Veronica Hostětín played an essential and active role, communicating the idea to the community, contributing to knowledge sharing with the Austrian energy sector, organizing seminars, and promoting the idea of local energy sourcing in the pre-investment phase.

"The initial support of inhabitants was 50% only. Based on the unique partnership of the municipality authority and the NPO Veronica Hostětín, we organized seminars to raise citizen awareness" (interview with the NPO Veronica Hostětín director, 9 November 2018). Moreover, information campaigns were conducted, and best practice examples were explained and shown. Later, technical problems appeared, such as insufficient material supply as the wood chip suppliers changed and no long-term supplies could have been agreed on.

The value proposition canvas, as shown in **Figure 4**, includes both the overall community energy supply (heat supply to end customers) and electricity generation for individual consumption or delivered to the distribution network. Fixed energy prices for heating, energy reliability, and affordability are related to the economic dimension, resulting in reducing the heating cost. On the contrary, one of the "pains" was the high unemployment rate in the municipality. The multiplication effect of the initial project idea was achieved by additional activities, such as local farming (juice plant). New jobs were thus created directly in the local renewable industry and at the juice plant, which turned out to lower the rate of population decrease (social dimension). The most important environmental dimension of the project is related

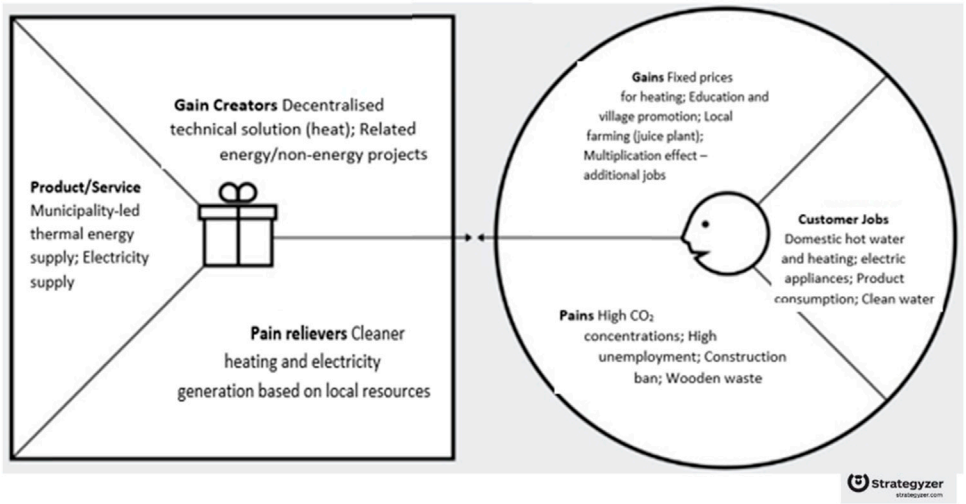


FIGURE 4 | Value proposition canvas (municipality-NPO) based on Osterwalder et al. (2014), Strategyzer.com, and with copyright by Strategyzer AG.

to the construction ban in the 1990s when the village was out of the main natural gas pipeline route. Significantly cleaner air was thus achieved by a complex of RE technology solutions.

Based on the case study analysis, the CRE value, in this case, is based on local business support and in line with the sustainable development principles. Related positive effects of energy self-sufficiency with decentralized local RE sources and other non-energy projects contributed to the multiplication effect of the whole project.

Municipality Union Case Study

The fourth case study is represented by the PV plant at the wastewater treatment plant (WWTP) in the Union of municipalities of the agglomeration Dolní Lhota near Valašské Klobouky (Union of municipalities). Initially, a contract on the voluntary creation of the Union of municipalities was signed in 2007. The purpose was the contractual settlement of particular activities related to the construction, operation, maintenance, and development of sewerage in favor of members of the Union of municipalities. The contractual parties include the municipalities of Dolní Lhota, Horní Lhota, Sehradice, and Slopné. The conclusion of the contract, including the Articles of Association, was discussed with the citizens and approved by the councils of all member municipalities.[5]

The WWTP produces 350 to 500 kWh of electricity, depending on the load and wastewater inlet. All produced energy is consumed directly at the WWTP; the distribution network counter flow is zero in this case. Sewage wastewaters lead to a common mechanical biological WWTP, which is built in the village of Dolní Lhota. The WWTP is designed as completely covered with the exhaust of air through the deodorizing filter, with sludge drainage installed. The WWTP capacity is 2,870 equivalent persons with 29.9 km line length (sewers and discharge pipes) and two filling stations.

The installed capacity of the PV power plant is 29.9 kW, and the electricity is consumed by the WWTP technological equipment. The project was realized in 2012 using the member municipalities' financial resources. The total payback period is 9 years, with a planned lifetime of 25 years. The PV plant operating costs equal zero, and the capital cost was 40 thousand EUR. Based on the contract, the members of the Union of municipalities undertake to finance the project of the sewerage system owned by the Union and share its total costs respecting mutually agreed rates for particular municipalities: Dolní Lhota 23.6%, Horní Lhota 21.9%, Sehradice 30.6%, and Slopné 23.9%.

Important project aspects are published on the Union website and the website of individual municipalities, including publishing the resolution of the member meetings. "The members of the Union of municipalities are informed about all activities from the very beginning of the plan up to the implementation. Municipalities have the opportunity to comment or disagree, [*sic*] however, the project is generally supported and positively viewed on" (interview with the mayor, 13 December 2018).

The value proposition canvas is presented in **Figure 5**. As a complex wastewater treatment including a RE source (PV). Cost-effective water cleaning and local wastewater treatment represent the economic dimension of the project. The social dimension includes future considerations about living standards. Complex wastewater treatment is considered the relevant service matched with clean water utilization (environmental dimension), together with RE-based energy consumption.

One of the most limiting barriers the Union of municipalities encountered in the implementation and operation of the project was the capacity performance limitation of the PV plant. "Major obstacle was the installation capacity limit, so we decided on a procedure without an energy licence. Considerable pre-implementation and subsequent administration would be otherwise needed" (interview with the mayor, 13 December 2018). The potential

[5]Dolní Lhota (©2020); http://www.aglomerace.cz/

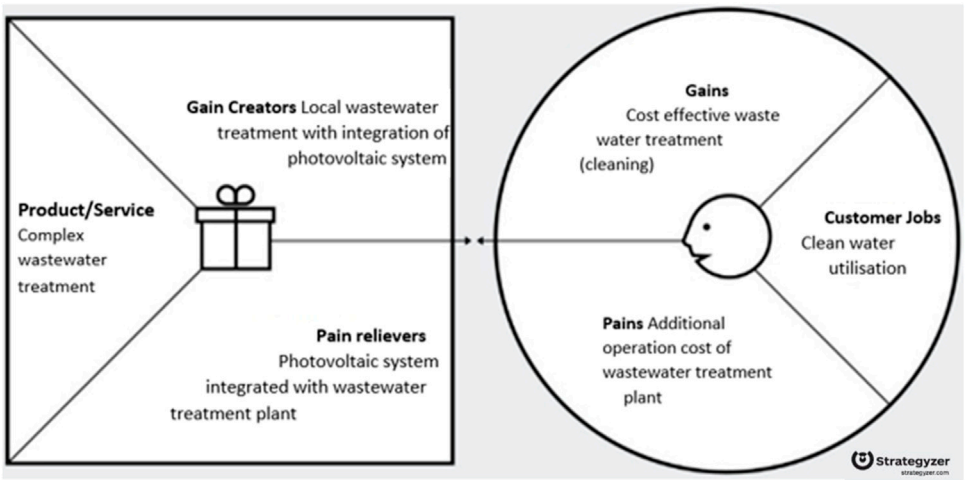


FIGURE 5 | Value proposition canvas (union of municipalities) based on Osterwalder et al. (2014), Strategyzer.com, and with copyright by Strategyzer AG.

administrative load on the project exceeding 30 kW of installed capacity discouraged the municipality from applying for a special energy generation license from the Energy Regulatory Office.

Municipality Community Renewable Energy Value Proposition Canvas

Resulting from the four case studies elaborated in the previous chapter, the value propositions of CRE projects are systematically captured by the complex value proposition canvas. While the value proposition is the plug-in part of the business model canvas, both tools are tightly interconnected, as proposed by Osterwalder et al. (2014). The community-based RES value propositions respecting the presented case studies are summarized in alignment with the 3BL approach. As a result, in the case of CRE projects, the 3BL approach is an integral part of the value proposition canvas, as proposed in **Figure 6**.

A novel approach for structuring value propositions and creation is demonstrated in four case studies. These cases represent different settlements of local public authorities, municipalities, and other stakeholders, which are active in Czech CRE projects. On the "customer" side of the scheme, the CRE jobs are summarized through "gains" and "pains" lenses. The product side represents the gain creators and pain relievers to CRE.

The most important considerations about the economic, social, and environmental dimensions of the value proposition canvas are elaborated as follows:

- Economic value dimension as cost-effective energy generation, delivery, and storage.

On the one hand, insufficient, mostly public financial resources are available for CRE, and complicated project administration is considered a burden. On the other hand, CRE projects might generate additional budget revenue for the municipality, directly due to the sale of electricity or indirectly due to savings resulting from the use of own electricity or heat for own needs.

- Social value dimension is community-led energy generation, delivery, and storage.

Some of the initiatives go beyond the core CRE project providing sustainable food, products, and services, including housing, education, health care, sports, and entertainment (described as the multiplication effect of the CRE project).

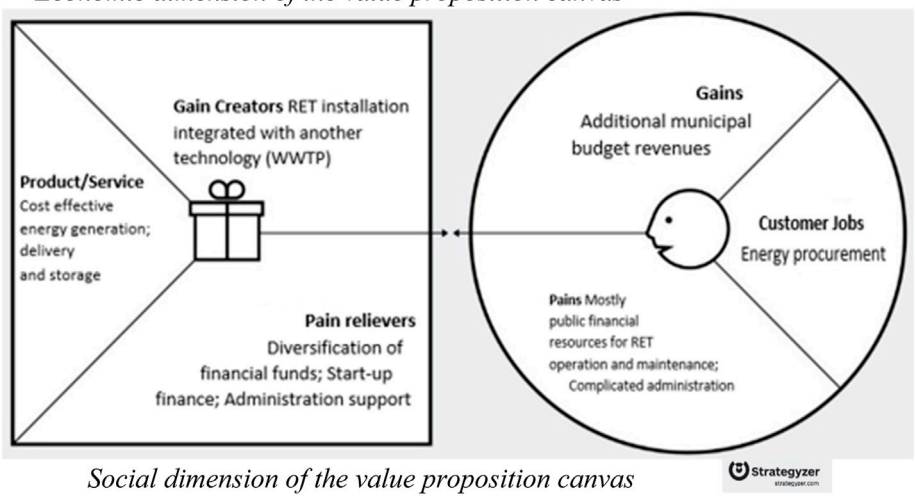
- Environmental value dimension as renewable energy generation, delivery, and storage.

As a result of fossil fuel replacement, greenhouse gas emissions are declining, and local air pollution is reduced. A cleaner environment also encourages biodiversity. Environmental education has also gained attention, and within many projects, cooperation with academic and research institutions has been developed.

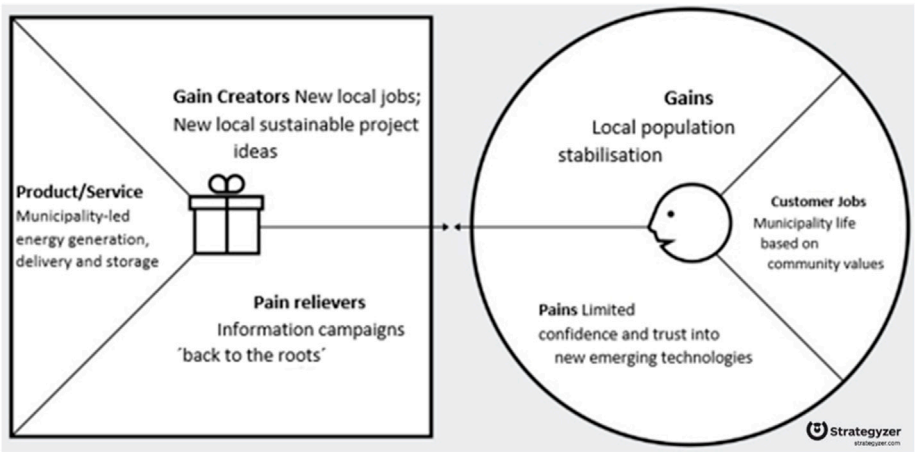
DISCUSSION

The business model framework focusing on the value proposition canvas is newly applied in Czech community renewable energy projects in municipalities. In line with Herbes et al. (2017), applying the business model concept to CRE projects is challenging and relevant as the process of value creation applies to energy communities as well. CRE value propositions are elaborated into 3BL dimensions reflecting on the case study results. However, compared to Herbes et al. (2017), who identified the morphology elements of RE cooperatives' business models, we propose a municipality CRE value proposition canvas interconnected with 3BL. Based on the

Economic dimension of the value proposition canvas



Social dimension of the value proposition canvas



Environmental dimension of the value proposition canvas

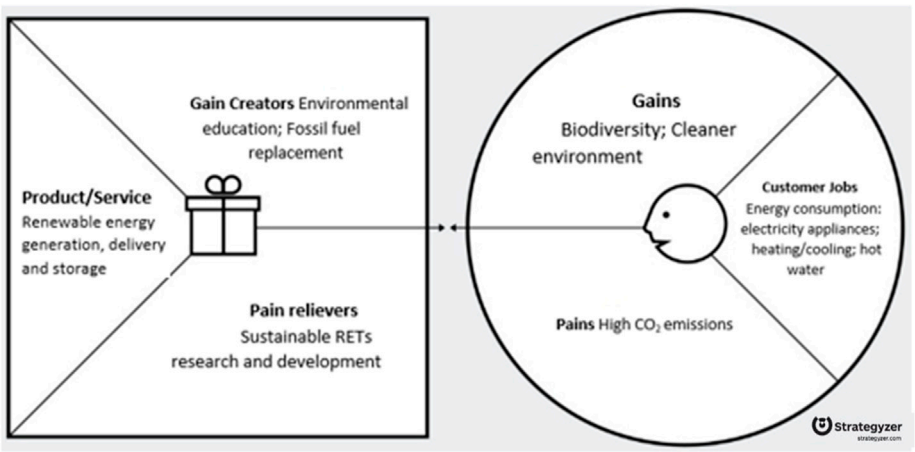


FIGURE 6 | Municipality CRE value proposition canvas based on Osterwalder et al. (2014), Strategyzer.com, and with copyright by Strategyzer AG.

previous research and the presented results, the municipal CRE is strongly oriented toward complex 3BL value propositions. Compared to the research on motivations and values in the CRE presented by Hicks and Ison (2018) as the STEEP model and Holstenkamp and Kahla (2016) using a socio-technical perspective, we used the 3BL concept (Elkington, 1997) with a priority set in economic-social-environmental value propositions.

Bioenergy is considered the most successful CRE sub-sector in the Czech Republic, with strong emphasis especially on the environmental dimension. Many community energy projects to date have focused on the heating sector. Examples were also presented in electricity production. Often, bioenergy utilization not only offers environmental benefits but also creates multiplication or spillover effects in rural areas (Fang et al., 2022). In line with the social business model by Yousuf et al. (2017), biogas is integrated biotechnology that offers social, economic, and environmental benefits. On the contrary, according to Irfan et al. (2022), the availability of an adequate subsidy policy is crucial for the further development of the sub-sector. The most common municipal use of RES in the Czech Republic is in the form of a biomass heating plant. The village of Kněžice is often set as an example of an energy self-sufficient municipality thanks to a biogas plant and a biomass plant.

The key common characteristic of the presented project case studies is the fact that they are strongly interconnected with municipalities in the form of direct municipal ownership and management, municipal ESCo, or a municipal or regional authority organization (schools, cultural centers, etc.), With respect to ownership and legal status, the majority of projects were initiated by municipalities in cooperation with a variety of actors. According to the research results, either individuals or local public authorities in municipalities are active in CRE. It was observed that municipality representatives, in some cases together with local activists, were active in the community, initiating and taking active roles in community energy projects. Community involvement in the broader context of regional authorities represents successful energy projects (Subbarao and Lloyd, 2011). Although the flat ownership collectives might represent an initial point to build on dedicated CRE collectives, they still have barriers in terms of citizen active roles in the Czech Republic, focusing mostly on the combination of energy efficiency and retrofitting of apartments (Malý et al., 2019). Private sector engagement in CRE is evidenced on both sides of the prosumer relationship as local energy producers offering services to the local citizens and energy consumers within the industrial production process. However, no significant active role has been evidenced. Klein and Coffey (2016) also called for solutions of a classification system for CRE projects at all societal and institutional levels.

The Hostětín project represents a strong involvement of the local community in the initial project idea formulation (NPO); its long-term partnerships with regional, national, and international organizations; and effective communication with the public. This CRE project exhibits diverse activities, which are directly or indirectly related not only to energy but also to agriculture and sustainable food production (Seyfang et al., 2014).

The cases of Kněžice and Měňany demonstrate individual personal involvement of municipality representatives together with favorable energy policy setup in the pre-investment phase as crucial factors of project success. Furthermore, the Union of municipalities Dolní Lhota is an example of successful cooperation among several neighboring villages.

POLICY IMPLICATIONS

In general, clear definitions on the EU and national level defining terms such as RE community, local energy community, low carbon community, or positive energy community are needed. The Czech definition of community RE should take the national specifics into account, and digital platforms of communities (private and publicly financed) should be envisaged. Unlike businesses, communities and especially municipalities have not only different motivations but also possibilities and conditions for the preparation of RES projects.

It is worth mentioning that the clear majority of municipal RE projects originated before 2013 due to unexpected changes in state energy policy related to RE support. In 2013, the Czech government decided to stop the FiT scheme for new RE with only a few exceptions. Respecting the European directive on the promotion of the use of energy from renewable sources 2018/2001/EU (RED II), the directive transition to the Czech law in 2021 was prepared—consumers, households, and communities will have the possibility to engage in energy production, storage, and consumption. The national authority, the Ministry of Industry and Trade, has been preparing an amendment to Act no. 165/2012 and an amendment to the Energy Act, which aims to relaunch the RES development. Both amendments should set new rules for developing RES in the Czech Republic and should also anchor energy storage systems in the Czech legislation.

The concrete steps taken by the Czech government include the launch of the National Climate and Energy Plan of the Czech Republic in 2020,[6] which identifies CRE as carriers of economic, environmental, and social benefits on a local and national scale. Moreover, new financial instruments are proposed in the Modernization Fund, which should provide financial resources to CRE projects. This should be a significant step, which could lead to the creation of new wind, biomass, or PV power plants in the Czech Republic. Following policy implications of CRE, future developments for CRE projects are divided into economic, social, and environmental dimensions.

Economic Implications

According to Zhang et al. (2021), public spending on human resources and research of green energy technologies prompts a sustainable green economy. The municipalities with their renewable energy projects may apply for both auctions and green bonuses for smaller projects. However, experience with auctions from the Western European countries shows that, in tendering procedures, municipalities cannot compete with

[6]National Climate and Energy Plan of the Czech Republic as of 13 January 2020.

commercial projects. Municipalities, unlike commercial developers, need more time to prepare a project, and they do not dispose of risk management expertise developed over the years. Organizational support for the interests of CRE (Herbes et al., 2017), such as a group of municipalities requiring better conditions for community projects and administrative support for project preparation, would certainly help. On the other hand, municipalities often own brownfields and other non-agricultural areas suitable for building renewable electricity generating plants. PV power plants built on these sites could be an important source of finance for the municipal budget (municipal power plants). On the techno-economic level, the operation of the local electricity distribution system would be another big step further.

Social Implications

Moreover, a multisectoral partnership might be supported. The municipal authority could use or rent the area or a roof (e.g., its own, typically at the school building), and the citizens are offered a project share, such as civil power plants. These settings might contribute to the spillover and multiplication effect of the projects (Fang et al., 2022), creating new value propositions for the local people, engaging local communities, not just municipal authorities, in different types of activities, and creating new jobs locally. Besides municipalities, another opportunity is energy collectives, traditionally related to block of flats ownership in the Czech Republic. Efforts should be made toward CRE awareness-raising with information campaigns.

Environmental Implications

Similarly to Geels et al. (2017), complementary innovations need to be considered, such as energy storage (batteries, flywheels, and pumped hydro), smarter grids (grid flexibility and management), demand response, and new market arrangements. The innovation in services, where the end user is a part of the system, requires a targeted behavioral approach, shifting from designing products to designing new business models. In the middle term, public sector incentives will still play a role in the energy sector. However, according to the Solar Dominance Hypothesis (Goodstein and Lovins, 2019), solar-based energy coupled with storage and related technology innovations will contribute 50% to electricity generation by 2030. Therefore, it is important to develop and test energy storage systems of different physical and chemical natures potentially suitable for different scales. The shared regime of stationary energy storage for the energy community or individual storage solutions with small decentralized energy generation will develop in the future.

CONCLUSION

Technologies, policies, and mindsets need to change and adapt to new business model types to achieve energy goals. Previous research results have repeatedly proven that one of the key parameters for the successful development of RES is the question of who owns and operates them. Moreover, we argue that the understanding of value proposition creation and structure is a vital part of successful CRE projects. Public sector involvement is relevant in the most important project phases and tends to be the key success factor in the case of financial planning. Collective ownership in energy communities is still not widely spread in the Czech RE projects, as can be seen in the Austrian and German municipalities. The expansion of energy cooperatives is still lacking behind its potential due to scarcity or limited need for "green" energy and because of missing persons or groups to promote this idea.

Our study contributes to the blooming literature on the business model canvas building blocks framework. Moreover, this study provides insights into the value proposition background and the 3BL concept based on those factors influencing value creation and value capture. The key contribution to the theory is thus the multidisciplinary integration of the business model theory with theories from other scientific fields and their application in the energy sector.

The methodological limitation of the presented study is attributed to the chosen case study method, which main advantage is an in-depth knowledge of the analyzed topic. However, the representativeness of the results might be an issue. Similarly, the regional geospatial comparisons would still need more detailed data collection. Data processing problems emerged due to the difficulty in finding community energy-related projects. It was also found that there is no systematic way to extract data for thermal RES generation and distribution license holders in the Czech Republic.

The CRE field offers much potential for projects differing in terms of economic, social, and environmental settings. A very promising research direction seems to be transdisciplinary research combining STEM and SSH aspects of energy-related topics. Communities and social networks might have a higher positive impact on behavior change than individually aimed policies.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors upon request without undue reservation.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

FUNDING

This work was supported by the Ministry of Education, Youth and Sports of the Czech Republic-DKRVO (no. RP/CPS/2022/005).

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