

Community-Based Virtual Power Plants: Against All Odds? †

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Abstract: Based on a European project entitled “Community-based Virtual Power Plants’ (Interreg 2017–2010) this paper discusses opportunities for community energy projects—focusing on the example of community-based virtual power plants. Using a business model canvas as heuristic and the Dutch demonstration case as an example, we show how a business model following a community logic is unfeasible in practice. The current institutional context compels community based cVPP initiatives to partially abandon such community-based values, in order to be able to survive in the energy services market. It is concluded that more attention is needed for institutional change since the current institutional bias that hinders cVPP projects is also hindering a more inclusive energy transition.

Keywords: community energy; virtual power plants; business models; institutional conditions; lock-in

1. Introduction

In EU but also national policy discourse on the energy transition, an increase in references to community energy can be found. Considering that community energy initiatives have different aims and are likely to be driven (partially) by different values than commercial energy projects, this raises the question what the opportunities are for community members to organise themselves and collectively organize local generation, storage and distribution of self-generated energy.

This question has been investigated for a specific example of community energy: community based virtual power plants (cVPP), based on the findings of the Interreg-funded cVPP project. Making use of a Virtual Power Plant (VPP), a cVPP in theory would allow communities to choose between (a combination of) several routes, e.g. generate energy and feed it back into the grid; manage and distribute their self-generated energy within their community; trade energy on the energy market and provide grid services to system operators. The VPP technology would enable communities to explore new ways of organizing the generation and distribution of energy within their own community, for example, in a more distributed and more sustainable way, reflecting community values. Community energy projects follow a community logic [1]. With community logic we mean the rationale behind a project, reflecting diverse community needs and values; the role of the community in deciding about the distribution of benefits, costs and risks; it refers to models of community ownership of assets, the organization and/or the cVPP; it refers to active engagement of community members in governance and decision making; and it refers to the ambition to have a scale and level of complexity that matches with the needs, abilities and ambitions of community members.

Within this Interreg cVPP project, attempts at setting up cVPPs in different EU countries entail experiments with new types of business models. A business model (BM) is understood here as the

organizational logic of an enterprise or cooperative and its partners, which is used to create and capture value—see Figure 1 [2].

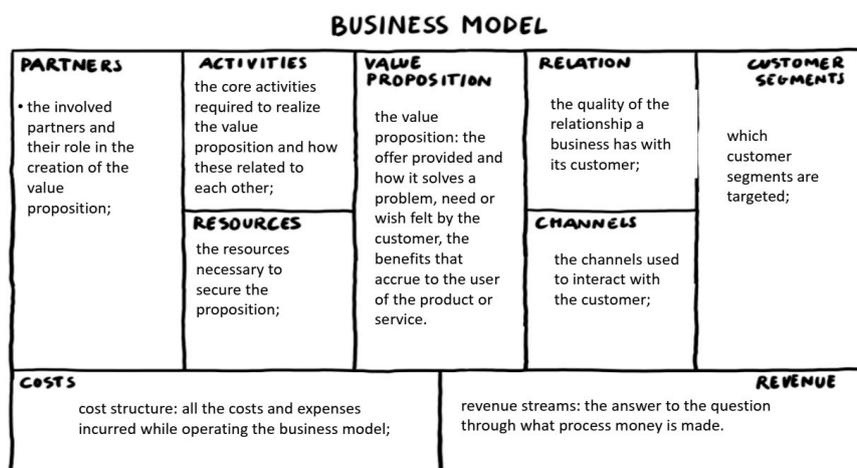


Figure 1. Business Model Canvas [2].

Below we confront an ideal-type BM for a cVPP - based on a community-energy logic - with real-life efforts at developing a BM for a cVPP project (based on the experiences of a cVPP project in Loenen, the Netherlands). (For more information on this Dutch project and an extensive discussion of the way in which the institutional context caters for incumbents and scale rather than for bottom-up initiatives, see [3].) This will clarify how, regardless of the policy discourse, institutional conditions (rules, regulations) in the energy market make it very difficult for an energy community initiative to become a success without abandoning its initial rationale.

2. Ideal-Type Community-Based Business Model Elements Confronted with Harsh Realities

2.1. Activities Inspired by Community-Energy Logic

The setting up of a cVPP is not a value in itself, but one of the activities that allow for the creation of various community and societal values. Following the community logic, the main activities of the cVPP business model would be the community planning, implementation and operation of a cVPP, which includes the local generation, supply and if necessary, storage of energy, and maintenance or outsourcing of maintenance as decided by the community, as well as the day to day administration and management of the cVPP. Engagement of others not (yet) involved can take place in several ways, e.g. by selling shares of the assets. To realize a good match between the local demand and local supply of energy the activities around a cVPP would furthermore include the use of ICT: VPP technology and an energy management system to enable demand response [1]. The scale and complexity of these technologies preferably would match with the local needs, ambitions, competencies and capacities.

2.2. Activities: Reality Check

Aiming at local generation and self-consumption, or peer-to-peer trade is not yet allowed in many European countries. cVPP Loenen has not decided what the course of action in reaction to this is going to be. When it decides to become a supplier itself, this would mean that its scale of operation has to become large (supra-local), limiting the possibilities for energy management to optimize local self-consumption. However, an option for cVPP Loenen could be to apply for the so-called ‘*Experimental Arrangement*’ (at the time of writing it is being revised), a national ruling that provides temporary exemptions on the Dutch Electricity Bill, allowing energy cooperatives to manage their own production, distribution and consumption of locally produced power “as if they were behind a single meter connection” [4]. However, there is no exemption from the tax regulation which would

still apply to all the connections and all exchanges in such a project. A final remaining activity for cVPP Loenen consists of selling flexibility on the energy market to support the TSO in grid balancing and the suppliers in optimizing their portfolio.

2.3. Value Proposition Inspired by a Community Logic

Community values would include economic and financial ones: rural regeneration, job creation, lower cost of energy; social values: community building, enhancing social resilience; political values: democratization of control, ownership, decision making, planning, but also about creating a system that provides a lower energy bill and tariff fairness; and environmental values: global carbon emission reduction, local environmental values. These may be relevant at different levels ranging from the household level (e.g. lower energy bill) to the community or regional scale.

In terms of process, the business model would ideally be created by, for and with the community members that initiate the cVPP, involving community members in the design, implementation and operation. This value generated with the BM would be driven by a diversity of community needs and motivations; the collective benefits as well as the risks and costs are distributed accordingly.

2.4. Values: Reality Check: from Community to Market Values

In practice, the value proposition of the Dutch cVPP had to change towards providing greater value for the grid than anticipated, because the activities necessary to meet community values, such as keeping energy and economic flows locally was not allowed. This means that the focus has to shift from local values based on community needs and ambitions, towards delivering value to the electricity grid and the energy incumbents. This also means a focus on financial revenues rather than on non-monetary community values. The value proposition therefore would now have to include providing reliability, network services, grid investment deferral, primary and secondary reserve capacity, demand response flexibility and/or balancing, contributing to reduced network congestion, to improved load forecasting, and to simplifying communication by having a single aggregator to communicate with [5,6].

2.5. Resources according to a Community Logic

The main resources of this community logic based cVPP business model would preferably consist of voluntary and paid contributions (based on various skills and expertise) by and of the community members acting as managers. Outsourcing would not be the first option for community led energy projects. Community owned land and property would be important resources as well.

2.6. Resources: Reality Check

Local voluntary contributions and (time, relational, intellectual) resources that are central in the community logic-based business model become less relevant when cVPP initiators are confronted with a situation in which the value proposition and activities have to change as set out above. Because of the increasing complexity, other resources that often cannot be provided by local community members become more important, such as external funding, external expertise and professional organisational skills. Resources that cVPP Loenen aim to use consist of a revolving fund and individual and collective household investments, as well as the time-, knowledge- and relational resources of community members. In addition, funding from European projects is used to develop and implement the cVPP and provide room for experimentation. However, the necessity to grow beyond the community scale will also mean that an increasing number of resources is necessary, which go beyond the means available in the community, e.g. human resources may need to be outsourced, placing day to day operation outside of the community.

2.7. Customer Segments according to a Community Logic

A community logic-based business model aims to serve the community (households, enterprises, schools, municipal services etc.). A cVPP's clients would most likely also be owners,

shareholders or operators of the cVPP. In addition, the business model would also consider selling the generated energy in case of surplus to an energy company that would thus become a customer, but nothing more. The community-customers would have full control and ownership, through different means, and the energy company-customer would not. On a more general level, the society at large is also considered a customer, since the cVPP aims to contribute to an inclusive low-carbon energy transition.

2.8. Customer Segments: Reality Check

To participate in the market as energy traders, supplying their surplus energy, cVPPs would need to have a substantial size in terms of connected renewable sources, or work with a licensed supplier that thus would become a customer of the cVPP, receiving its generated energy. In order to sell flexibility, it would need to have an aggregator as customer as well to sell their flexibility to. In addition, to the extent that the value being delivered shifts to include value to grid stakeholders such as DSOs and TSOs, these also become the customer segment targeted by the business model. In the Dutch case we see a clear risk that the primary customer segment no longer is the (initial) local community (including also local industry and SMEs) itself, but the grid stakeholders.

2.9. Relations according to Community Logic

The relationship between the cVPP and the community would revolve around involving the community in decision making on renting or buying (access to) property, technology selection and procurement. The relationship of the business developers and the customers would be face-to-face and personal, also because they would be one and the same to a certain degree, namely the community members.

2.10. Relations: Reality Check

When the customers include an increasing variety of institutional stakeholders, from energy suppliers to whom surplus electricity is sold, to aggregators' that buy the flexibility, and other grid stakeholders, relations become more complex. Apart from the risk of losing the connection with the community base, the Dutch cVPPs risk a significant increase of the administrative burden to the extent that it may no longer be feasibility for the community to handle the customer relationship itself. If this leads to a decision to outsource components of the cVPP, the business model is turned upside down: the community members become 'mere' shareholders, and resources for aggregators and suppliers instead of the providers of the value proposition and owners of the ideas and assets. In line with that, they will lose the ability to influence and control how energy is generated, stored, distributed and self-consumed within the community.

2.11. Channels according to Community Energy Logic

In terms of the channels used for interaction, these would be face-to-face meetings, for example through the daily administration and management of the cVPP and through shareholder meetings.

2.12. Channels: Reality Check

When cVPP projects change their proposition in order to be able to arrive at feasible business case, the customer interactions and relations change too, as explained above. There is consequently the risk that the direct, personal, face-to-face channels of interaction within the community become much less important as the cVPP initiators need to turn towards a variety of other stakeholders that they depend on for realising the cVPP initiative. This implies that the Dutch channels run the risk of becoming much more professionalised and resembling existing market-oriented type of interactions between energy suppliers and their customers with the community-type of channels fading into the background.

2.13. Partners according to the Community Logic

Ideally the cVPP would be owned and operated by, for and with the community members, making them the main partner. The partners for this model following the community logic, would first be the community members, both the directly involved and other residents, then the technology developers needed to develop the cVPP configuration, any supply chain partners needed and finally ethical financiers.

2.14. Partners: Reality Check

Initially, cVPP Loenen partnered with local actors like volunteers, the village council which could act as a supervisory board, local industry who provide space on their roofs for community owned solar panels, local SMEs taking care of insulating houses and installing solar panels, But given the current context, to keep alive, cVPP Loenen now has to partner with the DSO which supports integrating renewable energy sources and which has information regarding the status of the grid. cVPP Loenen would have to partner up with many incumbent actors far beyond the scale of the community. The current institutional setting drives cVPP initiators towards partnering with incumbent, licensed and large energy companies to make use of their license, under their flag—creating a dependent relationship with these partners which makes the ownership and participation of the community more challenging. Such partnering also is the only way to avoid the costly and organizational complex consequences of having to comply with the balancing mechanisms regulation, which requires either a very large portfolio in terms of the amount of electricity available to feed into the grid at any given time, or a very large sum of capital on the bank to be able to buy that amount of electricity quickly. Because most community energy projects lack the expertise and financial clout, they need an intermediary for this, whether it is an aggregator or a large incumbent supplier [6]. Partnerships with incumbent partners and other intermediary actors can take different forms, but in any case, it will be an asymmetrical relationship that risks undermining the role (influence, autonomy) of the community—contrary to the main values of the energy community logic.

2.15. Costs according to the Community Logic

Costs incurred in the community logic-based type business model would include costs for a feasibility study and development of plans, costs for land use planning approval, capital/ asset costs for construction and installation of the cVPP, costs of market participation, transaction costs and costs of reinvesting in improving, replicating or upscaling the cVPP.

2.16. Costs: Reality Check

The costs accompanying the changes to the business model as discussed above, are very different from the community logic type of costs, which would be manageable for the community to bear. For cVPP Loenen, if it decides to become a national level supplier or otherwise participate in the electricity market, in order to cover the costs for meeting the requirements involved in becoming a national supplier, it needs to either grow its customer base significantly, or find investors.

2.17. Revenues according to the Community Logic

Revenues would comprise contributions from community members in return for shares; energy contracts with suppliers to whom the cVPP would be selling energy in surplus; subsidies received through financial support schemes (e.g., Feed-In-Tariff Schemes or other long-term contracts between the government and renewable energy producers), and finally rent received for access to property where assets would be located.

2.18. Revenues: Reality Check

Changes to the BM to make it more compliant with the current institutional context, will result in a different type of revenue. When the community value so central in the community logic-based models is replaced by value for the grid stakeholders, then these community values will only be financed, if sufficient funds remain, through the revenue [5,7]. And then the question is if the revenue will be sufficient to indeed create the community values that Loenen cVPP aimed for (community building, lowering household energy bills, increase control over the siting of renewable energy generation, and improving the local economy).

Unless community members accept really long pay-back times, a community logic-based type of revenue aimed at serving the community is not yet achievable in practice (de Graaf, 2017). Evidence so far suggests that the BM for a cVPP that has adapted to the institutional realities, is unlikely to generate sufficient surplus revenue to pay for the desired community values beyond some direct economic value to individual participants. The fact that community energy initiatives need to achieve financial viability to survive, means that in the current institutional setting, they will opt first and foremost for a VPP that aims for financial optimisation (rather than an optimum based on CO₂ reduction or maximising self-consumption).

3. Conclusions: Community-Based VPPs

The ‘energy transition’ is becoming a mainstream term in energy policy making, with multiple references to bottom-up and community energy projects in which households and prosumers are assumed to take an active role. At the same time, this raises the question as to how and to what extent the organization of the current energy system actually allows for such initiatives to rise and thrive. How much room is there for community initiatives to collectively organize themselves to enable local generation, storage and distribution of self-generated energy?

More and more communities are starting cooperatives to create a local market for renewable energy, with the accompanying business models. These business models face great problems with the current institutional and regulatory national systems, problems similar to those described for the cVPP project in Loenen in this paper. The need to comply with context rules and regulations results in BMs that no longer are community based.

Some countries now use temporary exemptions (e.g. in the Netherlands and the UK) to enable initiatives that experiment with models that would not fit the existing regulatory, institutional, legal system, and these need more attention. If we take the aim to change our current energy system to allow for more bottom-up community energy seriously, we need to consider how current and changing energy markets, infrastructures, regulation and support mechanisms in different countries can support these initiatives. For community energy initiatives constitute an indispensable ingredient for an inclusive and (more) democratic energy transition.

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