COME RES

Advancing Renewable Energy Communities

Deliverable 5.3

Synthesis Report based on in-depth assessment of 10 transferable best practices

Date: 19/05/2022

Version: V3

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 953040. The sole responsibility for the content of this document lies with the COME RES project and does not necessarily reflect the opinion of the European Union.

www.com-res.eu

SUMMARY

WP:	Name of the WP:		
Dissemination level:	Public	Due delivery date:	31/05/2022
Type	Report	Actual delivery date:	19/05/2022
Lead beneficiary:	ECORYS		
Contributing beneficiaries:	ECORYS, FUB, VITO, REScoop.eu, ENEA, IPE, TU/e, CICERO, INEGI, ACER		
Authors:	**Lead authors:** Pouyan Maleki-Dizaji, Francisco Rueda **Contributing authors:** Irene Alonso, Nicoletta del Bufalo, Maria Rosaria Di Nucci, Michael Krug, Ana Maria Isidoro Losada, Dirk Vansintjan, Stavroula Pappa, Erika Meynaerts, Kelsey van Maris, Bruno Carvalho, Niccolò Primo, Ana Rita Antunes, Isabel Azevedo, Elena de Luca, Gilda Massa, Ivars Kudreņickis, Gaidis Klāvs, Aija Zučika, Stine Aakre and Karina Standal, Anna Piórkowska, Luc F.M. van Summeren, Kellan Anfinson, Sandor Löwik, Sophie Loots, Anna Dyląg		

Document history				
Version	Submitted for review by	Date	Reviewed/approved by	Date
V0	Pouyan Maleki-Dizaji (Ecorys)	09.05.2022	Michael Krug (FUB)	11.05.2022
V1	Pouyan Maleki-Dizaji (Ecoys)	12.05.2022	Michael Krug (FUB)	13.05.2022
V2	Pouyan Maleki-Dizaji (Ecorys)	17.05.2022	Maria Rosaria Di Nucci (FUB)	17.05.2022
V3	Pouyan Maleki-Dizaji (Ecorys)	19.05.2022	Maria Rosaria Di Nucci (FUB)	19.05.2022

ABOUT COME RES

COME RES - Community Energy for the uptake of renewables in the electricity sector. Connecting long-term visions with short-term actions aims at facilitating the market uptake of renewable energy sources (RES) in the electricity sector. Specifically, the project focuses on advancing renewable energy communities (RECs) as per the EU's recast Renewable Energy Directive (REDII). COME RES takes a multi and transdisciplinary approach to support the development of RECs in nine European countries; Belgium, Germany, Italy, Latvia, the Netherlands, Norway, Poland, Portugal, and Spain.

ISSUES ADDRESSED AND MAJOR STEPS

COME RES covers diverse socio-technical systems including community PV, wind (onshore), storage and integrated community solutions, investigated in nine European countries. The project has a specific focus on a number of target regions in these countries, where community energy has the potential to be further developed and model regions where community energy is in a more advanced stage of development. COME RES analyses political, administrative, legal, socioeconomic, spatial, and environmental characteristics, and the reasons for the slow deployment of RECs in selected target regions. COME RES synchronises project activities with the transposition and implementation of the Clean Energy Package and its provisions for RECs in policy labs. Policy lessons with validity across Europe will be drawn and recommendations proposed.

ABSTRACT

Work package 5 (WP5) of the COME RES project identifies good practices of renewable energy communities (RECs) as defined by the Renewable Energy Directive (2018/2001/EU) (RED II) and provides a best practices inventory. The inventory is part of a synthesis report of the best practice cases regarding novel and promising REC initiatives or REC approaches in the COME RES partner countries. Work package 5 includes in-depth assessments of innovative, adoptable and transferable cases. It examines the extent to which the good/best practices provide environmental, economic and/or social community benefits (as defined in cf. RED II, Art. 2). Based on the good/best practices a sustainability scorecard for renewable energy communities is developed. The scorecard provides principles and criteria for sustainable community energy which serve both as a self-assessment tool for RECs and a potential guidance tool for policy development to promote the further development and improvement of RECs. Methods applied include primary and secondary literature and document analysis, desk research and semi-structured, qualitative interviews with relevant stakeholders and discussion within the country desks in WP3.

This Deliverable 5.3 includes the presentation of the methodological process for best practice development and comparative analysis on drivers and success factors of the different best practice cases. All best practice case studies are synthesised and showcased. In order to conduct a first comparative analysis, a Truth Table has been developed that allows to compare the different relevant factors between cases and identify cross-case patterns in order to infer general conclusions. Based on this, the findings on common drivers and success factors are presented and analysed, both collectively and individually. As a result of this analysis, a series of lessons have been learnt and a list of recommendations for policymakers and REC developers are provided. Finally, some general remarks for the transfer of best practice cases to the COME RES target regions and beyond are elaborated.

Deliverable 5.3 is designed as follows: Section 1 introduces the deliverable. Section 2 presents the methodological process of the exercise and Section 3 the main categories of drivers and success factors identified. Then, Section 4 showcases the research synthesis and the comparative analysis. This includes the Truth Table, an overview of main findings, a comparative analysis of drivers and success factors, an overview of the lessons learnt and recommendations and general remarks for the transfer of best practice cases. Finally, Section 5 presents the conclusions.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Introduction

To achieve a low-carbon economy, system-wide transformations are key. In some regions of the COME RES partner countries, a transition to local and renewable energy systems (RES) is already taking place at the local level. The energy transition poses not only a technological and ecological challenge, but also a political and social one. However, the lack of local acceptance plays a role as a potentially inhibiting factor in the implementation of the energy transition. Indeed, this a core understanding of the COME RES project, as outlined in the preceding deliverable of this COME RES Work Package (Deliverable 5.2 Methodological Framework).

Furthermore, the social dimension has become just as important for a successful sustainable energy transition as the technological aspects. Citizen energy in general and energy communities in particular are becoming important instruments not only for decentralisation, but also for the democratisation of the energy systems in the COME RES countries and elsewhere. Community energy, citizen energy and renewable energy communities (RECs) have become increasingly important in recent years. These initiatives are more diverse today than ever before and will probably continue to act as incubators for significant activities dealing with virtually all aspects of energy. RECs are a specific form of community energy that organise collective energy action and are characterised by open and democratic participation and governance structures and generate significant added value for the local community. It is important to note that not all best practice cases included in this deliverable completely match the definition of the RED II. Nonetheless, all can be considered renewable energy communities in a broader sense.

Overall, based on the findings of the model regions, the analytical focus of COME RES is to examine the legal, socio-economic, spatial and environmental realities as well as the reasons for the slow uptake of RECs in selected target regions. Learning from other experiences and a comprehensive analysis of good/best practices that can be transferred to other local, regional and national contexts, can provide useful indications on how to face implementation barriers and enhance a market uptake of RES in target regions.

This deliverable aims to consolidate key findings and extract lessons of overall validity for the transferability of drivers and factors for RECs success. This is achieved by providing a synthesis and comparative analysis of best practice cases. It develops an assessment of the selected 10 best practice cases and conducts a comparative evaluation of the drivers and factors of success. In turn, lessons and transferability potential of drivers and success factors are derived from the comparative analysis.

The structure of the remainder of this report is as follows: after the description of the methodological process in Section 2, Section 3 presents the categorisation and selection of all best practice cases. Section 4 then provides a summary of each of the 10 best practice cases, conducts a rigorous comparative analysis of drivers and success factors and showcases overall findings and transferability potential. Sections 5 and 6 showcase our conclusions and briefly develop a methodological proposal to conduct the next steps.

2. Methodology and process for best practice development and comparative analysis

Attaining the objective of this report (Deliverable 5.3) – the consolidation of key findings and conclusions to extract lessons of overall validity for the transferability of drivers and success factors – is achieved through a two-step consecutive process. First, it is necessary to carry out the in-depth assessment of the 10 best practice cases. This enables the second step, which is a synthesis of the outcomes of the best-practice case studies and a comparative analysis of the factors/drivers which have led to success in the cases. Inherently, the methodological requirement and process for these two differ: the first step consists of case-study research, the second of a qualitative comparative analysis. The subsections below outline the approach taken for each one.

Case study research: the in-depth assessment of the best practice cases

A case study may be understood as the "intensive study of a single case where the purpose of that study is – at least in part – to shed light on a larger class of cases"[1]. Indeed, this has been the objective of the first step within the present report, which sets the basis for extracting lessons on the effective removal of barriers that have an overall validity.

The preceding project deliverable (D5.2) created a Good Practice Portfolio, whereby 21 good practice cases among all the COME RES project countries were identified. Crucially, for the purposes of the first step in Deliverable 5.3, the previous deliverable also carried out an additional exercise of selecting 10 best practice cases among the 21 good practice ones. This was achieved through a transparent selection procedure, in consultation with the project partners. In this regard, COME RES partners completed a self-evaluation matrix and ranked their respective national good practice cases. On top of the principles laid out in the self-evaluation matrixes, some additional principles and considerations were applied, including ensuring broad geographical representation, ensuring a variety of legal forms, driving motives, objectives, stakeholder involvement and technologies; and ensuring that the best practices are representative of different levels of REC implementation and development.

Using the 10 selected cases, Ecorys has been leading the design and coordination of the in-depth analyses, in collaboration with all partners, who are practically (in terms of language and contacts) in the best position to carry out in-depth primary and secondary research on the cases. The central objective has been, as far as possible, to harmonise the focus and structure of data within the case studies. It was crucial to enable an easier and clearer synthesis and comparative analysis of the best practice cases in the subsequent step.

Consequently, a template was designed to guide the further research and data collection of the partners on the selected in-depth case studies from their respective countries. This included 18 assessment criteria/headings which covered topics that each case study had to include and discuss. Under each heading, a short description and specific questions were posed in order to facilitate the

[1] Gerring, J. (2007). Case Study Research: Principles and Practice. Cambridge University Press.

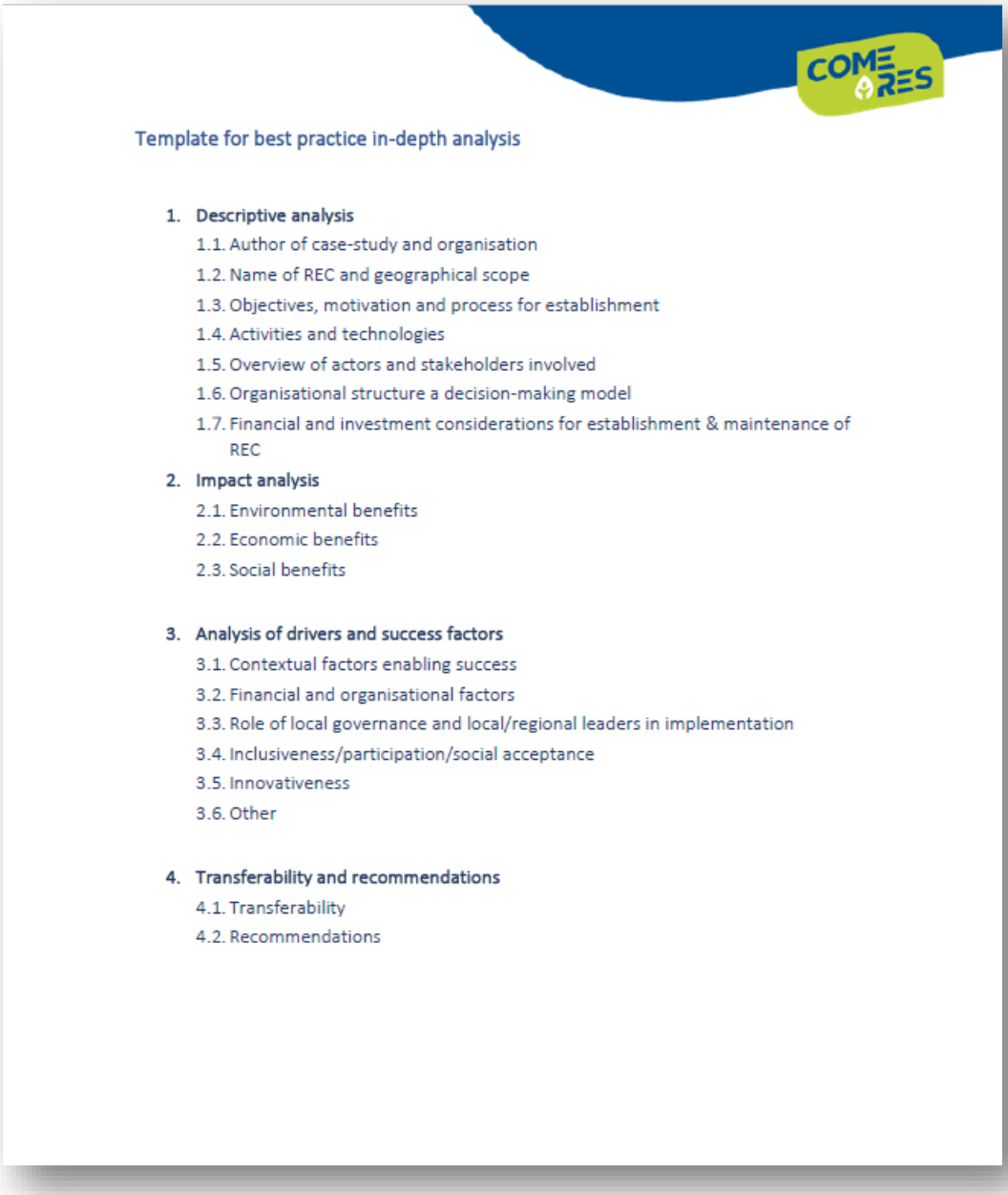
data collection and understanding of the topic. A brief summary of the template can be found in Figure 1. The full template can be found in the annex.

To further enable the clarity and harmonisation of the in-depth best practice case studies, using the template presented above, Ecorys carried out extensive research on the Spanish case study (COMPTEM - Enercoop). This involved desk research and consultations with stakeholders. On the basis of the data gathered (following the template), a properly written and designed “model” case study was completed. Once the template and “model” good practice case study were complete, these were shared with the partners as an orientation, to carry out the research on the case studies chosen from their home countries. The key contents and heading of these case studies are illustrated below.

Thus, the partners within all the countries used this specific template to proceed with their data collection, considering the “model” case study to visualise the final outcome. Data were collected through various methods, which included both primary and secondary literature analysis: desk research, semi-structured interviews with relevant stakeholders, as well as and observations and outcomes from the COME RES country desk meetings or thematic workshops.

In sum, each of the 10 case studies were between 8 – 11 pages in length, depending on the complexity and detail necessary to fully describe and analyse the case. This has provided a set of rich and complete case studies.

Figure 2. Final template for in-depth best practice case study



Template for best practice in-depth analysis

1. **Descriptive analysis**
   - 1.1. Author of case-study and organisation
   - 1.2. Name of REC and geographical scope
   - 1.3. Objectives, motivation and process for establishment
   - 1.4. Activities and technologies
   - 1.5. Overview of actors and stakeholders involved
   - 1.6. Organisational structure a decision-making model
   - 1.7. Financial and investment considerations for establishment & maintenance of REC
2. **Impact analysis**
   - 2.1. Environmental benefits
   - 2.2. Economic benefits
   - 2.3. Social benefits
3. **Analysis of drivers and success factors**
   - 3.1. Contextual factors enabling success
   - 3.2. Financial and organisational factors
   - 3.3. Role of local governance and local/regional leaders in implementation
   - 3.4. Inclusiveness/participation/social acceptance
   - 3.5. Innovativeness
   - 3.6. Other
4. **Transferability and recommendations**
   - 4.1. Transferability
   - 4.2. Recommendations

Synthesis and qualitative comparative analysis

Building on the in-depth best practice case study research outlined above, the second methodological step within this deliverable, which itself consists of two interconnected and complementary sub-steps, is to provide a synthesis and comparative analysis of the key findings, in order to more concretely identify the lessons learnt and implications for transferability. This is based

on the argument that "no single case study can hope to have the breadth to create broad generalisations"[2].

i) Research Synthesis

A research synthesis has as its primary focus and goal in "the attempt to integrate for the purpose of creating generalisation […] paying attention to relevant theories, critically analysing the results they cover, and attempt to identify central issues for future research"[3]. In other words, a research synthesis attempts to provide a holistic overview of the key findings and trends, and in doing so, compare the findings to existing research findings in the field.

As a first step of the research synthesis, it is claimed that it has long been part of a research synthesis to "review and summarise the outcome of the research"[4]. Given that each of the best practice case studies are extensive and highly detailed, as well as inevitably being written in slightly different styles, a summary of each case study has been written by Ecorys. These summaries (in section 4) provide an overview of the REC case, with a specific and clear focus on the drivers and factors that have enabled it to become a successful REC, as well as considerations on transferability and recommendations for REC developers and policymakers.

Furthermore, as second step of the synthesis, based on these summaries, a Truth Table has been developed[5]. This Truth Table maps in a standardised way all the different cases and their relevant success factors/drivers. The significance of the drivers has been rated on a scale of 0-3 (blank if not significant, X, XX, XXX), to determine and explain the significance of the role that the driver has played enabling the success of the case. The categories of drivers/factors have been selected based on the best practice template. The final objective of the Truth Table is to pinpoint and identify crucial cross-case patterns that can provide with an idea of what are the common denominators that enable the success of a REC, as well identifying what types of combinations of drivers, and other aspects, are more conducive to a successful outcome. In other words, this Truth Table attempts to serve as a cross-case comparative analysis matrix that can allow to infer more general conclusions. These assessments of the significance of the drivers and success factors have been proposed by Ecorys and verified by the COME RES project partners and country desk stakeholders who drafted the original case studies.

This has been a highly important practical exercise, because as it will be demonstrated in subsequent sections of the deliverable, a multitude of drivers have been in operation within each measure to ensure RECs success. Thus, the summaries and the Truth Table have been developed to practically enable and facilitate the overview and comparative analysis of the lessons learnt for the creation of an enabling framework for the success of REC initiatives.

As a final step of the synthesis, the initial results and outcomes which appear from the summaries and Truth Table are explained. Here is where the key findings are elaborated on and compared.

[2] Mosteller and Colditz (1996). Understanding Research Synthesis. Annual Review of Public Health, 17, pp. 1-23

[3] Cooper et al. (2009). The Handbook of Research Synthesis and Meta-Analysis. Russell Sage Foundation.

[4] Mosteller and Colditz (1996). Understanding Research Synthesis. Annual Review of Public Health, 17, pp. 1-23

[5] Schneider and Wagemann (2012). Set-Theoretic Models for the Social Sciences: A Guide to Qualitative Comparative Analysis. Cambridge University Press.

ii) Qualitative Comparative Analysis

QCA is a means of analysing the causal contribution of different conditions (i.e., drivers and factors) to an outcome of interest (success of REC initiatives). In other words, in QCA, it is asked whether factor X (i.e., a combination of or a single driver or factor) is the reason why a given outcome Y (successful REC initiative) has occurred[6]. This further justifies the development of a Truth Table, given that Truth Tables have been described a common element of QCA[7]. QCA and a Truth Table are capable of "pinpointing decisive cross-case patters" (ibid).

In practice, this means that QCA allows for comparisons between different drivers and success factors, which is crucial for creating generalisable outcomes concerning lessons learnt and transferability of measures. Moreover, QCA can provide various explanations and reasons for how one certain outcome is achieved. This is called "complex causality"[8].

[6] Legewie, N. (2013). An Introduction to Applied Data Analysis with Qualitative Comparative Analysis. Qualitative Social Research, 14*(3)*.

[7] Ragin, C. (1987). The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies. University of California Press.

[8] Mahoney, J. and Goertz, G. (2006). A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research. Political Analysis, 14*(3)*.

3. Categories of drivers and success factors

Deriving from the COME RES project as a whole and in particular from previous Deliverable 5.2, and as fine-tuned within Work Package 5 (specifically through analysis of the in-depth best practices), six categories of drivers and factors have been identified that contribute to the success of a REC initiative. Indeed, these drivers and factors served as the basis for constructing the Truth Table below (Table 1) that enables the pinpointing and identification of relevant cross-case patterns, which in turn creates an understanding and analysis of the common denominators that enable the success of a REC.

1) Contextual factors

This category refers to factors outside the direct control of REC developers and policymakers but that nonetheless strongly influence the success of a REC initiative. In other words, they are underlying and pre-existing factors that, although not the direct cause of the success, very much shape its potential. More specifically, contextual factors can be divided into "Cultural factors" (e.g., local cooperative culture and community feeling), "Social factors" (e.g., local problem of energy poverty), "Environmental factors" (e.g., local environmental factors), and "Political factors" (e.g., local political actors pushing for community energy development).

2) Financial factors

This category refers to factors related to the financial model and investments of the REC. Financial factors are critical for the materialisation of an initiative into an operational REC and are also important for its long-term (financial) sustainability. Financial factors can be divided into "Investment model and sources" (i.e., origin, participation, asset ownership, etc.) and "Financial model and long-term sustainability" (i.e., income sources, distribution among participants, etc.).

3) Organisational factors

This category refers to factors related to the legal and decision-making structure. Organisational factors are important because they enable the day-to-day work of the REC, as well as the roles of its members and the internal power operationalisation. Organisational factors can be divided into "Legal factors" (i.e., legal form such as cooperative, association, etc.) and "Membership rights, participants' roles, and decision-making structure".

4) Public authority support factors

This category refers to factors related to the support that public authorities have provided, directly or indirectly, to the REC. Public authority support factors are important, especially for the initiation of RECs, because they provide very valuable aid and support that may be determinant for its success. Public authority support factors can be divided into "Role and involvement of local public authorities" and "Established infrastructure of public assistance and institutional support".

5) Participation and inclusiveness factors

This category refers to factors related to the (public and social) openness of the REC and the inclusion of vulnerable groups. These factors are important because they comprise the social aspect of the community and its inclusive nature. Participation and inclusiveness factors can be divided into “Openness, stakeholder involvement and citizen participation” and “Inclusiveness and participation of vulnerable groups”.

6) Innovativeness factors

This category refers to how innovative the REC is and how this has impacted its probability of success. The only factor within this category is “Innovativeness and encouragement of innovative practices”.

4. Research synthesis and comparative analysis

4.1. Summary of best practice cases

As noted above, due to the length and detail of each of the in-depth best practice cases, as well as the slightly different structures of the in-depth best practices (stemming the differences in nature/story behind each of the cases), standardised summaries have been prepared for each of the cases. This both helps to digest the cases as well as provides a sound and transparent basis for cross-comparison. Specifically, the summaries emphasise and focus on elements relating to models, drivers and transferability.

The cases are provided first according to the alphabetical order of their country of origin, and within the countries, or the alphabetical order of the measure name. The list of the cases is provided below, as well as the shortened name which will be used in the subsequent analysis and synthesis.

1) Ecopower (Belgium - Ecopower)
2) ZuidtrAnt (Belgium - ZuidtrAnt)
3) Grenzland Pool (Germany - Grenzland)
4) COMPTEM-Enercoop (Spain - COMPTEM)
5) Energy City Hall REC-1 (Italy – City Hall)
6) Energy communities in apartment buildings (Latvia – Apartment buildings)
7) Energy Gardens (Netherlands – Energy Gardens)
8) Røverkollen housing cooperative (Norway - Røverkollen)
9) Energy Region Michałowo (Poland - Michałowo)
10) Energy community “Agra do Amial” (Portugal – Agra do Amial)

4.1.1. Ecopower (Belgium)

Descriptive analysis

Ecopower was constituted in 1983 in order to restore an old hydropower station in Rotselaar (Belgium). Currently, it is present in several municipalities of the Belgian region of Flanders. In 2020, it counted with 60,976 members and 50,000 clients. Its **objectives** are the cooperative investment in the generation and supply of renewable energy and the promotion of energy efficiency.

The activities of the cooperative include the generation of renewable energy, the supply of energy to its members-costumers, the investment in district heating, the provision of advisory services and the participation in R&D programmes. Ecopower generates electricity through wind turbines, PV installations, a small hydroelectric installation and a cogeneration power plant. It currently produces 106 GWh a year. The supply of this energy is restricted to members-customers for an all-in price per kWh. Additionally, wood pellets and briquets for renewable heating are also sold. In the field of heating, and in cooperation with the other

Belgian best practice case, ZuidtrAnt, Ecopower invested in district heating networks in two Flemish municipalities that supply heating to its members. In addition to this, Ecopower provides advisory services to its members (e.g., on energy efficiency) and participates in R&D programmes (e.g., Horizon2020).

The actors and stakeholders involved include a group of engaged citizens with an interest in developing renewable energies, and governments and local authorities that provide opportunities to invest through tenders. **Its organisational structure** is that of a cooperative company and it is managed by a Board of Directors and a General Assembly. Each member has one vote irrespective of the shares they own. **Its financial model** works through social capital (participations by members) and the sale of electricity and green certificates. Profits are directed to dividends for members and to a reserve. Ecopower also receives EU funding (e.g., Interreg, Horizon2020) in the framework of R&D projects. Green certificates (certificates for owners of RES installations) also work as financial support.

Impact analysis

The **environmental benefits** of Ecopower include a reduction in overall GHG emissions, an increase in the energy efficiency of its members and increased awareness about climate change. Its **economic benefits** include the supply of cheap electricity, the payment of dividends to members and the employment of 54 people. Its **social benefits** include its inclusiveness of vulnerable groups, the reduction of energy poverty and several research outputs.

Analysis of drivers and success factors

The **contextual factors** that have facilitated the success of Ecopower include the long tradition of cooperatives in Belgium, the existence of green certificates, the tenders issued by the city of Eeklo in 2001 for the construction of wind turbines, and the original opportunity to restore an abandoned hydroelectric installation. **Its financial and organisational structure** as a cooperative is also one of its success factors. All members have the same decision-making power and are co-owners of the installations. The help of EU fundings and the investment opportunities created by public tenders are also important drivers. Moreover, the cooperation with other cooperatives through REScoop, of which Ecopower is one of the founding organisations and its president, increase the outreach and effectiveness.

Local public authorities play an important role in providing investment opportunities through public tenders, participating in research projects, and promoting the cooperative. However, there is no established assistance infrastructure. **Participation** in Ecopower is open and voluntary and vulnerable members do not have to pay the share but are charged a little bit more on the energy bill so they can buy it in two years. **Innovativeness** is embodied through its participation in R&D projects and its efforts to promote cooperative structures.

Transferability and recommendations

The **transferability of internal factors** includes the establishment of a prosumer cooperative model. The **transferability of external factor**s includes public financial support including grants. Based on the model of Ecopower, it is **recommended for REC developers** to replicate

the prosumer cooperative model, to partner with local authorities and other cooperatives and to organise joint purchases of equipment. It is **recommended to local authorities** that they include a mandatory share of citizen participation in public tenders, that they provide funding and subsidies to RECs and that they offer public land and buildings for the installations. To **regional authorities, it is recommended** that they provide clear and transparent regulatory frameworks that promote a fair level playing field for RECs.

4.1.2. ZuidtrAnt (BE)

Descriptive analysis

ZuidtrAnt is an energy cooperative founded in 2013 present in several municipalities of the Belgian province of Antwerp. In 2022, it counted 643 members. Its **objectives** are playing an active role in the energy transition, contribute to a transition that creates local added value and organise activities for the benefits of members, such as the joint purchase of PV panels or advisory services in energy efficiency.

The activities of the cooperative include the generation of renewable energy, the provision of advisory services in energy efficiency, the joint purchase, the promotion of e-mobility, and the participation in R&D programmes. ZuidtrAnt generates electricity through rooftop PV installations, with a current installed capacity of 610 kWp. ZuidtrAnt provides advisory services on energy efficiency to citizens on how to conduct nearly zero-energy renovations, and to schools on how to reduce energy consumption. The cooperative conducts joint purchases of PV panels and batteries. Additionally, it participates in R&D programmes (e.g., Horizon2020).

The actors and stakeholders involved include a group of engaged citizens with an interest in developing renewable energies, and governments and local authorities that provide opportunities to invest through tenders and to carry out research through subsidies programmes. **Its organisational structure** is that of a cooperative with an explicit social purpose and it is managed by a Board of Directors and a General Assembly. Each member has one vote irrespective of the shares they own. **Its financial model** works through social capital (participation by members) and bank loans. Profits are directed to dividends for members and to social initiatives. ZuidtrAnt also receives EU funding (e.g., Interreg, Horizon2020) in the framework of R&D projects. Green certificates issued by the Flemish government (certificates for owners of RES installations) also work as financial support. Moreover, ZuidtrAnt members benefited during the first three years from a “tax shelter” (a 2.5% tax credit).

Impact analysis

The **environmental benefits** of ZuidtrAnt encompass a reduction in overall GHG emissions, an increase in the energy efficiency of citizens, the promotion of e-mobility and tree-planting campaigns and circular economy activities. Its **economic benefits** include the supply of cheap electricity and the payment of dividends to members. Its **social benefits** comprise electricity

and mobility sharing frameworks and the investment of at least 15% of profits on local social projects.

Analysis of drivers and success factors

The **contextual factors** that have facilitated the success of ZuidtrAnt include the long tradition of cooperatives in Belgium and the existence of green certificates. **Its financial and organisational structure** as a cooperative is also one of its success factors. All members have the same decision-making power and are co-owners of the installations and share on the profits. The help of public funding and cooperation with engaged local governments are also important drivers. Moreover, the cooperation with other local cooperatives and maintaining a limited geographical scope increase the outreach and effectiveness.

Local public authorities play an important role in providing investment opportunities to make installations in publicly owned buildings, by providing subsidies and grants, by cooperating in research projects and by promoting the cooperative. However, there is no established assistance infrastructure. **Participation** in ZuidtrAnt is open and voluntary. Moreover, ZuidtrAnt conducts **inclusiveness** activities by directing at least 15% of profits to social activities and by cooperating with social welfare offices and social housing companies. **Innovativeness** is embodied through its explicit social purpose and its locally anchored growth strategy. Moreover, the cooperative invests in innovative practices and business models (e.g., shared e-mobility, ESCo model).

Transferability and recommendations

The **transferability of internal factors** includes the establishment of an energy cooperative model. The **transferability of external factor**s includes public support and grants. Based on the model of ZuidtrAnt, it is **recommended for REC developers** to replicate the organisational cooperative model, to have an explicit social purpose, to transfer the lessons learnt to other initiatives and to organise joint purchases of equipment. It is **recommended to local authorities** that they include a mandatory share of citizen participation in public tenders, that they provide funding and subsidies to RECs and that they offer public land and buildings for the installations. To **regional authorities, it is recommended** that they provide clear and transparent regulatory frameworks that promote a fair level playing field for RECs.

4.1.3. Grenzland (DE)

Descriptive analysis

The Grenzland-Pool is a cluster of community energy projects including five community wind farms located in the German district of Nordfriesland, with the oldest one of them being founded in the year 2000. Currently, the wind farms comprise jointly 1,069 limited partners. Its **objectives** include the generation of profits for shareholders, the investment in local sustainable development, and the generation and preservation of local wealth.

The activities include the generation of electricity from community wind and solar farms, the sale of electricity through feed-in tariffs, market premiums and PPAs, of advisory services in energy efficiency, the investment in sector coupling projects including hydrogen

production and the creation of an energy park. Jointly, the Grenzland cluster counts 30 wind turbines with capacities varying from 1.3MW to 6.2MW. Although still at a very early stage, some of the wind farms are using part of the generated electricity to produce hydrogen that will be supplied to the local municipality. Moreover, there are plans to develop a large-scale off-grid energy park (Grenzland Energy Park) with hydrogen production, energy storage and distribution of residual heat.

The actors and stakeholders involved include the state planning authority (designation of wind energy zones), district administrations, the wind farms initiators (landowners and local residents), local residents as limited partners, the local municipalities, companies operating the community wind farms, promotional banks and other financing institutions (e.g. KfW, Development Agency for Agribusiness and Rural Areas), several public agencies (e.g., Federal Network Agency), the DSO and other energy companies, and environmental associations. The **organisational structure** of each wind farm is that of a limited partnership with a private limited liability company as the general partner. This allows to limit the liability of shareholders and, therefore, to attract greater participation. Voting rights depend on the number of shares. Management is appointed from among the investors and controlled by a supervisory board. **Its financial model** is based on the participation of shareholders as limited partners. Additionally, the wind farms benefit from feed-in tariffs/premiums and market premiums, but also from the financing of several promotional and local banks and from the participation of local municipalities. Moreover, the Federal Ministry of Transport, the Federal Ministry of Economy and two regional governments provide funding for the hydrogen projects.

Impact analysis

The **environmental benefits** of wind farms include mainly GHG reductions. Further, compensation payments for the intrusion on nature and landscapes (e.g., offsetting payments) are used in a constructive way. Its **economic benefits** include direct financial participation in the energy transition, payment of dividends to shareholders, land lease payments to landowners, generation of local taxes, increase of local purchase power, the development of local infrastructure, the investment in innovative technologies (e.g., hydrogen), the creation of local added value and local wealth, and the strengthening of regional economic cycles. Its **social benefits** include in-kind provisions to local environmental and social initiatives and associations.

Analysis of drivers and success factors

The **contextual factors** that have facilitated the success of the Grenzland community wind farms include a high degree of procedural and distributive fairness, trust in the managers and the benefit-sharing measures. **Its financial and organisational structure** as a limited partnership with a limited liability company as the general partner allows to limit the liability of private individuals in their role as shareholders and to attract many people. Moreover, profits flow directly to local limited partners and there is no institutional investor.

Local public authorities played an important role in facilitating and supporting the projects. Moreover, they also participate financially. Additionally, at least in the past, there has been a favourable political and regulatory framework (e.g., feed-in tariffs/premiums).

Participation in the Grenzland community wind farms is open and voluntary with relatively low minimum deposits (from €500). Moreover, vulnerable households can indirectly benefit from the in-kind donations of the wind farms to local initiatives. **Innovativeness** is embodied in the projects themselves, with the managers being among the pioneers in Germany in the field of community wind energy. Moreover, the wind farms invest in innovative projects, such as hydrogen development and the Grenzland Energy Park. **Another success factor** is that fact that all citizens benefit from the wind farms (and not just shareholders and landowners) through the business taxes paid.

Transferability and recommendations

The **transferability of internal factors** is not straightforward given the very specific conditions under which the wind farms were constituted. However, several elements, e.g., the benefit-sharing measures, the PPA model or the investments in sector coupling and hydrogen production could be considered for replication. Based on the model of Grenzland wind farms, it is **recommended for REC developers** to ensure the commitment of the municipality, to ensure the whole community benefits, and ensure that low-income households can at least indirectly participate. It is **recommended to public authorities** to establish a favourable regulatory framework.

4.1.4. COMPTEM-Enercoop (ES)

Descriptive analysis

COMPTEM is a pilot REC project established in 2021 in a neighbourhood of the village of Crevillent (Spain) by the local energy cooperative Enercoop. Currently, the pilot project provides energy for 250 people. Its **objectives** are contributing to achieving a 100% renewable origin in the electricity mix of Crevillent by 2050, producing rebates for the energy bills of users and democratising the access and management of energy. Eventually, the REC will expand to the whole village.

The activities of the cooperative include the generation and consumption of solar renewable electricity, the storage of part of the energy produced, the creation of an e-mobility charging facility, activities to increase energy efficiency and allow peer-to-peer electricity sharing, and dissemination and informative activities. Currently, COMPTEM counts with 300 PV panels with a peak capacity of 120kWp and 180,000kWh per year. The storage facility has a 240kW capacity and the e-mobility charging facility 44kW. Blockchain technology is used to optimise energy flows, and public digital information panels and a mobile application have been created to inform and educate citizens on the energy sector.

The actors and stakeholders involved include the energy cooperative Enercoop (founder and leader), the local municipality (provision of public spaces), the EU project MERLON (provision of 75% of investment and technology), the local cooperative bank Caja Rural Central (provision of 25% of funding), the neighbours' association and a number of private local companies. **Its organisational structure** is that of a cooperative of prosumers. Access to the cooperative is open and voluntary and each member has one vote. **Its financial model** is that of a non-profit company and, therefore, there are no profits paid to members. The public

land continues to be owned by the municipality and the energy installations are left to the village through a transfer contract. The investment has been provided by the EU project MERLON (grant) and the regional cooperative bank Caja Rural Central. The loan will be repaid through the rebates in the energy bills of members. Therefore, participation does not require any initial payment.

Impact analysis

The **environmental benefits** of COMPTEM include collaborating to achieve municipal GHG emission reduction targets and the ecological revitalisation of a previously unused plot of land. Its **economic benefits** include rebates on the energy bill of members of around 15-20%, the reduction of grid losses and the optimisation of energy flows. Its **social benefits** include citizen participation in the design of the space that the pilot project occupies.

Analysis of drivers and success factors

The **contextual factors** that have facilitated the success of COMPTEM include the village's long tradition of energy cooperatives and the strong political will of the municipal government. **Its financial and organisational structure** as a non-for-profit cooperative of consumers, the avoidance of any initial payment by participants, the EU funding and the transfer of public land are all important success factors.

Local public authorities played an important role in facilitating and supporting the pilot project and transferring the public land to make the installation. However, there was no established infrastructure of institutional support. **Participation** is, for now, limited to the 65 households in the vicinity of the installation. Given that no initial payment was needed, all citizens, including vulnerable ones, can participate irrespective of their income. **Innovativeness** is embodied in the project itself, which can be regarded as very innovative for the Spanish context.

Transferability and recommendations

The **transferability of internal factors** comprises the establishment of an anergy cooperative and the replication of the financial model (loan repaid through rebates). The **transferability of external factors** includes public financial assistance and the transfer of public municipal land. Based on the model of COMPTEM, it is **recommended for REC developers** to replicate the financial model. It is **recommended to public authorities** to transfer unused public land to RECs and to simplify administrative procedures. Moreover, it is recommended to establish support schemes, including financial but also technical and administrative support.

4.1.5. Energy City Hall REC-1 (IT)

Descriptive analysis

Energy City Hall REC-1 is a REC project established in 2020 based on the city hall of the municipality of Magliano Alpi. It provides electric energy to the city hall, the gymnasium, and the local library. New REC installations are currently implemented in the municipality. Its **objectives** are contributing to achieving the municipal energy and environmental objectives, offering services to its members and providing socioeconomic benefits to citizens

The activities of the REC include the generation and consumption of solar renewable electricity, the creation of an e-mobility charging facility and activities to increase energy efficiency. Currently, Energy City Hall REC-1 is based on a 20kWp PV system on the city halls' rooftop that provides electricity to the city hall and distributes excess electricity. The e-mobility charging stations can be used for free by citizens. Additionally, the DSO provides a management platform for the analysis and optimisation of energy flows.

The actors and stakeholders involved include the municipality of Magliano Alpi as the promoter and leader, Turin's Polytechnic University, and a group of engaged local citizens and SMEs. **Its organisational structure** is that of an association, the mayor of Magliano Alpi being also the president. A technical scientific committee formed by the president and a number of competent members assists with technical issues. GO-CER is its operational arm and supports the creation of local value chains between professionals and businesses. **Its financial model** is PA-driven, based on the initiative of public entities that install the facility and share excess energy to other users. The investment was provided by the municipal government, although its expansion will also count with private funding.

Impact analysis

The **environmental benefits** of Energy City Hall REC-1 include a reduction in energy consumption, increasing energy efficiency and limiting GHG emissions. Its **economic benefits** include rebates on the energy bill of users and the creation of local wealth. Its **social benefits** include the creation of a community operational group aimed at creating local short value chains between professionals and businesses and the sharing of excess energy with vulnerable households.

Analysis of drivers and success factors

The **contextual factors** that have facilitated the success of Energy City Hall REC-1 include the strong political willingness of the municipality. **Its financial and organisational structure** as using public buildings, making a first totally publicly funded investment, involving local citizens and SMEs, and using an association structure are also success factors for this case.

Local public authorities played an important role in leading and investing in the project. Moreover, the direct participation of the municipality gives citizens confidence on the project. **Participation** is open for all citizens, including for those that have private PV facilities, which can now be connected to the REC. Consumers in a situation of energy poverty benefit from the excess energy produced by the REC. **Innovativeness** is embodied in the project itself, which is a pilot experience in Italy. Moreover, the management digital platform is also an innovative activity of the REC.

Transferability and recommendations

The **transferability of internal factors** comprises the governance structure, the business model and the key role of the municipality. Based on the model of Energy City Hall REC-1, it is **recommended for REC developers** to replicate the financial model and the digital platform tool. It is **recommended to public authorities** to play a leading role in the development of

RECs, to have specific policy programmes for their promotion and to provide administrative and technical support.

4.1.6. Energy communities in apartment buildings (LV)

Descriptive analysis

This REC case was established in 2020 around two apartment buildings in the village of Mārupe. The REC provides energy to the residents of both apartment buildings. Its **objectives** are reducing energy expenditures of residents and contributing to the energy transition. The implementation of the projects followed three phases: awareness raising, construction of the facilities, dissemination of the experience and results.

The activities of the REC include the generation of electricity through renewable sources and electricity exchange with the grid. The technology used is solar panels (PV and heating) with a combined annual electricity production of 10.1 MWh and an annual production of heat of 20 MWh. Electricity is used to cover the consumption of the apartment buildings' common areas in one of the buildings and for charging e-vehicles in the other. The produced heat is distributed to all residents in one apartment building.

The actors and stakeholders involved include the homeowners' associations of the apartment buildings, the regional planning authority of Riga, the municipal government of Mārupe and a series of local professionals and NGOs. **Its organisation is structured** through the homeowners' associations, which in one case is registered as an NGO and in the other one as a simple association. **Its financial model** consists of the installation being owned by the Riga region planning authority and transferred to the homeowners through the Mārupe municipality. The investment has been made through a combination of EU funds (85%) and national funds (15%). Residents must cover maintenance costs.

Impact analysis

The **environmental benefits** of the two RECs include reduced GHG emissions and air pollution. Its **economic benefits** include rebates on the energy bill of residents. Its **social benefits** include awareness raising and the establishment of cooperation structures between residents.

Analysis of drivers and success factors

The **contextual factors** that have facilitated the success of RECs include a pre-existing community culture among residents and particularly high awareness among residents with respect to the environment. **Its financial and organisational structure** in having an appropriate cooperative legal framework and the access to public EU and national funding are also success factors for this case.

Local public authorities played an important role in leading, disseminating and creating trust in the project. **Participation** is open for all residents, who became convinced of the usefulness of the project after a series of events and discussions. **Innovativeness** is embodied in the project itself, which is a pilot experience in Latvia. Moreover, the

cooperative experience of residents in the apartment buildings promotes a sense of community thinking.

Transferability and recommendations

The **transferability of internal factors** includes assessing the technical solution individually for each apartment building. The transferability of external factors includes the role of municipal governments and the benefits of constituting pilot projects. It is **recommended to public authorities** to play a leading role in the development of RECs, to establish cooperation with different levels of the public administration, securing public funding for REC development and promoting the concept of community energy.

4.1.7. Energy Gardens (NL)

Descriptive analysis

Energy Gardens was established in 2019 on three pilot locations in different provinces of the Netherlands. It works as a project that supports and funds the constitution of RECs that want to follow the Energy Gardens multifunctional model. Its **objectives** are involving local citizens and stakeholders in the creation of a local natural landscape, and the creation of renewable energy generation facilities co-owned by local communities.

The activities of Energy Gardens are focused on ground-mounted PV panels, with a combined capacity of 40MW, that will supply electricity to the grid. **The actors and stakeholders** involved include the Dutch NGO 'Nature and Environmental Federations' (NMF by its acronym in Dutch), which leads and aims to realize multifunctional energy parks for and with the local community. Other important actors are the local municipalities and local SMEs, which partner with NMF. Moreover, households in the vicinity participate in the design and exploitation of the energy gardens. **There is no unique organisational model** to the Energy Gardens concept**.** Nonetheless, there is always a local imitative involved. Some Energy gardens are entirely owned by an energy cooperative, other together with a company and others open to citizens. **Its financial model** consists of a large subsidy from the national postcode lottery and investments by project developers. Project developers can be local municipalities or energy cooperatives. Moreover, Energy Gardens benefit from national subsidies to community energy.

Impact analysis

The **environmental benefits** include contribution to reducing GHGs emissions and enhancing local ecological and biodiversity value. Its **economic benefits** include financial participation by citizens and companies through shares and the creation of local funds for the local communities. Its **social benefits** include offering a recreational and educational value to the community.

Analysis of drivers and success factors

The **contextual factors** that have facilitated the success of Energy Gardens include the national spatial planning policy, that favours multifunctional combinations (i.e., energy and

garden), the national target of achieving a 50% citizen ownership rate of renewable energy capacity by 2050, and the historical cooperative tradition of the Netherlands. **Its organisational structure** in involving local citizens in the design of the gardens is also an important factor for the social acceptance of the initiative.

Local public authorities did not play necessarily an important role, although in some cases these were relevant partners. There was no established infrastructure of institutional support. **Participation** is embodied through the process of participative design. Nonetheless, inclusiveness of vulnerable groups is not a goal in itself. Energy Gardens are **innovative** because they are multifunctional spaces accessible to the public that combine energy generation with recreational and educational activities.

Transferability and recommendations

The **transferability of internal factors** includes combining renewable energy generation with the enhancement of ecological value and ensuring local ownership and participation. The **transferability of external factors** includes public financial assistance. It is **recommended to REC initiators** to adapt the Energy Garden concept to regional contexts. It is **recommended to public authorities** to transfer unused municipal land to Energy Gardens and to develop guiding principles for multifunctional land uses.

4.1.8. Røverkollen housing cooperative (NO)

Descriptive analysis

The REC of Røverkollen housing cooperative, in the north-east of Oslo, was established in 2018 to provide renewable electricity for charging residents' e-vehicles. Its **objective** is providing environmentally friendly electricity for residents' e-vehicles at a reduced cost. The decision was taken as a result of the anticipated national regulation requiring housing associations to provide e-vehicles charging facilities, the anticipated increase in electricity costs and the participation of the cooperative in an EU H2020 project called Green Charge.

The activities of the REC include the generation of electricity based on a rooftop PV facility, the purchase of a battery storage and the installation of an e-mobility charging system with capacity for 230 e-vehicles. Excess electricity is sold to the grid and the battery helps shave power peaks. Additionally, a weather forecast platform for power management has also been created. The e-vehicle charging system is a smart one based on predictive planning that allows the system to balance input electricity and consumption.

The actors and stakeholders involved include the residents and the housing community steering board, which is the actor responsible for operation and maintenance of the facility. Moreover, the partners in the Green Charge project provided important technical inputs. **The organisational model** works through the Røverkollen housing cooperative, in which each household owns one share and decisions are taken democratically. **Its financial model** is not known in detail, although a significant part of the investment has come from the Green Charge project.

Impact analysis

The **environmental benefits** include a decrease in electricity imports from fossil-fuel power plants, the postponement of a grid reinforcement and the shave in peak loads. Its **economic benefits** include the provision of low-cost electricity. Its **social benefits** include building a sense of community among residents, greater living comfort and easier access to more environmentally-friendly private transport. A negative aspect is that residents that do not want to make such an investment cannot opt out, given the majority system of the cooperative's general assembly.

Analysis of drivers and success factors

The **contextual factors** that have facilitated the success of the Røverkollen housing cooperative include government ambitions to electrify the transport sector and the anticipated rise in electricity costs. **Its organisational structure** in the form of a housing cooperative is also an important factor.

Local public authorities were important in the Green Charge project, and therefore also in the REC. The municipality also contributed to the purchase of PV panels, batteries and charging stations. There was no established infrastructure of institutional support. **Participation** is only open to residents of the cooperative, although residents not willing to make the investment cannot opt out. Nonetheless, inclusiveness of vulnerable groups is not a goal in itself. The Røverkollen housing cooperative is **innovative** approach to addressing multiple local needs and societal goals.

Transferability and recommendations

The **transferability of internal factors** includes establishing RECs in other housing cooperatives. The **transferability of external factors** includes public financial assistance and appropriate regulatory frameworks. It is **recommended to REC initiators** to look for opportunities for public support and assistance and to seek knowledge exchange with other cooperatives. It is **recommended to public authorities** to engage in similar projects, provide funding and promote the concept of REC. At the national level, support schemes are recommended.

4.1.9. Energy Region Michałowo (PL)

Descriptive analysis

The Energy Region Michałowo was established in 2017 in the municipality of Michałowo as an "energy cluster" and local market. Its **objectives** are to increase the share of renewable energy in the municipality of Michałowo through the construction of a local energy system and to increase citizens' knowledge about energy.

The activities of the REC include, among others, the generation of electricity through a 0.6 MW biogas plant and a 0.66 MW PV plant. Other activities include a programme of collective

prosumer renewable energy sources, advanced energy efficiency and building refurbishment measures and electricity exchange. Moreover, in cooperation with Warsaw University, a platform for the management of the cluster's energy is being developed. Additionally, a passive energy efficient building for a kindergarten is planned and projects to increase e-mobility are in process.

The actors and stakeholders involved include private companies (initiators and developers) and municipal governments (promotion and dissemination). Moreover, Warsaw University has recently joined and is responsible for the development of the energy management platform. **The organisational model** of the cluster is a private agreement between two energy companies, with a coordinator at the top. Although citizens are involved in the cluster, they participate in a procedural manner and therefore do not have any decision-making power. **Its financial model** consists of investments being supported by several public institutions, including municipal governments.

Impact analysis

The **environmental benefits** include a reduction in GHG emissions. Its **economic benefits** encompass the provision of low-cost electricity and the increase in value of previously unused spaces. Its **social benefits** comprise an activation programme for the local community through the transfer of energy and environmental knowledge.

Analysis of drivers and success factors

The **contextual factors** that have facilitated the success of the cluster include the historical underinvestment in energy infrastructure in the region and the consequent low efficiencies of energy plants in the area. **Its financial model** in the form of support from public institutions has also been a key success factor.

Local public authorities played a key role in providing administrative support, public spaces and rooftops, and in promoting the concept and raising awareness on energy efficiency. **Participation** is open to citizens, but they do not have any decision-making power. Inclusiveness of vulnerable groups is not a goal in itself. The Energy Region Michałowo is **innovative** in terms of its use of new technologies and in its participation in R&D programmes (with Warsaw University).

Transferability and recommendations

The **transferability of internal factors** includes establishing energy clusters in other regions and the transfer of knowledge activities. The **transferability of external factors** includes raising awareness about RECs and providing public financial assistance. It is **recommended to REC initiators** to replicate the cooperation model between businesses and municipalities.

4.1.10. Energy community "Agra do Amial" (PT)

Descriptive analysis

The REC Agra do Amial is currently established by the municipal government of Porto and is based on a local social housing condominium. Its **objectives** are to increase the sustainability of the neighbourhood, mitigate energy poverty and promote the inclusion of vulnerable citizens. Additionally, the REC is expected to work as a living lab for the solution to be replicated to other social housing complexes in Porto.

The activities of the REC include electricity generation and supply, and other energy services. It will be based on rooftop PV panels and storage with electricity generated to be consumed by the residents of the social housing complex, with excess electricity to be sold to the grid. The REC will also provide energy efficiency and demand response services to members, as well as e-mobility charging stations.

The actors and stakeholders involved include the local government and associated entities (leading role) and the collaboration of other organisations, such as regional transmission operators (RTOs), technology providers, an energy cooperative and local stakeholders. Although **the organisational model** is not defined yet, all households from the social housing blocks can participate. **Its financial model** consists of part of the investments being paid by the municipal government of Porto. The local municipality also provides the rooftops to install the facilities. Moreover, the initiative also counts on public funds from an EEA grant.

Impact analysis

Its **economic benefits** include rebates in the energy bill of vulnerable households of about 9%. Its **social benefits** include raising awareness on energy efficiency and the energy transition, increased participation of vulnerable groups in the energy transition, improving the living conditions of local inhabitants and increasing the integration of residents of social housing block with the rest of the community.

Analysis of drivers and success factors

The **contextual factor** that has facilitated the success of the REC is the political willingness of the municipal government to promote the local energy transition. **Its financial model** in the form of investments made by local authorities and support received through an EEA grant have been key for the success of the REC.

Local public authorities have played a key role in initiating and leading the project, as well as on financing the installations. **Participation** is open to all residents in the social housing blocks and therefore, the inclusiveness of vulnerable groups is a key objective of the REC. The REC is **innovative** in terms of the approach used to mitigate energy poverty and involve low-income groups.

Transferability and recommendations

The **transferability of internal factors** includes having local authorities as the initiators and promoters of the REC. The **transferability of external factors** includes the support from local energy agencies and R&D centres in the development of the concept of REC, as well as in the provisions of financing opportunities. It is **recommended to REC initiators** to replicate the

combination of energy initiatives and socially motivated activities because it can increase interest and acceptance of the projects. It is recommended to **public authorities** that they collaborate to develop further the concept of REC and provide an appropriate regulatory framework.

4.2. Truth Table of drivers and factors of success

This Truth Table maps, in a standardised way, the relevant success factors/drivers in all the different cases. The significance of the drivers is on a scale of 0-3 (blank if not significant/relevant, X, XX, XXX), to determine and explain the significance of the role that the driver has played enabling the success of the case. The final objective of the Truth Table is to pinpoint and identify significant cross-case and cross-cutting patterns. This can provide evidence for what common denominators enable the success of a REC, as well help the identification of what types of combinations (of drivers/factors) are more conducive to a successful outcome (i.e., a successful REC). Thus, to summarise, this Truth Table attempts to serve as a cross-case comparative analysis matrix that can allow to infer more general conclusions. These assessments of the significance of the drivers and success factors have been proposed by Ecorys and verified by the country desk partners and stakeholders who drafted the original case studies.

Table 2: Truth Table on the drivers and factors of success

	Contextual factors				Financial factors		Organisational factors		Public authority support factors		Participation and inclusiveness		Innovativeness
	Cultural (e.g., local cooperative culture and community feeling)	Social (e.g., local energy poverty problem)	Environmental (e.g., local environmental problem)	Political (e.g., local political actors pushing for development of REC)	Investment model and sources (i.e., origin, participation, ownership of assets, etc.)	Financial model and long-term sustainability (i.e., income sources, distribution among participants, etc.)	Legal form (i.e., cooperative, association, etc.)	Membership rights, participants' roles and decision-making structure	Role and involvement of local public authorities	Established infrastructure of public assistance and institutional support	Openness, stakeholder involvement and citizen participation	Inclusiveness and participation of vulnerable groups	Innovativeness and encouragement of innovative practices
Ecopower (BE)	XXX		XX	XX	X	XXX	XXX	XX	XX		XX	X	X
ZuidtrAnt (BE)	XXX		XX		X	XX	XXX	XX	XX		XX	X	XX
Grenzland (DE)	XXX	XX	XX	X	X	XXX	XX	XX	XX	XX	XXX	X	XXX
Energy City Hall REC-1 (IT)				XXX	XX	X	X	X	XXX	X	XX	XX	XX
Energy communities in apartment building (LV)	XXX		X	X	XXX		XX	X	XXX	X	XXX		
Røverkollen (NO)		XX	X	XXX	XX	X	X	XX	XXX			X	X
Energy Region Michałowo (PL)		XXX		X	XXX	X			XXX	X	X	X	XX
Energy community "Agra do Amial" (PT)		XX		XXX	XXX	X			XXX	X	XX	XXX	XX
COMPTEM – Enercoop (ES)	X			XX	XXX	XX	XX		XXX		X		
Energy Gardens (NL)	X		XXX	XXX	X			XXX	X		XXX	X	XXX

Blank=not significant | X=relevant | XX=important | XXX=high importance

4.3. Overview of main findings

This section serves to consolidate the findings of the case studies, with the view of describing and analysing the outcomes, where possible in light of existing research. The primary goal is to create generalisations and arguments of overall validity. The case study summaries and the Truth Table form a central basis for deriving such overall findings and conclusions. Subsequent to this section, there will be attempts to comparatively analyse in more depth and detail the individual factors and drivers, providing more specific analysis and generalisation on each of those.

Firstly though, below, a number of the key overall findings which were derived from the in-depth case studies are presented in form of statements, which is followed by an elaboration on those findings.

A) No case falls under only a single category of drivers/factors of success

As a result of the process of summarising the in-depth case studies and the assessment and mapping of the drivers/factors (and their significance) in the Truth Table, what its strikingly clear is that none of the cases exclusively possess drivers/factors from just one of the categories. This is observed by the fact that most cases show a very broad spectrum of drivers from different categories in operation, with 9 out of the 10 case studies having drivers falling under all 6 categories of factors.

Consequently, it seems that, in order for a REC initiative to be successful, it must possess drivers/factors in all or almost all categories. Hence, the success of a REC appears unlikely unless the initiative is able to capitalise on a broad range of factors. Namely, it seems that, for the most part, successful REC projects must:

i) rely on some positive contextual conditions,
ii) design financial and organisational models tailored to the specific local context,
iii) receive some type of support from public authorities
iv) ensure a degree of openness and inclusiveness
v) incorporate some innovative aspect that creates added value.

It is therefore clear that the success of renewable energy community initiatives is generated by a combination of different drivers and factors, and thereby, an integrated and holistic approach that considers a wide range of interconnected factors is required. The need for such an integrated and holistic approach constitutes an important finding of this research exercise.

B) Although a multitude of success drivers/factors is necessary, those which are categorised under financial and public authority support are most critical

What is overwhelmingly evident from the summaries and the Truth Table is the presence, as well as the significance (in terms of degree of significance assessments), of drivers which relate to financial, public authority support, and to a slightly lesser extent, participation and inclusiveness categories in the vast majority of cases. The Truth Table above illustrates and maps the drivers, which have served to contribute towards RECs 'success, with the presence and degree of significance of each driver/factor being allocated a certain number of "X" depending on how significantly they have contributed.

Table 2 below showcases the importance of each category of factors/drivers for all combined best practice case studies. In other words, the table presents the percentage of cases for which each category has a specific significance out of the theoretical maximum. For example, drivers under the category Contextual have been *Important (XX)* 8 times out of a theoretical maximum of 40 (4 drivers by 10 cases), this is, 20%.

Table 2: Combined significance of each category for all cases

Category	Not significan	Relevant (X)	Important (XX)	High importance (XXX)
Contextual	38%	18%	20%	25%
Financial	10%	40%	20%	30%
Organisational	15%	20%	35%	15%
Public authority support	25%	25%	20%	30%
Participation and inclusiveness	15%	35%	25%	20%
Innovativeness	20%	20%	40%	20%

From Table 2, two categories stand out in the *High Importance (XXX)* significance level: financial and public authority support. Therefore, there is clear evidence that the drivers in these two categories are central in ensuring the success of REC initiatives. Based on this conclusion, REC developers and policymakers should put special emphasis on designing well-functioning financial structures and in looking for/offering support from public authorities in some way or another.

C) Successful RECs are to some extent context specific and to some extent predictable

A central outcome of this research is that contextual factors, although not being among the most important ones, are definitely very significant drivers. Contextual factors cannot be modified by a REC initiator and are very much pre-determined by the broader cultural, social, environmental and political context. The fact that these factors play a relevant role means that some areas and/or groups have it easier to succeed in the process of establishing a REC because of given, pre-existing conditions means that successful RECs are context specific to some extent. In other words, there is no “one size fits all” solution for developing a successful REC. Each project is unique, facing unique challenges and opportunities, rooted in local context. It is clearly demonstrated within each one of the cases, as illustrated in the summaries and the wide spread of drivers in the Truth Table, that successful RECs are not achieved by a single method. Rather, a highly broad variety of drivers and combinations increase the chances of success. These varieties are caused by the differing local contexts.

Importantly, despite the fact that there is no “one size fits all”, there are certainly some drivers/factors of success which can be transferred to other contexts/situations to promote successful REC developments. Their existence forms the basis for transferability of drivers/factors of success to other regions and countries in Europe. The following sections explore in more detail how the individual drivers have operated in the case studies, to uncover whether there is indeed a

great deal of similarity between the cases in achieving success, setting the basis for discussion on lessons learnt and transferability.

4.4. Comparative analysis of drivers and success factors

The present subsection outlines and compares the ways in which individual drivers/factors have in different cases, specifically and practically, contributed towards successful outcomes in REC developments. It starts with an assessment of the most significant drivers/factors of success identified in the previous subsection (thus financial and public authority support), whilst gradually paying attention to the next most important drivers in order of their overall presence.

The objective of this exercise and comparative analysis is two-fold. Firstly, to better understand the individualities and similarities of the operation and success of drivers in different contexts. Secondly, leading on from the first, to feed the development of the lessons learned about the drivers/factors which will be elaborated upon in the next subsection. Practically speaking, each driver will be succinctly defined. This will be followed by consideration on how often the driver has been relevant in the 10 case studies, as well as comment on how significant the driver has been in each of the cases. Subsequently, a comparative analysis is provided on how specifically the driver has operated in practice.

Financial factors

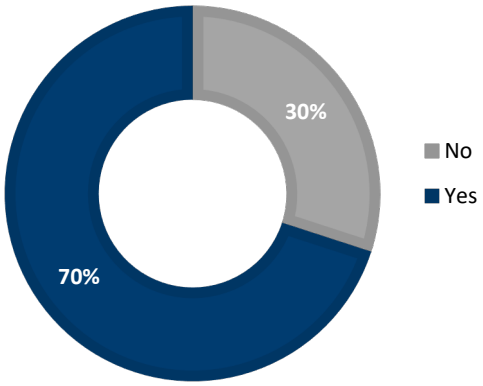
As illustrated previously, two specific drivers fall under this category. These include "investment model and sources" and "financial model and long-term sustainability". Both of these are analysed individually below:

i) Investment model and financing sources

This driver/factor refers to the investments that REC initiators and developers have to make in order to materialise the project. These investments can differ widely from REC to REC in who finances the installations and how, who owns the assets purchased, under which conditions are spaces leased, and other aspects. This is a critical factor of success, being present in 9/10 cases and being *Important (XX)* or of *High Importance (XXX)* in 6/10 cases.

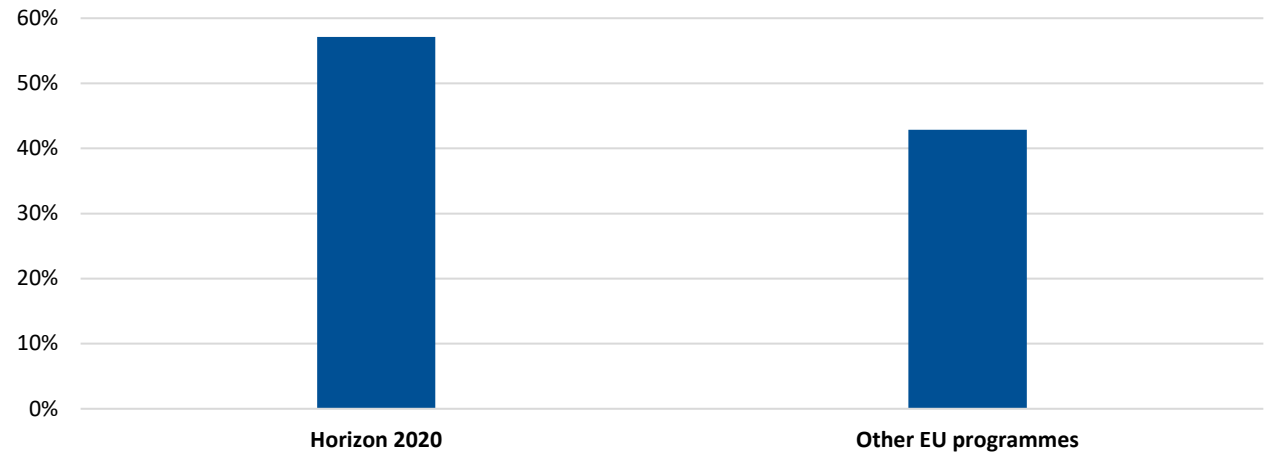
Almost all affected case studies receive all or part of the funding necessary to finance the investments from public authorities. This has been mostly in the form of grants and subsidies from regional/local, national and EU authorities. Additionally, bank loans and private contributions from members are also important factors in some cases. EU funding has been particularly relevant (see Figures 1 and 2). For instance, the Røverkollen housing cooperative (Norway), COMPTEM (Spain) receive funding through research projects within the framework of Horizon 2020. Additionally, other projects receive EU funding through other

Figure 2: Proportion of projects receiving some type of EU funding



programmes, such as the Energy communities in apartment buildings (Latvia). Moreover, many local governments have found innovative ways of contributing financially to development of RECs by, for example, transferring or leasing the use of public spaces and rooftops, what constitutes an effective in-kind financial support.

Figure 3: Origin of EU funding



ii) Financial model and long-term sustainability

This driver/factor refers to the day-to-day financial functioning of the REC. This includes what are the income sources, the existence of profits, the distribution or reinvestment of profits, the economic rights and obligations of members, and other aspects. This is an important factor of success, being present in 8/10 cases and being *Important (XX)* or of *High Importance (XXX*) in 4/10 cases.

The studied cases vary widely in their financial models and each has found a specific and tailored design to ensure its financial viability. An important part of them receives contributions from members of the REC in the form of social capital or other forms. This is the case, for example, of the two Belgian cases, Ecopower and ZuidtrAnt. Others have different structures in the form of private companies. For instance, Grenzland (Germany) is designed as a limited partnership with a private limited liability company as its general partner. In some cases, there exist profits that are paid as dividends to the members of the community. In contrast, other cases direct surpluses to social initiatives and reinvestments, such as the Spanish COMPTEM.

Public authority support factors

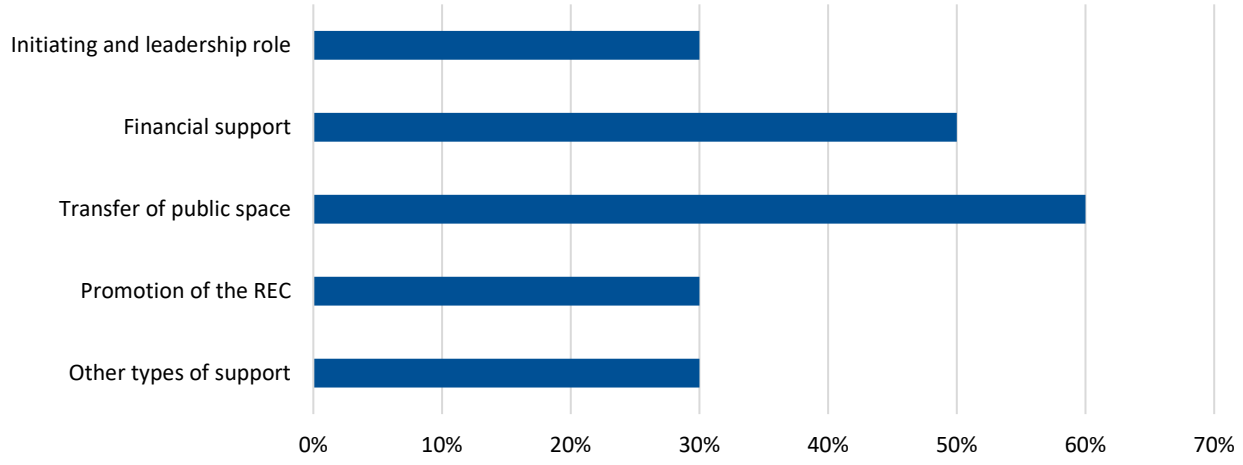
As shown above, two specific factors fall under this category. These include “role and involvement of local public authorities” and “Established infrastructure of public assistance and institutional support”. As it is explained below, the importance of public authority support has come mainly through the “role and involvement of local public authorities, with the second factor Established infrastructure of public assistance and institutional support” being relatively unimportant. Each of these are analysed individually below:

i) Role and involvement of local public authorities

This driver/factor refers to the role local authorities have played in the development of the REC and the extent of their involvement. This includes whether or not local public authorities initiated the REC, whether or not they assumed a leadership role, and the significance and extent of their support to the REC. This is a the most critical factor of success, being present in all 10 cases and being *Important (XX)* or of *High Importance (XXX)* in 9/10 cases.

Although local public support has been absolutely necessary for the success of all cases studied, the forms of support vary widely. In some cases, municipal governments initiated the REC and played a leadership role in their development. For instance, in Energy City Hall REC-1 (Italy) the local municipality has carried out the constitution of the REC almost all by itself. In other cases, local public authorities have provided other types of support while maintaining a secondary role. This type of support can include subsidies and grants, transfers and provision/leasing out of public spaces, promotion activities, and others. For example, the Polish Energy Region Michałowo benefitted from local public financial assistance, the Latvian RECs from promotional activities organised by the municipality and the two Belgian cases from transfers of public spaces through public tenders. Additionally, the involvement of local public authorities has a more subtle but equally important effect in creating trust and confidence in the project. Figure 3 below summarises the different types of local public assistance. It is visible how transfers of local public spaces and local financial support have been key for the majority of the projects.

Figure 4: Proportion of cases that have received a specific type of local public support



ii) Established infrastructure of public assistance and institutional support

This driver/factor refers to the role that established programmes of assistance and support have played in the development of the REC. This includes the existence of support schemes for community energy, specific funding facilities for RECs, and other measures. In contrast to the previous driver, this factor has been relatively unimportant for the majority of cases, being present in all 5 of the 10 cases and being *Important (XX)* only in 1 case.

Most cases have not benefited from established support programmes. This is because of the fact that established infrastructures of assistance for RECs or similar did not exist at the time the RECs were constituted for the majority of cases. Nonetheless, some cases have benefited from assistance programmes. For instance, the system of feed-in tariffs/premiums has been an important factor for the success of the German case, Grenzland.

Contextual factors

Four specific drivers fall under this category. These include "cultural", "social", "environmental" and "political". The political drivers are, by far, the most significant ones within this category. Each of these are analysed individually below:

i) Cultural

This driver/factor refers to the role that pre-existing cultural and societal attitudes have played in enabling the success of the REC. This is, overall, a relevant factor of success, being present in 6 of the 10 cases and being of *High Importance (XXX)* in 4/10 cases.

The cases that have cultural drivers as one of their success factors have so because they have profited from historical traditions of cooperative activities or because they have been developed in areas with a strong community feeling. For instance, the two Belgian cases, Ecopower and ZuidtrAnt, benefit from being located in a region with a long history of cooperative societies. This makes it easier for citizens to trust and understand the functioning of cooperative initiatives.

ii) Social

This driver/factor refers to the role that local social conditions and problems have played in the development of the REC. This includes, for example, being in an area where there is a high rate of energy poverty. This is a relatively unimportant factor of success, being present in 4 of the 10 cases, although it has been rated *Important (XX)* or of *High Importance (XXX)* in all 4.

The cases that have social drivers as one of their success factors have so for a variety of reasons. For example, the Portuguese case, Agra do Amial, has a direct social purpose and aims to reduce energy poverty in a social housing complex and create a community feeling between low-income groups and the rest of the neighbourhood. This social context is one of the main drivers of the REC.

iii) Environmental

This driver/factor refers to the role that local environmental conditions and objectives have played in the development of the REC. This includes, for example, the existence of a local environmental problem to be resolved or some technical constraints created by the environment. This is, overall, a relevant factor of success, being present in 6 of the 10 cases and being *Important (XX)* or of *High Importance (XXX)* in all four.

The cases that have environmental drivers as one of their success factors have so for a variety of reasons. For example, the Dutch case, Energy Gardens, has as one of its drivers the spatial and

environmental limitations of Dutch geography, what makes multifunctional projects, such as energy gardens, particularly well-suited to the context.

iv) Political

This driver/factor refers to the impact of political objectives and the willingness of local political actors on REC success. This includes, for example, having a political commitment of being a municipality 100% renewable. This is a very important factor of success, being present in all 10 cases and being *Important (XX)* or of *High Importance (XXX)* in 6/10 cases.

Although all cases have benefitted from political contextual factors, the specific driver varies widely, although it normally includes political commitments or policy goals. For example, in the case of COMPTEM (Spain), the development of the REC is the keystone of the municipal environmental strategy. In the case of Energy Gardens (Netherlands), the projects are framed within the national policy target of reaching 50% citizen ownership of renewable energy installations.

Participation and inclusiveness factors

Two specific drivers fall under this category. These include "openness, stakeholder involvement and citizen participation" and "Inclusiveness and participation of vulnerable groups". Each of these are analysed individually below:

i) Openness, stakeholder involvement and citizen participation

This driver/factor refers to the impact of being open and allowing participation by different groups on the REC's success. This includes the question for whom membership is open, the extent to which ordinary citizens have been involved in the design of the REC, and other related aspects. This is an important factor of success, being present in 9 of the 10 cases and being *Important (XX)* or of *High Importance (XXX)* in 7/10.

Although this has been a relevant driver in most cases, its actual forms vary widely from case to case. In some cases, participation is open to all citizens/residents. For example, the Italian case of REC-1 Energy City Hall is open to all interested citizens, even those that already have individual self-consumption installations. In other cases, participation is open but decision-making power for ordinary citizens is very limited. This applies to the Polish case. Additionally, other more innovative ways of encouraging participation exist. For instance, Energy Gardens (Netherlands) are designed through a participative process with local communities.

ii) Inclusiveness and participation of low-income and vulnerable groups

This driver/factor refers to the extent to which the REC is able to involve vulnerable citizens and not let anyone behind. This includes special treatment for low-income households, having the mitigation of energy poverty as a target, and other related aspects. This is a relevant factor of success, being present in 8 of the 10 cases, although only being *Important (XX)* or of *High Importance (XXX)* in 2/10.

The importance and form of this driver varies a lot from case to case. In some cases, the inclusion and participation of vulnerable groups is a secondary phenomenon. Nonetheless, in other cases, inclusiveness is one of the main objectives of the REC. This is the case of Agra do Amial (Portugal), which has reducing energy poverty and offering rebates to residents in social housing blocks as its main goal. Some cases also find innovative ways to make their REC more inclusive. For instance, the Spanish COMPTEM does not charge any amount for participating in the community and investment costs are repaid through the rebates in members' energy bills.

Innovativeness factors

Only one specific driver falls under this category: „Innovativeness and encouragement of innovative practices". It is analysed below:

i) Innovativeness and encouragement of innovative practices

This driver/factor refers to the extent to which the REC is innovative or takes innovative measures. This includes the use of innovative technologies, applying innovative business models, creating an environment that encourages innovation, and other related aspects. This is an important factor of success, being present in 8 of the 10 cases and being *Important (XX)* or of *High Importance (XXX)* in 6/10.

Cases differ widely on their innovativeness. Some have innovative, well-functioning business models. For instance, Grenzland (Germany) applies an innovative organisational model for a REC of limited partnerships in wind farms, even if the legal form in itself is not new. Other cases use or invest in innovative technologies, such as the case of Poland. Additionally, some RECs participate very actively in R&D projects. This is the case of the two Belgian cases, Ecopower and ZuidtrAnt, which are involved in several Horizon 2020 projects.

Organisational factors

Two specific drivers fall under this category. These include "legal form" and "membership rights, participants' roles and decision-making structure". Each of these are analysed individually below:

i) Legal form

This driver/factor refers to the legal form of the REC. The variety of legal forms that a REC can adopt is wide, as there is no specific one indicated in REDII. REC developers adopt the legal form that they consider most appropriate for the specific conditions of the project and the wider local circumstances. This is a relevant factor of success, being present in 7 of the 10 cases and being *Important (XX)* or of *High Importance (XXX)* in 5/10.

Cases differ widely on the legal forms they adopt. A common one is creating a cooperative company. Although their form varies with national and regional legislations, membership in a cooperative is normally open and voluntary. Examples of RECs that have adopted cooperative forms are the two Belgian cases. RECs can also form other types of legal entities. For example, the Latvian energy

communities in apartment buildings are constituted as homeowners' associations. Another example of different but successful legal form is that of Grenzland (Germany), which is a limited partnership with a private limited liability company as the general partner.

ii) Membership rights, participants' roles and decision-making structure

This driver/factor refers to the rights, roles and governance of the REC. This driver is highly linked to the legal forms, as the legal form normally shapes, to a great extent, these aspects. This is a relevant factor of success, being present in 7 of the 10 cases and being *Important (XX)* or of *High Importance (XXX)* in 5/10.

Cases differ their governance structures and membership rights. Although the exact form varies with national and regional legislations, cooperatives are structured democratically, and each member has one vote irrespective of the social capital he/she has contributed. For example, this is the case for the housing cooperative of Røverkollen (Norway) and the energy cooperative of COMPTEM (Spain). RECs can also have much more innovative governance and participation structures. For instance, Energy Gardens (Netherlands) have an interesting framework of project co-design with local communities and citizens.

4.5. Overview of lessons learnt and recommendations

The present section builds directly upon the synthesis and comparative analysis carried out in the previous subsections to develop a specific and targeted list of lessons learnt and recommendations for the successful development of a REC. Fundamentally, the purpose of this exercise is to provide recommendations and facilitate the transfer of the best practice cases to other regions and contexts.

More specifically, the lessons learnt and recommendations are differentiated between those for policymakers (i.e., local, regional and national authorities) and those for REC initiators and developers. This distinction is made due to the fact that, although there is often an overlap in the recommended activities for both parties, it is better to specifically recommend how these actors (who differ in the roles, motives and nature) can practically support the development and success of RECs across Europe. Indeed, these recommendations are directly based on the outcomes, successes and failures of the 10 in-depth best practice cases. The lessons learnt and recommendations concern how drivers and factors of success can be successfully brought into practice in order to more effectively contribute to the widespread development and success of REC initiatives. It must be noted that although lessons have been identified about most drivers, this is not necessarily the case for every single driver.

Lessons and recommendations for public authorities

- *Promote and support RECs through public tender processes*

  Public tender processes offer a great opportunity to organically integrate RECs into energy systems and to support the widespread development of community energy initiatives. Public authorities competent on energy matters and with the powers to launch tenders on renewable energy projects (be it local, regional and/or national authorities, depending on the context) have the opportunity to make an important difference on the chances of success of REC initiatives. Competent public authorities can choose to launch public tenders that specifically seek the development of RECs, for example by creating tenders for offering services to RECs, including the preparation of feasibility studies and the provision of technical assistance. Moreover, competent public authorities should consider including specific provisions for RECs in energy tendering processes, including procurement of electricity/heat for public buildings and RES competitive biddings for public support. For example, competent authorities can include a mandatory share of citizen participation in renewable energy auctions.

- *Transfer and assign concessions of public spaces for the development of RECs*

  Many municipal public spaces are currently underutilised. This includes unused public land and, crucially, most rooftops in municipal public buildings (e.g., sport facilities, schools, city halls, libraries, etc.). These spaces, and especially rooftops, are ideal for the installation of REC facilities. The transfer of these spaces to REC initiatives (e.g., via leasing contracts) can greatly facilitate their development and significantly reduce investment costs. Municipal authorities can choose from a variety of ways and instruments to transfer these spaces depending on the specific legal context. Be it through public tendering processes for the

transfer of its use or through other types of initiatives, the concession of underutilised public spaces to REC developers is probably one of the most effective ways in which a municipal government can contribute to the development of energy communities. Apart from contributing to REC development, the assignment of underutilised public spaces can provide environmental, economic and social value to previously unused land. This is especially true if REC installations are coupled with multifunctional activities, such as including sport and recreational facilities. Importantly, the possibility and extent of transferring public spaces to REC initiatives will be determined by the availability of underutilised spaces in the first place. In this sense, it can be easier for the municipal government of a rural area to implement compared to the local authorities of a densely-populated large city.

- *Promote the understanding of the REC concept*

  In many areas, the concept of community energy and RECs is not known or well-understood by the public. National, regional and public authorities should make an effort to promote the many environmental, economic and social benefits of REC initiatives in order to make the concept well-known. For example, information and promotion campaigns could be organised to make the concept and its benefits known to the general public. Ideally, public endorsement and support to RECs should create trust among citizens, especially in those areas where their development is little. This will expand the idea that RECs are a viable and positive opportunity for citizens to actively participate in the energy transition.

- *Provide incentives for REC development*

  Public authorities should strive to incentivise participation in RECs by, for example, providing tax cuts to members of RECs and establishing feed-in tariffs systems. This will expand the benefits of participating in RECs and make them more feasible and present an opportunity for citizens to benefit economically and socially. In turn, this could spur the development of many more REC projects and create a collaborative environment.

- *Endorse local REC initiatives and disseminate/champion their results*

  Municipal authorities should publicly endorse efforts by local REC initiators and developers. Moreover, they should disseminate the specific benefits and results of local REC initiatives. For example, the activities, discussions and events held within the ZuidtrAnt case could serve as a role model. They should help local enthusiastic citizens and REC developers to disseminate and expand the outreach of energy community initiatives. This would help other less engaged local citizens to know about the effort of their neighbours, be conscious about the benefits and be comfortable with it. Ideally, this will produce expansions of the REC or replications of it as more and more local citizens want to participate from the benefits of energy communities.

- *Establish funding programmes for RECs*

  National, regional and local public authorities should establish funding programmes and financing facilities to contribute to the development of RECs. Public financial support to RECs can take a wide variety of forms. It could be through direct financial participation (e.g., local authorities becoming one of the partners of local RECs), grants, subsidies and/or favourable

lending facilities. Given that energy community initiatives are very recent and innovative in many parts of Europe, REC initiators often struggle to access the necessary funds. Private citizens and financial institutions are normally reluctant to invest in projects of which they know little and do not understand. In this sense, the benefit of public funding programmes for RECs would be double. Firstly, and most obviously, these will provide much needed resources to REC developers that struggle to find them elsewhere. This can directly support the development of energy community initiatives. Secondly, public authorities having a vested interest can reassure private citizens and financial institutions about the benefits and sustainability of investing in REC initiatives. Therefore, establishing public funding programmes can unleash a form of multiplier effect by which private investment starts to be funnelled to REC developments.

- *Establish administrative and technical support programmes for RECs*

  National, regional and local authorities should establish administrative and technical support programmes. Many REC developers might not be experienced in the many complexities of administrative procedures for energy projects and might lack the technical skills (engineering, economic, legal, tax, etc.) needed to successfully set up a REC. Although current REC initiators might have the skills and patience to go through these complex processes, if RECs are to be expanded and disseminated, setting up a REC must be much easier than it is currently. This includes simplifying administrative and licensing procedures but also providing a range of services to REC developers. For example, financing feasibility studies, recommending the most appropriate legal form and governance structure, helping design financial models, etc.

- *Providing a favourable and truly enabling regulatory framework (in line with RED II)*

  National and regional authorities should strive to make sure that there is a level playing field on the energy market that facilitates the development of REC. This necessarily entails fully transposing the REDII and removing barriers to REC development. The regulatory framework should be stable and transparent and provide a trusted legal and policy structure for REC initiators that levels the currently asymmetric playing field of the energy sector.

- *Taking a leadership role in the development of RECs*

  In cases where RECs do not naturally come from private citizens' initiatives, local and regional public authorities should consider becoming REC initiators themselves. By adopting a leadership role and providing the confidence of having the public administration involved, RECs developed in this way can attract the participation of many ordinary citizens and can inspire others to set up RECs themselves. This is especially true for territories where energy communities are inexistent.

Lessons for REC initiators and developers

- *Including a strong local community purpose in REC objectives*

  Including an explicit local community purpose as one of the objectives and activities of the REC can increase the chances of success for the initiative. Firstly, having a community

purpose can contribute to a fairer and more inclusive development. Secondly, an explicit community purpose adapted to the specific socioeconomic conditions of the territory where the REC is established can significantly increase trust and participation in the project. The combination of environmental and economic objectives with community ones can leverage potential synergies, increase the level of engagement of local citizens and reduce mistrust in the initiative. Moreover, showcasing the beneficial community effects of RECs, such as tackling energy poverty, can inspire other engaged citizens to develop their own initiatives. Community purposes can work by ensuring that the entire community benefits from the renewable energy projects (and not just members or shareholders), by contributing to strengthening the local economy and promoting local added value creation.

- *Taking measures to promote participation of low-income groups and vulnerable citizens*

  REC initiators and developers should strive to ensure that vulnerable citizens can participate in REC initiatives in order to make projects truly equitable and not let them degenerate into an opportunity restricted to affluent citizens. Moreover, REC developers should try to encourage low-income and vulnerable households to participate and benefit from the REC. This can be done through a wide variety of instruments. For example, by allowing vulnerable citizens to participate with lower or no investments, or by creating effective benefit sharing mechanisms.

- *Capitalising on public financial support and technical assistance programmes for RECs*

  Public authorities across Europe are starting to establish infrastructures of assistance and funding programmes to spur the development of RECs. These facilities offer a great opportunity for REC initiators that are struggling to constitute and raise funds for their initiatives. Given that the financing tends to be an obstacle in the development of RECs, applying for public funding, be it in the forms of direct financial participation, grants or loans, can significantly increase the chances of success. Moreover, many enthusiastic REC initiators may lack the skills necessary to establish a well-functioning community. In this sense, public programmes offering support in the conduct of administrative and legal procedures and in the more technical aspects can be a great opportunity. Additionally, other public programmes not directly targeting RECs can also be considered. For example, many of the best practice cases presented in this deliverable have benefitted from support in the frame of Horizon 2020 projects.

- *Seek the collaboration and support of local authorities*

  Local municipal authorities can be great allies and partners. As shown previously, all best practice cases presented here benefited significantly from collaborating with municipal governments. Local authorities can provide a wide range of very valuable services, including the transfer of public spaces, support with administrative procedures, promotion of the initiative, financial assistance, etc. Moreover, having the municipal government behind, publicly endorsing the REC, can increase trust and social acceptance, and convince reluctant citizens to participate.

- *Exchanging and collaborating with other RECs and similar initiatives*

  More established RECs and other institutions (e.g., research institutes) can contribute significantly to the further development and long-term viability of a REC. Collaboration with similar initiatives in the concept development and implementation can be a valuable asset, as REC initiators may not have the necessary competences to decide on the technological and legal approach. Moreover, this can promote experimentation of innovative solutions in terms of technology choice, activities performed, and even legal forms.

4.6. Transferability and next steps: looking ahead at WP6

A central mechanism investigated by the COME RES project to understand, analyse and address the success of RECs is the identification, analysis and transfer of successful measures from other contexts or similar situations to less-developed territories in terms of REC initiatives. The COME RES project takes inspiration from a number of existing measures within project countries that show how RECs can be successfully established, with the objective of transferring and implementing these successful measures in other regions.

The present section is devoted to setting the practical foundations of the transfer of selected best practice cases, which is carried out in WP6. Each of the case summaries in Section 4.1 already devoted a small section discussing the extent to which the cases can be transferred. The following subsection will first give a brief overview of what can be concluded as the main factors for the RECs to succeed, and what are important considerations for those who may in the future wish to transfer any of the individual cases. This will be followed by a synthesis and comparative analysis as to how, generally speaking, the transferability of the cases to other regions can be facilitated. It is important to restate the fact that in the preceding project deliverable (D5.2), one of the key criteria by which the 10 case studies were selected was the potential for transferability.

In terms of practical relevance to the forthcoming activities of the COME RES project, this will be particularly relevant for WP6. The transfer workshops under WP6 serve to inspire transfers and validate the best practice cases in the respective learning regions. This will be done through the detailed consideration of the best practice case and through enabling partnerships of key actors of a certain best practice with key actors from the learning region. The central objective being to provide general guidance on how to adapt and implement the best practice measures into the learning region.

Key enabling factors

The present subsection provides for important considerations for the future transfer of each of the cases. For each of these, the key factors, which have enabled the success of the measure in that particular context have been identified. In practice, it is important that efforts for the future transfer of these cases are aware of the existence or non-existence of similar forms of the factors, either to encourage the transfer of the case or to consider how to compensate for the absence of such factors.

1) **Ecopower (Belgium)**

   The key success factors of this best practice case include the long cooperative tradition of the region where the REC is established, its organisational structure as a cooperative and the participation in public tenders and EU-funded projects.

2) **ZuidtrAnt (Belgium)**

The key success factors of this best practice case include the long cooperative tradition of the region where the REC is established, its organisational structure as a cooperative, the support of public authorities and the provision of public funding.

3) **Grenzland (Germany)**

The key success factors of this best practice case include the favourable regulatory framework, trust in the managers and identification with the projects, their organisational structure (limited partnership), the local socio-economic benefits and the benefit sharing measures.

4) **COMPTEM-Enercoop (Spain)**

The key success factors of this best practice case include the local history of energy cooperative activity, particularly the ownership of the distribution grid, the involvement of the municipal government, the transfer of public land and the EU funding.

5) **Energy City Hall REC-1 (Italy)**

The key success factors of this best practice case include the strong political will of the municipal government, the use of public spaces and the public funding.

6) **Energy communities in apartment buildings (Latvia)**

The key success factors of this best practice case include a pre-existing community culture among residents and the public funding.

7) **Energy Gardens (Netherlands)**

The key success factors of this best practice case include the national spatial planning policy, national energy ownership targets, the historical cooperative tradition of the region and the co-design processes.

8) **Røverkollen housing cooperative (Norway)**

The key success factors of this best practice case include the government policy objectives and measures, and the organisational form as a housing cooperative.

9) **Energy Region Michałowo (PL)**

The key success factors of this best practice case include the local situation of underinvestment in energy infrastructure and the provision of support from public authorities.

10) **Energy community "Agra do Amial" (PT)**

The key success factors of this best practice case include the strong political willingness of municipal authorities and the public support and funding.

Overall considerations for the successful transfer and utilisation of best-practice cases

Although the previous section has demonstrated that some key success factors have existed in the cases, there are three general and universal factors which can also strongly contribute. Thus, the present section will present three general findings from the case studies on the overall lessons learned about the transferability of drivers and factors of success. They will be individually explained to highlight their importance. Collectively, these form the basis for transferring any of the factors to other contexts.

1) **Strong involvement of local/regional public authorities**

In order to successfully transfer a best practice case study, strong involvement and endorsement of local and regional public authorities will be necessary. It has been demonstrated that all best practice cases presented here have significantly benefitted from the support of public authorities, and it is unlikely that they would had succeeded to the extent they have without the assistance of local administrations. Hence, the transfer of any best practice case will necessarily need to involve municipal and regional public authorities. As previously shown, there is a wide range of ways in which public authorities can engage with REC developers. The specific form of this involvement will depend on the specific local context and willingness of local authorities.

2) **Promotion, dissemination and openness**

For the successful transfer of any best practice case, the REC concept and the specific project must be promoted and disseminated as much as possible. REC initiatives are often regarded by ordinary citizens with mistrust. Moreover, the concept of REC itself is normally not known or well-understood. Any transfer will have to consider carrying out promotional activities, disseminating the results and being as open as possible in order to achieve social acceptance.

3) **Strong leadership role of a "change agent"**

In order to successfully transfer any best practice case, an agent must take a strong leadership role. In all cases studies, one of the actors involved has worked as a "champion"

that initiated, designed, developed and convinced others. This has been of paramount importance in order to see concrete material results on the ground. “Change agents” can be any actor that takes a leadership role, such as enthusiastic citizens or engaged local municipalities.

5. Conclusion

The present deliverable, alongside the whole Work Package 5, have provided a both broad and deep variety of insights into existing cases – across all countries represented in the COME RES project – about how to ensure that REC initiatives are developed successfully. The cases chosen for and analysed in this deliverable have proven to be those which have most effectively done so, whilst at the same time showing stronger potential to being transferred to other contexts and regions. Such transfer potential is crucial and forms the basis of the work package (WP6) – which seeks to stimulate the transfer of selected actions/activities taken in the target regions striving to replicate the success of the best practice cases and draw lessons for policy.

Perhaps the key point is that, although the chances of success of a REC initiative in a particular place may to some extent vary, there are often common ways that can lead to it. In other words, particularities of each case deserve specific attention, however a certain combination of drivers and factors and the following of certain principles are likely to collectively lead to successful REC initiatives in similar situations where similar contexts exist. This of course is the basis for the expectation that the best practice measures can indeed be transferred to other regions and contexts.

Annex 1: Template for best practice case studies

Overall objective and best practice definition

After the development of good practice portraits and selection of the 10 best practice cases carried out in Task 5.2, an in-depth analysis of each of the 10 best practice cases will be developed in WP 5.3 in order to understand in detail their success factors and potential for replicability. On the basis of the outcome and findings of the **in-depth assessments**, the best practice cases will be compiled in a best practice portfolio. They will also be further assessed and presented in a synthesis report (Deliverable 5.3), which will cluster the best practice cases according to different categories, provide a comparative analysis of success factors (and failures) and draw lessons that can have general validity.

Therefore, it is useful to recall the definition of best practices so as to ensure consistency across the 10 different in-depth analysis. Best practices are considered to be superior to good practices because they require **innovative, testable, and replicable approaches** which contribute to the improved performance of a project or policy, usually recognised as best by peer organisations. Best practices are means to **provide guidance**. Through trial and error, best practices provide the framework to help guiding policies and measures to be implemented. The Merriam Webster dictionary defines *best practice* as "a procedure that has been shown by research and experience to produce optimal results and that is established or proposed as **a standard suitable for widespread adoption**"[1]. Best practice cases can be proposed for widespread adoption.

The main theoretical and practical characteristics which the cases must satisfy in order to be selected for in-depth analysis have been elaborated in Deliverable 5.1 "Methodological Framework for good/best practices selection"[2]. Thus, in the context of the COME RES project, a "**best practice**" is defined as a **proven or innovative REC**, preferably implemented in a COME RES model region, target region or any other region of the COME RES partner countries, or third countries.

Methodology and tools for best practice in-depth analysis

This section describes the way in which the selected best practice cases should be assessed and elaborated in more detail. Our methodological approach is conscious of the fact that, in order to be able to compare across diverse cases, similar data need to be collected.
Possible methods and sources of information for the **in-depth analysis** include:

- The analysis of **desk research**, including revisiting and utilising other COME RES deliverables (e.g., WP 4.1, WP 2, WP 5.2, etc.).
- Further **stakeholder consultation** may involve:
    - Dedicated discussions in the framework of Country desk meetings, brief phone calls and/or email correspondence. This further consultation strategy, and especially desk meetings, are encouraged to gain a more in-depth understanding of certain aspects relevant to the best practice development).
    - Consultations are also recommended (where possible) in order to complement desk research and address possible information gaps. The

factors that could be more suitable for development through this stakeholder consultation are those within the analysis of drivers and success factors (see below).

- A generic topic guide will be developed to be facilitate and used as the basis for this stakeholder consultation (e.g., sample questions to send by email, topics for discussion by telephone or during meetings, etc)

The in-depth analysis should be 5-10 pages long for each best practice case study. Therefore, it is necessary to provide an explanation of **why and in what way** the RECs or initiatives that have a best practice character have been successful. Thus, it is also important to address the question of what processes and frameworks led to a successful outcome and ultimately to best practices and whether there was a participatory process.

Template for best practice in-depth analysis

1. Descriptive analysis

1.1. Author of case-study and organisation

1.2. Name of REC and geographical scope

Specify the type of region where the REC is established (target region, model region, other region in COME RES country, third country). Please, indicate the geographical coverage and size of the REC and whether participation in the energy community extends beyond the immediate neighbourhood (local, regional, national and the number of participants).

1.3. Objectives, motivation and process for establishment

Detail the key motivations for the establishment of the REC (e. g. cutting energy costs, reducing carbon footprint, strengthening community, protecting the rights of future generations, co-housing communities, etc.). Describe when and how the REC was initiated, launched and what has been its subsequent development (if appropriate).

1.4. Activities and technologies

Describe the main activities of the REC in the electricity system (generation, supply, distribution, consumption and energy sharing, aggregation, energy services, etc.), as well as the energy technologies (i.e., wind, solar, small hydro, bioenergy or electric vehicles).

1.5. Overview of actors and stakeholders involved

Detail which types of stakeholders/actors were key in supporting/realising the REC. Please, specify the range of actors involved (e.g., members of the community including households, citizens, municipalities, SMEs as a legal entity, other stakeholders). Include their significance and specific roles.

1.6. Organisational structure a decision-making model

Detail the organisational structure/ownership model/legal form of the REC (cooperative, association, foundation, partnership, limited partnership, development trust, private company). Describe the specific roles/positions of the key actors outlined in section 1.5, governance and management structures and voting rights in the decision-making structure. Finally, indicate membership profile and gender balance of the REC.

1.7. Financial and investment considerations for establishment and maintenance of REC

Describe the origin of the initial investment (e.g., members' shares, EU grants, bank loans, etc.) and the REC's sources of income. Explain how the REC's financial model works (e.g., sale of surplus, partition coefficient mechanism, distribution of rebates on energy bills, etc.). Detail how the REC ensures financial sustainability over time. Outline whether the REC counts on public funds and/or support schemes and indicate where the funding or support is coming from (i.e., EU, national, regional, local).

2. Impact analysis

2.1. Environmental benefits

Describe additional environmental benefits generated by the REC apart from CO2 emissions reductions (e.g., specific packages that provide high ecological valorisation, enhanced ecological rehabilitation of the area).

2.2. Economic benefits

Describe economic benefits generated by the REC (e.g., development of local economies (i.e., value added, employment effects/income generation), local tax revenues, rebates on energy bills, increased enterprise competitiveness).

2.3. Social benefits

Describe social/community benefits generated by the REC (e.g., the REC brings together people from different socio-economic backgrounds and in particular lower income groups, benefit sharing, social community activities, increased environmental awareness, sense of collective ownership of the energy transition process).

3. Analysis of drivers and success factors

3.1. Role of local governance and local/regional leaders in implementation

Describe the role local and/or regional authorities played in establishing and sustaining the REC (e.g., leadership and initiator role, provision of public spaces, administrative support, financial assistance, etc.). Explain to what extent relevant public actors took up a leading role and innovative forms of leadership. Describe whether the REC could count on an established infrastructure of assistance and institutional support, and if so, in what way. How important has this local and/or regional support been in establishing and sustaining the REC?

3.2. Inclusiveness/participation/social acceptance

Explain in which ways (and the extent to which) the REC fosters the participation of different actors, including also vulnerable group (e.g., employment issues, gender issues, sustainability issues). Describe how actively citizens are involved in the decision-making processes.

3.3. Financial and organisational factors

Explain which aspects of the REC's organisational structure have been key in ensuring the success of the project (e.g., ownership model, membership profile, decision-making mechanisms, etc.). Explain which aspects of the REC's financial model have been key in ensuring the success of the project (e.g., origin of the investment, sources of income, etc.)

3.4. Innovativeness

To what extent is the REC itself innovative or does encourage innovative practices (e.g., innovative business models, innovative cooperation models and stakeholder engagement strategies, innovative financing models, etc.)?

3.5. Contextual factors enabling success

Describe and detail the contextual factors have/had a role in shaping the development of this REC, including, if appropriate:

- Cultural (e.g., local cooperative culture and strong community feelings)
- Social (e.g., local energy poverty problem)
- Environmental (e.g., local environmental problems tackled by the REC)
- Political (e.g., local political actors pushing for the development of the REC)
- Infrastructure (e.g., pre-existing local grid infrastructure)

3.6. Other

Describe any relevant driver and success factor not developed above, if appropriate.

4. Transferability and recommendations

4.1. Transferability

Please, indicate the extent to which the drivers and success factors of the REC as a whole or in part can be transferred and replicated elsewhere. Try to assess the transfer potential and under which conditions the best practice might be transferable to other regions/countries and contexts, particularly in regions with a very low penetration of RECs. Please distinguish between:

- Transferability of internal drivers and factors (e.g., stakeholders involved, organisational model, financial aspects, etc.)
- Transferability of external drivers and factors (e.g., local government policies, contextual aspects, etc.)

4.2. Recommendations

Reflect on which success factors could be recommended to replicate in other contexts. Please distinguish between:

- Recommendations for REC initiators and developers
- Recommendations for policymakers:
  - Local
  - Regional
  - National
  - EU

Annex 2: In-depth best practice case studies

a. Ecopower (BE)

1. Descriptive analysis

1.1. Author of case-study and organisation

Kelsey van Maris – VITO/Energyville

Dirk Vansintjan – Ecopower

1.2. Name of REC and geographical scope

The offices of Ecopower are located in Berchem, Antwerp, which is considered a model region for Belgium (Flanders) in the COME RES project. However, the geographical coverage extends beyond the local level as the energy cooperative carries out renewable energy projects and supplies green electricity in the Flemish region and has renewable energy production installations across the entire Belgian territory. At the end of 2020, Ecopower counted 60.976 members and almost 50.000 electricity clients.

1.3. Objectives, motivation and process for establishment

The foundations for Ecopower were laid in 1983, as an initiative of a handful of citizens to finance the renovation of the hydropower installation of the watermill of Rotselaar. This watermill had been acquired by an NGO, involving Dirk Vansintjan, Relinde Baeten and Johan Hamels, in 1985. Driven by the will to set up concrete alternatives to nuclear power production after the nuclear disaster in Chernobyl in 1986, they seized the opportunity to invest in the alternative offered by the restauration of the old hydropower installation. In 1991, the citizen energy cooperative 'Ecopower' was officially established; its objectives were to unite people in a cooperative to invest in the production, and supply of renewable energy and to promote energy efficiency.

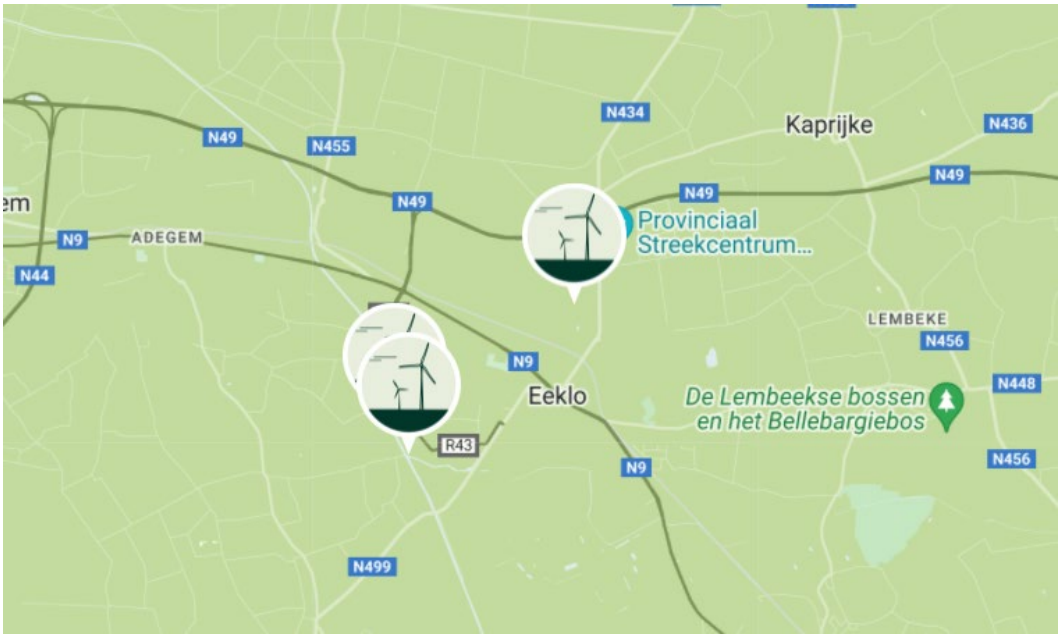
Figure 1: the watermill in Rotselaar, postcard from before 1920

Source: https://www.ecopower.be/over-ecopower/tijdlijn (Accessed on 18/03/2022)

The first milestone of the cooperative was winning the tender issued by the city of Eeklo that allowed Ecopower to build 3 wind turbines (two of 1.8 MW and one of 600 kW) in 2001-2002.

Additionally, the member basis increased from 34 to 1250 members. For the first time a dividend was paid out.

Figure 2: Location of the first 3 wind turbines



Source: https://www.ecopower.be/over-ecopower/productie-installaties/eeklo-1 (Accessed on 21/03/2022)

A year later, in 2003, the liberalisation of the energy market resulted in Ecopower applying for and acquiring a supplier license and so becoming a green electricity supplier. The number of clients grows steadily and reaches 1000 after only half a year. Ecopower sells their electricity at one all-in rate, irrespective of the location in Flanders, and does not make profits from the sale of electricity. Due to this low price for electricity, the members and equity have been growing in constant manner: now more than 60.000 members participate, 55.000 households are being supplied and 60M€ equity is invested. Ecopower produces more electricity than its members consume (106 GWh/year).

1.4. Activities and technologies

Renewable energy production[9, 10, 11]

Ecopower collects social capital from its cooperative members to invest in, install and manage various installations that produce renewable energy. For electricity, those comprise wind turbines and PV installations on public roofs, a small hydro installation and a cogeneration power plant. It started with three wind turbines in the city of Eeklo, but today the production installations are spread across Belgium (although the majority is to be found in Flanders) and was worth an injection of 106 GWh of renewable electricity in 2020. Ecopower also runs a factory that produces wood pellets and briquettes which are then sold.

[9] https://www.ecopower.be/nieuws/verslag-van-de-algemene-vergadering-van-burgercooperatie-ecopower
[10] https://www.ecopower.be/over-ecopower/productie-installaties
[11] https://www.ecopower.be/groene-warmte/onze-aanpak

Energy supply[12, 13]

Ecopower also acts as an energy supplier: it supplies its members-customers with the renewable electricity that was produced in their installations. In 2020, for the third year in a row, Ecopower produced more electricity than it could supply to its members-customers. Only members can become a customer. They have an all-in price per kWh in every grid area, with no fixed costs and no distinction between day and night rates. This way the member-customer only pays for what they use and Ecopower encourages energy efficiency. Concerning renewable heating, the supply is a bit more indirect: the wood pellets and briquettes are sold to any consumers, hence 'supplying' them with renewable heat. In 2020, 17,117 tons of wood pellets and briquettes were sold. Members have a discount.

Investing in district heating[14, 15, 16]

Ecopower also invested capital in two district heating networks: 'Warmtenet Eeklo', in the city of Eeklo and 'Warmte Verzilverd' in the municipalities Edegem and Mortsel, with the cooperation of another energy cooperative, ZuidtrAnt. Both district heating networks will be supplying to industry and businesses but also to citizens. Ecopower enables those citizens to become co-owner of the heating network that supplies their energy, when they become member of Ecopower.

Advisory role[17]

In addition to these activities, Ecopower also provides advice to members about energy topics, for example, energy efficiency in their homes, solar panels, pellet stoves or boilers.

R&D[18, 19]

Ecopower participates in various EU funded research projects (such as Interreg and Horizon 2020) on topics such as developing and validating circular solar service models and Renovation and Renewable Energy Services (ESCo-model for cooperatives).

1.5. Overview of actors and stakeholders involved

Ecopower was founded by a group of engaged citizens that wanted to contribute to the energy transition, moving away from nuclear power by setting up a concrete alternative, namely the restauration of an old hydropower installation. Currently, Ecopower is governed by its members through the General Assembly, the Board of Directors, the group of controllers, its coordinator, the rest of the managing committee, volunteers and its 54 employees. Additionally, governments and local authorities play an important role in the establishment and growth of Ecopower as they provide the opportunities to invest (e.g., the tender for windmills in the city of Eeklo in 2001). Local authorities are also important partners in research projects such as the Interreg project

[12] https://www.ecopower.be/nieuws/verslag-van-de-algemene-vergadering-van-burgercooperatie-ecopower
[13] https://www.ecopower.be/groene-stroom/prijs
[14] https://www.ecopower.be/nieuws/warmtenet-eeklo-gaat-definitief-van-start
[15] https://www.ecopower.be/nieuws/ecopower-zuidtrant-w-en-kelvin-solutions-zorgen-voor-vlaamse-warmtenet-primeur
[16] https://www.warmteverzilverd.be/overons/
[17] https://www.ecopower.be/energiebesparing/tips-voor-energiebesparing
[18] More information: https://www.circusol.eu/en/topics/demonstrators
[19] More information: https://www.grensregio.eu/projecten/rhedcoop-renovatie-en-hernieuwbare-energie-diensten-via-co%C3%B6peraties.

RHEDCOOP[20]. In 2017, the city of Leuven selected Ecopower as its strategical partner in the energy transition.

1.6. Organisational structure a decision-making model

Ecopower is a cooperative company (abbreviated in Dutch as 'cv'); according to Book 6 of the Belgian law on legal entities[21]. Ecopower is committed to the 7 principles outlined by the International Cooperative Alliance in the way they organize, manage, and develop their initiative[22] when they subscribed to the REScoop.eu Charter[23] in 2013. Ecopower is organised by two bodies: the Board of Directors and the General Assembly. There is only one category of members. Each member has one vote in the General Assembly, irrespective of the number of shares they own (there is a maximum of 20 shares per member). Shares are worth €250. There is no information on the gender balance aspect of the membership, though a lot of shares are owned by couples.

1.7. Financial and investment considerations for establishment and maintenance of REC

Financial model

The investments in renewable energy production installations are mainly financed by means of social capital (from the cooperative members) and the sale of green electricity and green certificates. The profits realised with the renewable energy production installations are used for turning out dividends to the cooperative members and for growing the reserve. It is defined by law and in the statutes of the energy cooperative that the dividend cannot be more than 6%.

Subsidies

Ecopower applies for EU funding (mainly Interreg, Horizon 2020) in the frame of research projects or pilot projects in which they can increase the implementation of renewables, or test new business models (e.g., revenue models for circular PV projects) that can contribute to their future development. These projects can be co-funded by local governments such as the province of Vlaams Brabant and the Interreg project "RHEDCOOP".

In Flanders, owners of installations producing electricity based on renewable energy sources are eligible for green energy certificates. As such, these subsidies are part of the business model of renewable energy cooperatives. However, for some categories of installations the certificate system has been phased out or replaced by an investment subsidy. For example, wind turbines between 10 kWe and 300 kWe and PV installations between 40 kWp and 2 MWp can apply for an investment subsidy through a call system[24].

2. Impact analysis

2.1. Environmental benefits

Ecopower produces green electricity from its own installations, thus contributing to the reduction of the CO2 emissions. Moreover, Ecopower contributes towards the reduction of the energy

[20] More information: https://www.grensregio.eu/projecten/rhedcoop-renovatie-en-hernieuwbare-energie-diensten-via-co%C3%B6peraties.
[21] https://www.ejustice.just.fgov.be/cgi_loi/loi_a1.pl?language=nl&la=N&table_name=wet&cn=2019032309&&caller=list&N&fromtab=wet&tri=dd+AS+RANK&rech=1&numero=1&sql=(text+contains+(%27%27))#LNKR0237.
Accessed on 08/04/2022.
[22] https://www.ica.coop/en/cooperatives/cooperative-identity. Accessed on 08/04/2022.
[23] https://www.rescoop.eu/uploads/REScoopEU_Charter.pdf . Accessed on 13/04/2022.
[24] More information on: https://www.energiesparen.be/call-groene-stroom.

consumption of its members by stimulating energy efficiency through selling their electricity at an all-in rate and organising events to interact more closely with local members or people living around Ecopower's renewable installations. By means of this social engagement, Ecopower tries to increase awareness around climate change. Almost 50% of its members have installed PV panels on their roof. Additionally, Ecopower removes waste out of the river Dijle at its watermill in Rotselaar.

2.2. Economic benefits

Ecopower supplies green electricity to its members and local society at a lower price (1,6% market share households). Moreover, when there is profit (all years since 2002, except for 2 years) a dividend goes to the members (legal maximum is 6%). In terms of the employment effects, currently 54 people work for Ecopower.

2.3. Social benefits

Ecopower brings several social benefits to the local community where it operates. To start with, its membership is open to people from different socio-economic backgrounds, including vulnerable and low-income groups. Moreover, it contributes to the reduction of energy poverty as it supplies green electricity at a lower price. Research is being carried out by the cooperative energy suppliers in the EU to help households that have a budget meter. Additionally, Ecopower is part of a research project with the city of Eeklo and Energent that focuses on lower-income groups. Finally, Ecopower contributes to social awareness raising with regards to renewable energy and climate change, as it provides information and advice to its members on renewable energy, energy efficiency and the reduction of their energy consumption (the average consumption of their members is 50% lower than that of an average household in Flanders) and organizes social community activities, such as the Energy Cafés.

3. Analysis of drivers and success factors

3.1. Contextual factors enabling success

Belgium has a long historical cooperative tradition. People are familiar with the legal structure and the cooperative principles. In 2013, REScoop.eu was created to promote the cooperative principles in the energy sector at an EU level. In Flanders, owners of installations producing electricity based on renewable energy sources (e.g., wind, solar, biomass, etc.) are eligible for green energy certificates (feed in premium system). As such, these subsidies are part of the business model of renewable energy cooperatives, guaranteeing a certain ROI. However, this system is gradually phased out or replaced by a competitive call system.

Specifically, for Ecopower, the contextual factor that enabled the start of the cooperative, was the opportunity of restoring the hydropower installation in the old watermill of Rotselaar. What stimulated the growth and real take-off of Ecopower as a cooperative, was the tender issued by the city of Eeklo that allowed Ecopower to build 3 wind turbines (two of 1.8 MW and one of 600 kW) in 2001-2002. This boosted the member basis significantly. Ecopower played an important role in the advocacy for a support mechanism for renewable energy in Flanders.

3.2. Financial and organisational factors

Following aspects of Ecopower's organisational structure and financial model are key in ensuring its success:

- Ecopower is a renewable energy cooperative that commits to the 7 principles outlined by the International Cooperative Alliance in the way they organize, manage, and develop their initiative. All citizens are eligible to join the renewable energy cooperative. After purchasing a cooperative share and becoming a co-owner of the local RES production installation(s), the members share in the profits and are given the opportunity to buy goods and services provided by the energy cooperative at a fair price. The members or cooperants participate actively in Ecopower and are part of the decision-making process through the General Assembly.
- Ecopower offers a diverse portfolio of products and services contributing to the energy transition at large, such as investments in renewable energy production (PV, wind, renewable heat, and a district heating network), supply of renewable energy, advice on energy-related matters, energy efficiency services and social awareness raising through local events.
- Ecopower applies for EU funding (mainly Interreg, Horizon 2020) in the frame of research projects or pilot projects in which they can increase the implementation of renewables, or test new business models (e.g., revenue models for circular PV projects) that can contribute to their future development.
- Ecopower collaborates with local governments that value citizen participation. The municipality can for example promote the RES project through its communication channels or create an opportunity to invest by launching a tender for PV panels on public roofs or a district heating network.
- Ecopower collaborates with other renewable energy cooperatives to reinforce each other by e.g., sharing knowledge and skills. Ecopower holds presidency and is one of the founding members of REScoop.eu, the European federation of citizen energy cooperatives. By connecting networks, they can increase their outreach and work more effectively. They see these partnerships as an opportunity to involve more citizens in the energy transition and stay anchored in the local context.

3.3. Role of local governance and local/regional leaders in implementation

Ecopower collaborates with local authorities, though there is no established infrastructure of assistance and institutional support. The collaboration can be seen as an opportunity for mutual benefits, where local authorities provide investment opportunities to Ecopower (e.g., solar roofs of public buildings, district heating network), and where Ecopower from the other hand supports local authorities to reach their commitments in frame of their local energy and climate plans. Local authorities are also important partners in research projects such as the Interreg project RHEDCOOP, and can promote the cooperative and the local RES project that is realised in their municipality via for example the local papers or information magazine.

3.4. Inclusiveness/participation/social acceptance

Ecopower has an open and voluntary membership, meaning that all citizens, including vulnerable groups, can become a member of the cooperative. Vulnerable customers can pay a small amount extra on the energy bill, that enables the acquisition of the share in two years. Finally, Ecopower supplies green electricity at low cost (currently, the lowest price).

3.5. Innovativeness

Ecopower is characterised by a broad range of activities: renewable energy production and supply, energy efficiency, and participation in (EU funded) research and development projects (e.g., on aggregation, storage, balancing, VPP), which promote the energy transition, circular economy and social innovation. Moreover, it is very actively collaborating with municipalities and especially other cooperatives (Coopkracht, Board of Cooperatives Europe etc.), striving to promote the cooperative economy. Finally, Ecopower contributed to the creation of the REScoop Federations at the Flemish, Belgian and EU level.

4. Transferability and recommendations

3.6. Transferability

In terms of the transferability of internal drivers and factors, the establishment of a renewable energy cooperative with a combined producer/supplier model could in practice be replicated elsewhere in Europe taking into account the country's or region's legislation. The legal form of a cooperative is well known and recognised both in Belgium and around the EU, which contributes to the transferability of the case. However, it has to be taken into account that renewable energy cooperatives in Flanders/Belgium can benefit from a long historical cooperative tradition.

With respect to the transferability of external drivers and factors, subsidies, grants and other types of funding for RECs could be offered in other contexts by EU, national, regional or local authorities. Of course, this will in the end depend on political willingness, budgetary constraints and policy priorities of such public support providers.

3.7. Recommendations

Based on the findings of this best practice, the main recommendation for REC initiators and developers would be to replicate the organisational and financial model of Ecopower, especially the combined producer/supplier role. Also, the transfer of the lessons learned with regard to partnerships with other RECs, local authorities and knowledge/research institutes can contribute significantly to the further development and long-term viability of a REC. In addition to local renewable energy production, a REC can also create local added value in the energy transition and "unburden" citizens in this process by organising activities such as the joint purchase of solar panels and home batteries, energy savings advise and renovation support.

With respect to local authorities, it is recommended that they include a mandatory share of citizen participation in the public tendering of RES projects. Local authorities play an important role in the establishment and growth of RECs as they are the owner of public buildings (e.g., swimming pools, sport and community centres, schools, library) and land which offer an investment opportunity. Local authorities should promote RECs and the community energy projects that are realised in their municipality to contribute to the outreach. In addition, local authorities should provide funding and subsidies that enable RECs to do research and offer energy efficiency and renewable energy services for citizens.

At the regional level, the Flemish authorities should provide a stable, transparent and adequate regulatory and enabling framework for RECs that promotes a level playing field on the energy market and facilitates their development as stipulated in the revised Renewable Energy Directive REDII.

b. ZuidtrAnt (BE)

1. Descriptive analysis

1.1. Author of case-study and organisation

Erika Meynaerts – VITO/Energyville

Sophie Loots – ZuidtrAnt

1.2. Name of REC and geographical scope

ZuidtrAnt is a renewable energy cooperative that is registered as a Renewable Energy Community (REC) at the website of the Flemish Regulator for the Electricity and Gas Market[25]. ZuidtrAnt is located in the province of Antwerp and carries out its activities in the cities and municipalities in the southern region of Antwerp (e.g., Aartselaar, Berchem, Boechout, etc.)

Figure 3: Geographical coverage of ZuidtrAnt

Source: https://www.zuidtrant.be/onze-projecten (Accessed on 15/03/2022)

As in March 2022, ZuidtrAnt had 643 members or cooperants (including the founders) who invested ca. €650,000 of social capital.

[25] In Flanders Energy Communities of Citizens (EGB) and Renewable Energy Communities (HEG) must register on the website of the Flemish Regulator for the Electricity and Gas Market.

1.3. Objectives, motivation and process for establishment[26,27, 28]

ZuidtrAnt was founded in 2013 after a series of local events in the neighbouring cities and municipalities of Antwerp brought together a group of engaged citizens that were already involved in several "transition movement groups" (i.e., repair cafés, climate events, information evenings, etc.). The key motivation for the establishment of ZuidtrAnt was the drive to act and play an active role in the transition from a fossil-based to a low-carbon society. In addition to local renewable energy production, ZuidtrAnt wants to create local added value in the energy transition and "unburden" citizens in this process by organising activities such as the joint purchase of solar panels and home batteries, energy savings advise and renovation support. Since its foundation the number of members or cooperants has increased steadily: from 120 in December 2016 to 643 in March 2022. In 2018 the cooperative hired its first employee and since June 2021 the "workforce" of ZuidtrAnt consists of 1,5 full-time equivalents and 15 volunteers.

1.4. Activities and technologies

Renewable energy production (solar roofs)[29]

ZuidtrAnt collects social capital from its cooperants to invest in, install and manage PV installations on (public) roofs, owned by large consumers for whom the investment cost is too high. The owner of the roof concludes a leasing contract with ZuidtrAnt that has ownership of the PV installation during a period of 20 years and takes care of all maintenance and repair costs. The profits realised are used to finance other sustainable (social) projects and turn out a dividend to the cooperants of ZuidtrAnt. The investments in renewable energy production installations have been growing from 1 PV project in 2017 to 17 PV projects in 2022, with a total installed capacity of 610 kWp.

Nearly zero-energy renovation

ZuidtrAnt supports citizens to renovate their houses to nearly zero-energy buildings. The aim is to 'unburden' owners and residents by supporting them in the different phases of the renovation project. An accredited coach from ZuidtrAnt carries out an audit, drafts renovation plan and provides personalized guidance during the execution of the works. For the assistance provided ZuidtrAnt receives a subsidy from the Flemish distribution system operator (DSO) Fluvius.

Joint purchase of PV panels and advise[30]

ZuidtrAnt, with support of the city of Antwerp, wants to encourage and support more citizens to generate their own solar power by providing free advice and organising a joint purchase of solar panels and home batteries.

Electric (shared) mobility (car, bicycle)[31, 32]

With the project "Deeldezon" (financed by Interreg Vlaanderen - Nederland and co-financed by the province of Antwerp) ZuidtrAnt combines solar roofs, smart charging stations, electric cars and electric bicycles to contribute to the realisation of energy-neutral neighbourhoods in its working area.

[26] https://www.zuidtrant.be/over-zuidtrant. Accessed on 16/03/2022.
[27] https://www.zuidtrant-w.be/over-ons. Accessed on 16/03/2022.
[28] https://www.warmteverzilverd.be/. Accessed on 16/03/2022.
[29] https://www.zuidtrant.be/zonnedaken. Accessed on 16/03/2022.
[30] More information: https://www.klimaatwerf.be/zonnewerf/
[31] https://www.zuidtrant.be/deeldezon. Accessed on 16/03/2022.
[32] https://www.zuidtrant.be/deelbakfiets. Accessed on 16/03/2022.

Figure 4: Electric shared mobility – project "Deeldezon"

Source: https://www.zuidtrant.be/deeldezon (Accessed on 28/03/2022)

Energy efficiency services and workshops for schools[33]

With the project "Energy Efficient at School" ZuidtrAnt measures how much energy a primary school consumes and helps to reduce its consumption. ZuidtrAnt does an assessment of the energy consumption, provides energy savings advice and organises workshops on energy and climate for the children from the third to the sixth grade.

Figure 5: Energy efficiency at the Zepplin School

Source: https://www.zuidtrant.be/energiezuinig-op-school (Accessed on 16/03//2022)

[33] https://www.zuidtrant.be/energiezuinig-op-school. Accessed on 16/03/2022.

Research and development

ZuidtrAnt participates in several EU funded research projects (such as Interreg and Horizon 2020) to explore new technologies and business models such as electric and hydrogen storage[34] and Renovation and Renewable Energy Services (ESCo-model for cooperatives)[35].

1.5. Overview of actors and stakeholders involved[36]

ZuidtrAnt was founded by a group of engaged citizens that wanted to make a change and contribute to the energy transition. Governments, and local authorities in particular, play an important role in the establishment and growth of ZuidtrAnt as they are the owner of public buildings (e.g., swimming pools, sport and community centers, schools, library) which offer an investment opportunity to ZuidtrAnt (e.g., solar roofs). In addition, they provide funding and subsidies that enables ZuidtrAnt to do research and offer energy efficiency and renewable energy services to citizens. Local authorities are also important partners in research projects such as the Interreg project RHEDCOOP[37].

1.6. Organisational structure and decision-making model[38]

ZuidtrAnt is a cooperative company with limited liability and a social purpose (abbreviated in Dutch as: CVBA-SO), according to Book 6 of the Belgian law on legal entities[39]. ZuidtrAnt is committed to the 7 principles outlined by the International Cooperative Alliance in the way they organize, manage, and develop their initiative[40]. ZuidtrAnt is organised by two bodies: the Board of Directors and the General Assembly. There is only one category of members. Each member has one vote in the General Assembly, irrespective of the number of shares they own (there is a maximum of 50 shares per member). Shares are worth €100.

1.7. Financial and investment considerations for establishment and maintenance of REC[41, 42, 43]

Financial model

The investments in renewable energy production installations are mainly financed by means of social capital (from the cooperants) and bank loans (in case of large investments, such as district heating network or wind turbines). The profits realised with the renewable energy production installations are used for turning out dividends to the cooperants and supporting the local energy transition by e.g., education, awareness raising, information provision. It is defined by law and in the statutes of the energy cooperative that the dividend cannot be more than 6%. ZuidtrAnt explicitly defined in their statutes to donate at least 15% of its annual profits projects that have a social added value (e.g., tree planting campaign) before turning out a dividend to the cooperants (this is the "SO" part, the social purpose).

A growth in the number of profitable projects is necessary to be viable in the long term and to generate a stable income flow that makes further professionalisation possible. On the one hand, ZuidtrAnt is taking action to accelerate the growth in profitable projects by opting for an increase in scale in the existing services relating to solar roofs and renovation guidance. The existing cooperation with neighbouring energy cooperatives (e.g., Zonnewind and Klimaan) is making an important contribution to this growth. On the other hand, ZuidtrAnt is also taking action to explore new services and strengthen its existing services, such as providing advice on ventilation and energy efficiency in schools (via an ESCo model) and investing in offshore wind (via a concession from the federal government). When screening opportunities, ZuidtrAnt aims to take into account not only the profitability, but also the social added value.

Subsidies

ZuidtrAnt applies for EU funding (mainly Interreg, Horizon 2020) in the frame of research projects or pilot projects in which they can explore new technologies (e.g., hydrogen, storage) or business models (e.g., shared mobility, flexibility services) that can contribute to their future development. These projects can be co-funded by local governments such as the Province of Antwerp and the Interreg project "Deeldezon".

In Flanders, owners of installations producing electricity based on renewable energy sources are eligible for green energy certificates. As such, these subsidies are part of the business model of renewable energy cooperatives. However, for some categories of installations the certificate system has been phased out or replaced by an investment subsidy. For example, wind turbines between 10 kWe and 300 kWe and PV installations between 40 kWp and 2 MWp can apply for an investment subsidy through a call system[44].

Fiscal instruments[45,46,47,48]

ZuidtrAnt made use of the tax shelter, a fiscal instrument to facilitate the raise of social capital during the first 3 operational years of the energy cooperative when there is no dividend to be paid out to the cooperants. To provide additional support to SMEs, the Flemish government grants a tax credit of 2,5% to Flemish taxpayers (natural persons) who inject fresh capital into Flemish companies (Vriendenaandeel). As a result, a cooperant of ZuidtrAnt that buys more than ten shares can apply for a tax credit of 2,5% on the invested amount for 5 years (i.e., 2,5 euros tax credit per share of 100 euros for 5 years).

[34] More information: https://h2coopstorage.eu/.
[35] More information: https://www.grensregio.eu/projecten/rhedcoop-renovatie-en-hernieuwbare-energie-diensten-via-co%C3%B6peraties.
[36] https://www.zuidtrant.be/over-zuidtrant. Accessed on 16/03/2022.
[37] More information: https://www.grensregio.eu/projecten/rhedcoop-renovatie-en-hernieuwbare-energie-diensten-via-co%C3%B6peraties.
[38] https://www.zuidtrant.be/_files/ugd/df9b44_79e0145f8e574a4d8382438bd8e98d4f.pdf (statutes). Accessed on 16/03/2022.
[39]https://www.ejustice.just.fgov.be/cgi_loi/loi_a1.pl?language=nl&la=N&table_name=wet&cn=2019032309&&caller=list&N&fromtab=wet&tri=dd+AS+RANK&rech=1&numero=1&sql=(text+contains+(%27%27))#LNKR0237. Accessed on 16/03/2022.
[40] https://www.ica.coop/en/cooperatives/cooperative-identity. Accessed on 16/03/2022.
[41] https://www.zuidtrant.be/over-zuidtrant. Accessed on 16/03/2022.
[42] Deliverable D4.2 'Report on comparative case studies' (3/05/2021) of the COMETS (Collective action Models for Energy Transition and Social innovation) project, funded by the Horizon 2020.
[43] Deliverable D5.2 'Report on Scenarios for CAIs' development' (8/10/2021) of the COMETS (Collective Action Models for Energy Transition and Social Innovation) project, funded by Horizon 2020.
[44] More information on: https://www.energiesparen.be/call-groene-stroom.
[45] More information: https://www.vlaio.be/nl/subsidies-financiering/subsidiedatabank/tax-shelter-voor-startende-ondernemingen.
[46] More information: https://www.pmvz.eu/vriendenaandeel
[47] https://www.zuidtrant.be/doe-mee-word-cooperant. Accessed on 16/03/2022.
[48] https://www.zuidtrant-w.be/investeer-mee. Accessed on 16/03/2022

2. Impact analysis

2.1. Environmental benefits

ZuidtrAnt produces renewable energy from its own energy production installations, thus contributing to the reduction of the CO2-emissions. In the project "Deeldezon" the energy cooperative is providing electricity directly from its PV-installations to the smart charging infrastructure, electric vehicles (car sharing) and e-bikes (bike sharing). As such, ZuidtrAnt contributes to environmental benefits in the realm of mobility: lowering emissions because of a fuel switch to electric vehicles, facilitating a modal shift by replacing cars with bikes, creating small mobility hubs, and also focusing on shared economy by car and bike sharing. The energy-efficiency projects in schools and nearly zero-energy renovation in residential buildings also contribute to raising awareness on energy efficiency, renewable energy and reduction of CO2-emissions. ZuidtrAnt organised a tree planting campaign (as one of their social projects) which contributes to biodiversity. ZuidtrAnt organises repair cafes with their non-profit association, ZuidtrAnt vzw, in order to put the circular economy and sustainable use of materials in the spotlight.

2.2. Economic benefits

Cooperants can have the renewable electricity produced by ZuidtrAnt's solar roofs supplied to their homes via an agreement with Ecopower, at a competitive, if not lower price. Moreover, if there is a profit realized a dividend goes to the cooperants (legal maximum is 6%). Also, economic benefits (i.e., savings on the energy bill) are generated for the owners of the solar roof and the "clients" of the energy efficiency services. In March 2022 ZuidtrAnt employs 1,5 FTE.

2.3. Social benefits

There are several examples of social benefits. One is the sharing of electricity generated from PV with the neighbourhood, another is the project of the car and bike sharing, bringing people together that would otherwise not have interacted but now are making use of the mobility hub that was created at, for example, the local library. ZuidtrAnt actively cooperates with Public Welfare Centres, social housing companies and other non-profit organisations that work with people in need. As ZuidtrAnt is a cooperative with an explicit social purpose, part of the profits (at least 15%) is invested in local projects with social added value.

3. Analysis of drivers and success factors

3.1. Contextual factors enabling success

Belgium has a long historical cooperative tradition. People are familiar with the legal structure and the cooperative principles. In 2013 REScoop.eu was created to promote the cooperative principles in the energy sector at an EU level. In Flanders, owners of installations producing electricity based on renewable energy sources (e.g., wind, solar, biomass, etc.) are eligible for green energy certificates (feed in premium system). As such, these subsidies are part of the business model of renewable energy cooperatives, guaranteeing a certain ROI. However, this system is gradually phased out or replaced by a competitive call system.

3.2. Financial and organisational factors[49, 50]

Following aspects of ZuidtrAnt's organisational structure and financial model are key in ensuring its success:

- ZuidtrAnt is a renewable energy cooperative that commits to the 7 principles outlined by the International Cooperative Alliance in the way they organize, manage, and develop their initiative. All citizens are eligible to join the renewable energy cooperative. After purchasing a cooperative share and becoming a co-owner of the local RES production installation(s), the members share in the profits and are given the opportunity to buy goods and services provided by the energy cooperative at a fair price. The members or cooperants participate actively in ZuidtrAnt and are part of the decision-making process through the General Assembly.
- ZuidtrAnt offers a diverse portfolio of products and services contributing to the energy transition at large, such as investments in renewable energy production (PV on roofs of public buildings, district heating network), nearly zero-energy renovation advise, energy efficiency services and workshops for schools on energy and climate, shared electric mobility (cars, bikes).
- ZuidtrAnt invests at least 15% of the profits in local projects with social added value and contributes as such to a fair and inclusive energy transition.
- ZuidtrAnt applies for grants in the frame of research projects or pilot projects in which they can explore new technologies (e.g., hydrogen, storage) or business models (e.g., shared mobility, flexibility services) that can contribute to its future development. ZuidtrAnt applies for subsidies at different governmental levels. In case of larger (European) grants ZuidtrAnt joins partnerships in which another partner can take up the lead of the project.
- To maintain their local identity and keep the connection with the citizens and the local context, they limit their geographical expansion or try to set up a partnership with the locally anchored energy cooperatives. It is important to have these local ties to know the local context.
- ZuidtrAnt collaborates with local governments that value citizen participation. The municipality can e.g., promote the RES project through its communication channels or create an opportunity to invest by launching a tender for PV panels on the roof of their buildings.
- ZuidtrAnt collaborates with other (neighbouring) renewable energy cooperatives to reinforce each other by e.g., sharing knowledge and skills. By connecting networks, they can increase their outreach and work more effectively. They see these partnerships as an opportunity to involve more citizens in the energy transition and stay anchored in the local context.

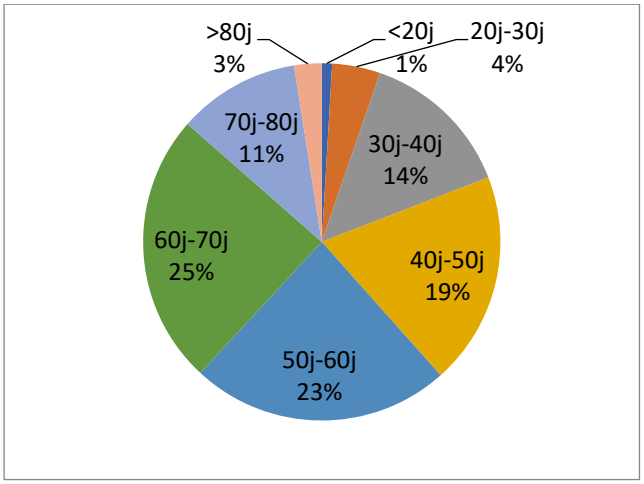
3.3. Role of local governance and local/regional leaders in implementation[51,52]

ZuidtrAnt collaborates with local authorities, though there is no established infrastructure of assistance and institutional support. Local authorities play an important role in the establishment and growth of ZuidtrAnt as they are the owner of public buildings (e.g., swimming pools, sport and community centres, schools, library) which offer an investment opportunity to ZuidtrAnt (e.g., solar roofs). In addition, they provide funding and subsidies that enables ZuidtrAnt to do research and offer energy efficiency and renewable energy services to citizens. Local authorities are also important partners in research projects such as the Interreg project RHEDCOOP. Local authorities promote the cooperative and the local RES or energy efficiency project that is realised in their municipality e.g., in local papers or information magazine.

3.4. Inclusiveness/participation/social acceptance[53,54]

ZuidtrAnt has an open and voluntary membership, meaning that all citizens, including vulnerable groups, can become a member of the cooperative. The social and inclusive aspect is very explicit in ZuidtrAnt, as its legal form implies that (at least 15% of) the profits are used for a social purpose. In March 2022 ZuidtrAnt had 643 members (including the founders) of which 67% is between 40 and 70 years old. There is no information on gender balance of the members.

Figure 6: Age distribution of the members of ZuidtrAnt



Source: ZuidtrAnt (status on 28/03/2022)

[49] https://www.zuidtrant.be/over-zuidtrant. Accessed on 16/03/2022.
[50] Deliverable D4.2 'Report on comparative case studies' (3/05/2021) of the COMETS (Collective action Models for Energy Transition and Social innovation) project, funded by the Horizon 2020.
[51] https://www.zuidtrant.be/over-zuidtrant. Accessed on 16/03/2022.
[52] Deliverable D4.2 'Report on comparative case studies' (3/05/2021) of the COMETS (Collective action Models for Energy Transition and Social innovation) project, funded by the Horizon 2020.
[53] https://www.zuidtrant.be/_files/ugd/df9b44_79e0145f8e574a4d8382438bd8e98d4f.pdf (statutes). Accessed on 16/03/2022.
[54] Deliverable D4.2 'Report on comparative case studies' (3/05/2021) of the COMETS (Collective action Models for Energy Transition and Social innovation) project, funded by the Horizon 2020.

ZuidtrAnt works together with social welfare offices and social housing companies and participates in projects that have a social aspect or focus. Examples are the renovation of a house together with the social welfare office in the municipality of Mortsel, renovation coaching for vulnerable house owners with the social welfare office of municipality of Kontich, the participation in the research project RHEDCOOP, that is testing an ESCo-model for increasing the sustainability of and installing renewable energy in family homes and social housing.

3.5. Innovativeness

ZuidtrAnt may not be especially innovative with regard to the organisational and financial model of a renewable energy cooperative. Nonetheless, being a renewable energy cooperative with an explicit social purpose makes ZuidtrAnt an interesting case with respect to inclusiveness and social acceptance. Moreover, the growth strategies applied by ZuidtrAnt, while remaining locally anchored and loyal to its initial values, can be interesting for other RECs. Also, ZuidtrAnt encourages innovative practices and business models, such as cooperative district heating, shared electric mobility, storage and hydrogen, ESCo-model for increasing the sustainability of and installing renewable energy in family homes and social housing.

4. Transferability and recommendations

4.1. Transferability

In terms of the transferability of internal drivers and factors, the establishment of a renewable energy cooperative could in practice be replicated elsewhere in Europe taking into account the country's or region's legislation. The legal form of a cooperative is well known and recognised both in Belgium and around the EU, which contributes to the transferability of the case. However, it has to be taken into account that renewable energy cooperatives in Flanders/Belgium can benefit from a long historical cooperative tradition.

With respect to the transferability of external drivers and factors, subsidies, grants and other types of funding for RECs could be offered in other contexts by EU, national, regional or local authorities. Of course, this will in the end depend on political willingness, budgetary constraints and policy priorities of such public support providers.

4.2. Recommendations

Based on the findings of this best practice, the main recommendation for REC initiators and developers would be to replicate the organisational and financial model of ZuidtrAnt, especially the explicit social purpose as it can contribute to a fair and inclusive energy transition. Also, the transfer of the lessons learned with regard to partnerships with neighbouring RECs, local authorities and knowledge/research institutes can contribute significantly to the further development and long-term viability of a REC. In addition to local renewable energy production, a REC can also create local added value in the energy transition and "unburden" citizens in this process by organising activities such as the joint purchase of solar panels and home batteries, energy savings advise and renovation support.

With respect to local authorities, it is recommended that they include a mandatory share of citizen participation in the public tendering of RES projects. Local authorities play an important role in the establishment and growth of RECs as they are the owner of public buildings (e.g., swimming pools, sport and community centres, schools, library) and land which offer an investment opportunity. Local authorities should promote RECs and the community energy projects that are realised in their municipality to contribute to the outreach. In addition, local authorities should provide funding and subsidies that enable RECs to do research and offer energy efficiency and renewable energy services for citizens.

At the regional level, the Flemish authorities should provide a stable, transparent and adequate regulatory and enabling framework for RECs that promotes a level playing field on the energy market and facilitates.

c. Grenzland Pool (DE)

1. Descriptive analysis

1.1. Authors of case study and organisation

Michael Krug, Ana María Isidoro Losada, Maria Rosaria di Nucci, Freie Universität Berlin, Research Center for Sustainability[55].

1.2. Name of REC and geographical scope

The case study covers a cluster of five community wind farms (CWF) in the rural district of Nordfriesland in Germany. These CWF form part of the so called "Grenzland-Pool" a pool of community energy projects which, in addition to the five CWFs, comprises community ground-mounted solar farm projects, green hydrogen projects as well as other projects. Nordfriesland is part of the federal state of Schleswig-Holstein, the northernmost of the 16 federal states which serves as the German model region in the COME RES project. The five community wind farms which build the focus of this case-study include:

- Community wind farm Ellhöft (year of commissioning 2000),
- Cross-border community wind farm Grenzstrom-Vindtved (2007/2009),
- Community wind farm Süderlügum (2014),
- Community wind farm Brebek (2015 and 2017),
- Community wind farm Grenzstrom Bürgerwind (2020).

The CWFs are located in the municipalities of Ellhöft, Westre and the neighbouring villages, not far from the North Sea coast and very close to the Danish border. One of the outstanding elements of the CWF Grenzstrom-Vindtved is the fact that it is a cross-border project that also involves Danish communities and not only enables the development of good neighbourly relations across the border but is also forward-looking in terms of sustainable energy use and with a view to developing joint value creation potential.

Fig. 1. The team of the Grenzland Pool Business Office

Source: © Levke Jannichsen, courtesy of Horst Leithoff

[55] The authors are grateful to Horst Leithoff, one of the managing directors of the community wind farms, for his valuable comments.

Each of the CWF is operated by an independent company. In almost all five cases the CWF share the same managing directors.

According to the latest available data, in total, 1,069 persons are participating financially as limited partners in the CWFs (Ellhöft (51), Grenzstrom-Vindtved (220), Süderlügum (400), Brebek (280), Grenzstrom Bürgerwind (260). These represent almost 25% of the residents in the respective villages[56].

1.3. Objectives, motivation and process for establishment

The generation of profits and the provision of annual disbursements to the shareholders are certainly key objectives. However, the projects are not merely based on economic efficiency rationales but pursue also social and environmental targets. The CWF appear highly beneficial in terms of local sustainable development.

The case of the CWF Grenzstrom Vindtved can be regarded exemplary for the other CFW. Creating a profitable and clean energy investment and avoiding the involvement of and dependence on external investors were among the key motivations. In addition, the generation of stable business tax revenues for the local municipalities and the strengthening of the economic power and value creation in the region were among the central motives. This was accompanied by the prospect of giving the municipalities back a certain degree of independence and freedom of action, as well as enabling those concerned to diversify their income from agricultural land. These motivations were guiding also the development of the other projects.

The idea of the CWF in Ellhöft was borne by municipal councillors and local farmers in summer 1994. The other four wind farms were partly initiated by the same persons, partly by other local actors and investors (often farmers and landowners). The initiators/managers of the Ellhöft and Grenzstrom Vindtved supported the development of the CWF Süderlügum and Brebek and were invited to perform the management of those wind farms as well. At the same time, these persons can be regarded as pioneers in the field of citizen and community wind energy in Germany.

The initiators have partly jointly, partly individually developed a number of related resp. follow up projects including the construction and operation of a transformer substation, of ground-mounted community solar farms (one commissioned in 2010, one planned) and sector coupling projects including the production of hydrogen from wind-based electricity (onsite and offsite). In the case of the CWF Ellhöft, the operating company Windpark Ellhöft GmbH & Co. KG was established in November 1995. The other four farms were established in 2005, 2007, 2009 and 2016 respectively.

[56] Leithoff, Horst (2021): Bürgerprojekte im hohen Norden (Best Practice-Beispiele). „Wind & Sonne gemeinsam nutzen“. Presentation delivered to the COME RES German Country Desk Status Meeting, 30 September 2021, available from https://come-res.eu/resource?uid=1162

Fig. 2. Community wind farm and solar farm in Ellhöft

Source: Bündnis Bürgerenergie e.V./Jörg Farys; courtesy of Horst Leithoff

1.4. Activities and technologies

The main activity of the CWF is the production of electric power and the sale of electricity based on a feed in tariff/premium. In most cases, the electricity is sold to a direct marketing company which then re-sells the electricity to the power exchange. Additionally, the operators receive a market premium from the distribution system operator. In the case of the CWF Grenzstrom Vindtved, direct marketing companies have so far been Spanish Iberdrola, Norwegian Statkraft and Nordgröön, a regional company.

Due to the expiry of the legally guaranteed remuneration (feed-in tariff for 20 years), the operators of the Ellhöft CWF have been looking for new ways to market the electricity from 2020 onwards. Being pioneers in this field, in 2018, they concluded the first Power Purchase Agreement (PPA) with the energy cooperative Greenpeace Energy eG, a green electricity and gas supplier (since September 2021: Green Planet Energy eG). The contract for the supply of wind power entered into force on 1 January 2021 and lasts five years. During this time, the operating company is going to sell its electricity to Green Planet Energy eG at a fixed price per kWh. The value can be adjusted during the term of the contract if the stock exchange prices rise above or fall below a certain threshold, with the wind farm operators and Green Planet Energy eG sharing the risks and benefits. Part of the electricity generated is going to be fed via a direct connection cable to an electrolyser where green hydrogen is produced, stored and supplied to cars with fuel cells. E-cars with battery technology may also be charged at a fast charger.

Technologies are based on wind turbines of various capacities, sizes, manufacturers and types. In the case of the oldest of the five CWF, Ellhöft, 6 x 1.3 MW turbines (Bonus) were installed[57], in the case of the newest wind farm (Grenzstrom Bürgerwind), 5 x 3.2 MW turbines (Siemens Gamesa). In the case of the CWF Grenzstrom-Vindtved, 4 x 2.3 MW turbines and 3 x 6.2 MW turbines are in operation. In each of the cases of CWF Süderlügum and CWF Brebek, 12 x 3 MW turbines are operated.

Cross-sector electricity use and hydrogen production - the case of the CWF Ellhöft – the Grenzland Energy Project

Part of the renewable electricity generated at the CWF Ellhöft is going to be used to feed a PEM (proton exchange membrane) electrolyser from H-TEC – ME 100/350 that is operated close to the

[57] Two existing AN Bonus turbines (1,3 MW) were replaced. Later, the management decided to change the type of one turbine and replaced it (1x SWT-DD-130 turbine with 4.3 MW instead of SWT-3.6-130 with 3.6 MW).

wind farm. Commissioning is planned in November 2021[58]. With a nominal production rate of 100 kg of hydrogen per day, a peak electric load of 350 kW, an overall efficiency of up to 95% using heat extraction, the electrolyser may be used on-site, directly at the wind turbine. The hydrogen produced will be used to supply a hydrogen filling station at the municipality of Westre.

The founder and managing director of the CWF Ellhöft is co-founder and one of the managing directors of the company Energie des Nordens GmbH & Co. KG (EdN), a company incorporating around regional 80 companies in the renewable energy sector. In cooperation with Greenpeace eG, EdN is currently implementing a project for the cross-sector use of electricity from renewable energies, the power-to-gas project Windgas Haurup. This envisages, inter alia, the construction and operation of an electrolyser in the municipality of Handewitt near Flensburg. The annual production volume of 3 million kWh of hydrogen is purchased by Green Planet Energy eG for its approximately 30,000 proWindgas customers. The electrolyser started regular operation in 2021 and uses surplus electricity from nearby wind turbines, also including the CWF Ellhöft. In addition, the fast-reacting electrolyser stabilises the electricity grid by keeping the electricity supply in balance with the electricity demand in the grid area by ramping up or down hydrogen production. EdN is both the project initiator of Windgas Haurup and the owner and operator of the electrolyser. The gas grid operators responsible for gas feed-in, Gasunie and Open Grid Europe, are also involved in the project implementation.

Together with other partners, the management of the CWF in Ellhöft has developed further plans for a large-scale, integrated energy park based on renewable energy sources and hydrogen production and use. The “Grenzland Energieprojekt” aims to develop a fully RES-based hydrogen value chain in the districts of Northern Friesland, Schleswig/Flensburg and the city of Flensburg. This includes hydrogen production, refinement, storage and use in novel dimensions the centrepiece being the construction of the "Grenzland Energy Park"[59]. Core element of the value-creating infrastructure is a 10 MW electrolyser. The goal is to successively expand the project with corresponding electrolysers and to supply it with renewable energy from the region. .

It is planned to operate the energy park independently of the public grid (offgrid/stand-alone operation). At the same time, it should be possible to connect the plants to the public grid to support the grid if necessary. The aim is to form an operative cluster that can jointly provide answers to questions of energy supply security and grid stability[60].

One of the key elements are the planned storage systems (hydrogen storage and battery storage), which are of crucial importance, especially regarding the system's island capability. The battery storage offers the possibility to start the system independently, without access to the public grid.

In addition, the Grenzland Energy Project plans to use the waste heat to supply farmers located in the immediate vicinity of the energy park. In this way, the by-product "heat" creates the opportunity to produce organic food in greenhouses and create new jobs.

1.5. Overview of actors and stakeholders involved

- State planning authority (responsibility for developing the regional plans designating wind energy suitable areas/priority zones) and district administrations (up to 2015 responsibility for the development of informal wind energy concepts and for proposals for the designation of wind energy suitable areas/priority zones)

[58] Personal communication with Reinhard Christiansen, managing director of the community wind farm Ellhöft, 24.11.2021.
[59] See also https://www.grenzland-energieprojekte.de; https://www.ulrich-jochimsen.de/files/Grenzland_Energieprojekt_noerdliches_SH.pdf
[60] Personal communication with Horst Leithoff, one of the managing directors of the five community wind farms, 10.05.2022.

- Initiators of the farms (landowners, local citizens etc.) and other landowners
- Citizens in their role as limited partners/shareholders
- Mayors, municipal councils in Ellhöft, Westre and neighbouring municipalities
- Companies operating the community wind farms (including general partner)
- Technical planners/developers
- Promotional banks (e.g. KfW, Landesbank Baden-Württemberg)
- Development Agency for Agribusiness and Rural Areas (Landwirtschaftliche Rentenbank) and local/regional banks (e.g., VR Bank Niebüll)
- Federal Network Agency
- Local construction companies, service providers
- Distribution System Operator (Schleswig-Holstein Netz AG)
- Wind turbine manufacturers and service companies
- Direct electricity marketing companies
- ARGE-Netz GmbH & Co. KG
- Green Planet Energy eG) and Energie des Nordens GmbH & Co. KG
- Insurance companies
- Foundation B.E.N.T.U.S.S (Citizens-Energy-Nature-Tourism-Environment-School-Social)
- Nature conservation association „Verein Naturengagement Bürgerwindparks Nordfriesland“ (NBN e.V.)
- Gasunie, Open Grid Europe (hydrogen project Ellhöft).

1.6. Organisational structure and decision-making model

Each CWF is being operated by an independent company under the legal form of a limited partnership with a private limited liability company as general partner (Gesellschaft mit beschränkter Haftung & Compagnie Kommanditgesellschaft, acronym: GmbH & Co. KG). This represents a hybrid form consisting of a private limited company (Gesellschaft mit beschränkter Haftung, GmbH) and a limited partnership (Kommanditgesellschaft, KG). It can be regarded a modification of a limited partnership in which the fully liable partner (called general partner) is not a natural person but a limited liability company with the intention of limiting the liability for the persons behind the company. The legal form allows for a broad participation. Under this model, citizens provide capital as limited partners (Kommanditisten). Local residents had the opportunity to participate directly as limited partners. Voting rights increase proportionally with the number of shares.

In practice, a GmbH & Co. KG is often organised in such a way that the management of the limited liability company also takes over the management of the limited partnership. It is appointed by the general meeting of the partnership. In contrast to the general partner, the limited partners are not personally liable with their private assets. However, in this specific model, the general partner is a limited liability company and not a natural person. Therefore, this model has the advantage that no single natural person is fully liable with its private assets. The decision-making bodies comprise the partners' meeting and the management. The partners' meeting consists of the general partner and the limited partners. Voting rights increase proportionally with the number of shares.

In the following, we illustrate the case of the CWF Grenzstrom Vindtved. The general partner is the limited liability company Grenzstrom Bürgerwind GmbH which is represented by the founders and managers of the wind farm, whereas the citizens and other actors like local SMEs act as limited partners. Important decisions are made jointly at partners' meetings. The work in the partnership is essentially based on the relationship of trust built up between the management and the limited partners. Since the managing directors live in the vicinity of the plants, there is a high level of social control. The management is usually appointed from among the investors, advised by a planning council and controlled by a supervisory board. All governance bodies are made up of limited partners of the company.

1.7. Financial and investment considerations for establishment and maintenance of REC

The CWF operators benefit from financial incentives under the Renewable Energy Sources Act (feed in tariffs/premiums). Financing was partly provided by the promotional bank KfW, the Development Agency for Agribusiness and Rural Areas and local/regional banks. In most cases, the councils of the affected municipalities have supported the projects by large majorities. The municipalities participate financially in the projects showing both their commitment and trustworthiness of the initiators.

Part of the electricity generated at the CWF Ellhöft is going to be fed via a direct connection cable to an electrolyser where green hydrogen is produced, stored and supplied to cars with fuel cells. This on-site hydrogen project is supported by the Ministry of Transport under the National Innovation Programme Hydrogen and Fuel Cell Technology (https://enargus.de/). The project Windgas Haurup is supported by the Federal Ministry of Economy and Energy under the "North German Energy Transition 4.0" (NEW 4.0) programme[61]. The project is also supported by the two state governments of Hamburg and Schleswig-Holstein with the goal to supply Hamburg and Schleswig-Holstein completely with renewable energies by 2035.

2. Impact analysis

2.1. Environmental benefits

According to the Federal Nature Conservation Act, significant intrusions of nature and landscape that cannot be avoided must be offset by compensatory or substitute measures. If such measures are not possible, monetary compensation is envisaged. Also, the operators of wind farms have to compensate for intrusions of nature and landscape. The CWF Grenzstrom Vindtved provides a Best Practice case in terms of compensatory measures providing additional environmental benefits[62]. To compensate for intrusions of the habitats of amphibians and meadow birds, the operators of the wind farm reached an agreement with the nature protection authority that payments to offset the negative impact on landscape should be spent for local nature protection measures in the community, e.g., through natural/extensive use of arable land. 22 ha of land were initially acquired in consultation with the lower nature conservation authority to be managed in a nature-oriented way. A non-profit nature conservation association (NBN e.V.) was founded by the managers of the wind farm for the maintenance and management of the areas. Its purpose is to further develop this basic stock of compensation areas into a nature conservation project that is as coherent as possible. In the meantime, ecological compensation payments from other CWF have been used to purchase additional 80 ha as amphibian and meadow bird protection areas, which in turn are leased to

[61] for more information see https://www.new4-9.de/

[62] https://ae-beispiele.fachagentur-windenergie.de/massnahmen/grenzstrom-vindtved-windpark-schleswig-holstein

farmers for nature-oriented management. The lease income is administered by the association and flows entirely into the maintenance and further development of the conservation concept.

2.2. Economic benefits

Economic benefits include the direct financial participation of citizens with relatively small shares as well as land lease payments to landowners based on a pool model and the respective diversification of income from agricultural land. The respective municipalities benefit from business tax payments (Gewerbesteuer). Further benefits include local infrastructure development (e.g., road construction, broadband infrastructure) associated or still to be expected with CWFs, as well as technology innovations and developments (e.g., hydrogen production) and the associated potential local value creation and job creation. Additional economic benefits result from the involvement of local enterprises and regional banks. In addition, there is benefit sharing via donations, in-kind benefits and foundations to support social projects.

For four of the five CWF (without Grenzstrom Bürgerwind), total dividend payments in 2020 reached 9.1 million EUR. In the case of the CWF Ellhöft, shareholders did benefit from annual returns on investment of up to 12 to 16 %[63]. To avoid conflicts among landowners, sophisticated pool models have been developed that also enable those landowners in the vicinity of the wind turbines whose land was not directly earmarked for the construction of wind turbines to benefit from the lease payments. For four wind farms (without Grenzstrom Bürgerwind), total land lease payments in 2020 reached 1.7 million EUR[64].

Usually, the local municipalities hosting the CWF benefit from annual local business tax payments. The revenues are generally allocated fairly between the municipalities, as for instance in the case of Brebek, according to their respective share of the installed capacity. As a rule, the business tax revenues are not set aside for any special purposes, but form part of the general budget of the municipalities. For the four wind farms, total business tax payments in 2020 amounted to 1.9 million EUR[65]. In Germany, however, the municipal fiscal equalisation scheme (kommunaler Finanzausgleich) allows that usually only part of the tax revenues remain in the municipalities.

In the case of the CWF Grenzstrom Vindtved, each limited partner receives an annual distribution of approximately 5,000 EUR. Since there are 200 limited partners, the purchasing power of the region is increased by about 1 million EUR which means a significant increase in purchasing power for the structurally weak region of Northern Friesland.

The initiators of the CWFs have developed a number of further CWF and ground-based PV projects in the region including the cross-border project Grenzstrom Vindtved. The managers are highly committed to link the energy transition with a sustainable mobility transition based on electric battery vehicles and vehicles with fuel cell drive. They launched a sector coupling project which envisages the cross-sector use of electricity based on an electrolysis facility and hydrogen filling station. Wind power-based hydrogen can be regarded a new product which opens up new markets, including mobility.

In all five cases, local construction companies were at least partly involved in the construction works. The operators of the CWF in Ellhöft pursued a consequent local contracting strategy, not only for the construction of the wind farm, but also for planning, financing, maintenance etc. Furthermore, in most cases, local/regional banks were involved for securing debt capital.

[63] See https://edison.media/ertraeumen/ellhoeft-ein-wind-dorf-setzt-auf-wasserstoff/23627132.html

[64] Leithoff, Horst (2021): Bürgerprojekte im hohen Norden (Best Practice-Beispiele). „Wind & Sonne gemeinsam nutzen". Presentation delivered to the COME RES German Country Desk Status Meeting, 30 September 2021, available from https://come-res.eu/resource?uid=1162

[65] Ibid.

The CWF Ellhöft and Grenzstrom Vindtved helped to create regional jobs. So, a Siemens service station was established in Northern Friesland. An engineering company set up a field office for the maintenance of substations in the neighbouring village. Another engineering company was able to expand its technical operations management department.

2.3. Social benefits

The operating companies provide in-kind benefits to local environmental and social associations and initiatives. This can be illustrated by the example of the CWF Grenzstrom Vindtved. The company managers set up the Foundation BENTUSS (capital contribution 70,000 EUR), which is intended to support social purposes and energy-saving measures including PV based street lighting at bus stops and school routes. The acronym of the foundation is Bürger-Energie-Natur-Tourismus-Umwelt-Schule-Sozial meaning Citizens-Energy-Nature-Tourism-Environment-School-Social. This charitable (non-profit) foundation provides benefit sharing opportunities to those households which cannot directly participate, e.g., due to financial constraints. The wind farm also invested in the development of a local broadband network. It provides regular donations to local and regional associations including Lebenshilfe, for children's festivals, the fire brigade etc. Grenzstrom Vindtved was the first wind farm in Germany to publish a Common Good Balance Sheet, a form of corporate sustainability reporting.

In the case of the CWF Ellhöft, the operators of the plant supported the development of a new recreation area in the community, as well as a hiking, riding and bicycle path. The operating company also supported the development of a local broadband network. Each household obtained a connection worth 1,200 EUR free of charge[66]. Further, the community is supported by the wind farm operating company through donations in kind (e.g., renewal of community roads, improvements to local childrens' playground).

In the case of the Brebek CWF, the operators committed themselves to dedicate a certain share of the revenues towards social projects, as not all citizens were able to benefit directly from the wind farm through their shares. This includes the purchase of a van for the local food bank ("Tafel"), support to a volunteer organisation distributing food to people in need, and high-speed Wi-Fi for public use.

For four of the five wind farms (excluding Grenzstrom Bürgerwind), a total of 600,000 EUR has been paid in 2020 for such social and infrastructural purposes in the region[67].

3. Analysis of drivers and success factors

3.1. Contextual factors enabling success

Aspects such as a high degree of procedural and distributive justice as well as a well-founded trust in the initiators/managers are among the success factors to be particularly emphasised. The benefit for the entire community through benefit-sharing measures is also among the important contextual factors enabling success.

[66] Sorge, Nils-Viktor (2016): Schleswig-Holstein - Wie Windkraft ein 113-Seelen-Dorf reich machte. Spiegel Online 22.02.2016.

[67] Leithoff, Horst (2021): Bürgerprojekte im hohen Norden (Best Practice-Beispiele). „Wind & Sonne gemeinsam nutzen". Presentation delivered to the COME RES German Country Desk Status Meeting, 30 September 2021, available from https://come-res.eu/resource?uid=1162

3.2. Financial and organisational factors

The ownership models are quite similar in all five cases. Each CWF is operated by an independent company that is fully owned and operated by local residents and organisations.

In the case of Grenzstrom Vindtved, the initiators/founders are acting as managing directors of the wind farm. Together they do not hold more than 3% of the shares. No investor could purchase more than 5% of the shares in order to avoid that individual investors gain control or exerting influence over the company. All limited partners are participating on more or less equal terms. In the case of Grenzstrom Vindtved, which included a repowering project, the owners of those wind turbines which were dismantled were offered significantly higher shares reflecting the residual value of their dismantled assets. Initially, each limited partner was allowed to acquire maximum one business share (1 business share: EUR 26,000 = 26 voting shares). The company belongs 100% to the citizens of the region. The profits of the company flow directly to locally anchored limited partners, none of whom has a determining influence on the company. There is no capital fund or institutional investor involved in the company.

3.3. Role of local governance and local/regional leaders in implementation

In all cases the municipalities (mayors, councils) played a key role as facilitators and supporters of the projects. As a rule, the municipalities are also financially participating in the wind farm projects. The municipalities participated financially in the project to show its commitment and the trustworthiness of the initiators.

On the political-administrative level, the commitment and support of the municipalities as well as favourable political and regulatory framework conditions (feed-in tariffs/premiums under the Renewable Energy Sources Act provide long-term investment security) constitute important success factors.

3.4. Inclusiveness/participation/social acceptance

The projects are not only based on economic efficiency rationales but aim to pursue social and environmental objectives. The local municipalities participate financially, a fact that shows commitment and trustworthiness of the initiators/operators. None of the five projects faced any serious opposition from local citizen groups. One of the factors that ensured community support and acceptance from the very beginning was that the whole community could benefit from the projects, not just the landowners and founding shareholders. The community members were continuously informed and there is a relatively high level of identification with the projects among the local residents. However, a high level of community acceptance does not mean that there were no administrative barriers. In almost all cases planning of the community wind farms was accompanied by political, administrative, regulatory and planning obstacles which could be finally overcome.

With regard to local and regional involvement, the CWFs attaches great importance to continuous accessibility for the public. Thus, the operation of an information pavilion in cooperation with a neighbouring Danish wind farm and the installation of bilingual information boards are intended to give interested citizens the opportunity to inform themselves about current developments. Furthermore, both the wind farm and the information centre are integrated into the border concept "Cultural-Historical Adventure Cycle Route".

Local residents had the opportunity to obtain shares and participate directly as partners with limited liability. In order to enable many citizens to participate financially, it was possible to buy shares from 500 EUR. In the other cases, similar minimum amounts were required (e.g., community wind farms Süderlügum and Brebek: 1,000 EUR).

Low-income households benefit mainly indirectly from the trade tax revenues (Gewerbesteuer), and directly from in-kind benefits, donations or the disbursements of local foundations like the BENTUSS foundation which receives parts of the revenues of the wind farm. Part of the revenues is used to support charitable and social projects.

The authors lack information about the individual shares of low-income households, vulnerable households, women, persons with migration background, or disabled persons as limited partners in the community wind projects.

3.5. Innovativeness

The managers of the CWF belong to the pioneers in Germany in the field of citizen/community wind energy. The CWF Ellhöft is among the first CWF in Germany and the first wind farm to conclude a Power Purchase Agreement after expiry of the financial support period of 20 years. Furthermore, the wind farm is a frontrunner in the field of sector coupling and the cross-sector use of electricity for hydrogen production.

Grenzstrom Vindtved is the first cross-border wind farm in Germany and represents one of the first wind energy repowering projects in Germany. It was also the first wind farm in Germany to publish a Common Good Balance Sheet. The wind farm owners were among the first in Germany to set up a community foundation disbursing a certain share of wind farm revenues for social purposes and energy saving measures (Foundation BENTUSS). Another innovative element is that the managers founded a local non-profit nature conservation association for the management of the ecological compensation activities of the wind farm and other CWF. The managers are among the initiators of a voluntary label for “fair wind farm developers” in Schleswig-Holstein. They also developed a scorecard for managers/members of community wind farms in Germany to self-assess their business activities.

This best practice stands out because it is especially forward-looking in its overall concept. Recently, targeted initiatives by the managers of the CWF Ellhöft have been bundled to set up the so-called Grenzland Energy Project. The aim of the project is to map the entire hydrogen value chain: generation, infrastructure, mobility and industry. It starts with the production of hydrogen from wind and solar energy supplied from the community farms in proximity, but also includes the vision to provide the infrastructure for the island grid including storage, superconductivity, filling plant and trailer system. In the area of mobility, targeted offers for public transport and freight forwarders are to be expanded and the expansion of the filling station network is to be initiated. In addition, the integration of industry through tube-storage transport and pipeline to Flensburg.

With the current geopolitical developments and the expected shifts on the global energy market and a politically forced expansion of renewable energies, community projects combining wind and photovoltaics with electrolysis will gain in importance in Germany, especially in view of the National Hydrogen Strategy adopted in 2020.

3.6. Other

Among the notable factors that have led to CWF's success is the requirement that every resident or landowner should have the opportunity to become a member of the operating company. Another success factor is the fact that the entire community benefits from the wind farm, not just the landowners and founding shareholders. Thus, the site communities benefit from the business taxes paid by the wind farm operators. The aim is not only to make a profitable, clean energy investment, but also to strengthen the regional economy and promote local value creation.

4. Transferability and recommendations

4.1. Transferability

Replicability of the illustrated CWF showcases is limited, also in a German context, due to the different frame conditions today (i.e., auction system based on competitive bidding replaced feed-in tariffs/premium system). Long-term investment security for small players including community groups is no longer given as under the price-based support scheme. The showcases provide examples for grassroots initiatives under specific socio-economic, planning and regulatory frame conditions and actor constellations. They are certainly not transferable 1:1 but must be accommodated to the specific context.

There are several elements which have model character, and which may be more easily transferable. Providing funding for civic associations or non-profit foundations can serve as a model for other regions, including other COME RES target or model regions, especially where direct financial participation of citizens/municipalities is difficult, e.g., due to financial constraints.

Replicability of the PPA model as in the case of the Ellhöft wind farm is high at least in the German context. PPAs provide a promising business model for wind farms which are no longer eligible for remuneration based on the Renewable Energy Sources Act. In 2021 alone, 4,400 MW of wind power generation capacity in Germany will be affected by the expiry of the 20 years support period, and by 2025 this will be around 16,000 MW. Without having a perspective for the sales of the electricity, many of these plants would need to be dismantled.

Sector coupling projects based on power to gas or power to heat may offer promising business cases with high replication potential in regions with a high production of renewable energy including wind energy. With the recently adopted Ordinance to the Renewable Energy Sources Act (Erneuerbare-Energien-Verordnung, EEV) of 14 July 2021, the federal government took measures to make hydrogen production based on electricity from RES more attractive.

The Ellhöft wind farm and the Grenzland Energy Project planned with the other wind and PV communities are forward-looking examples of how the production of hydrogen could be organized via renewable energy communities also in other regions and countries. The expansion of locally generated energy to sustainable and locally produced hydrogen offers enormous potential for local value creation and regional business models. Through the smart combination of several individual renewable energy projects, virtual power plants are being developed that will make important contributions to grid stabilisation and supply security. In the long term, they will even be able to enable black start capability of smaller regions.

The direct proximity to Denmark and local communities can be seen as an extremely positive aspect in the area of spill-over effects. This connection and proximity enable direct cooperation with Danish partners and the international transfer of know-how and best practices.

4.2. Recommendations

Recommendations for REC initiators and developers

- Ensure the commitment of the municipality and local decision-makers
- Ensure that the entire community benefits from the renewable energy projects not just the landowners and founding shareholders.
- Contribute to strengthen the local/regional economy and to promote local added value creation.

- Ensure that low-income and vulnerable households can also benefit from a REC, at least indirectly. For those households, even minimum shares of 500 EUR are usually not affordable. Consider to create effective benefit sharing mechanisms including foundations, funds, association disbursing parts of the revenues to social/environmental purposes.
- In order to ensure acceptance, trust and trust building measures are key. The latter may also comprise voluntary actions going beyond the legally required minimum.

Recommendations for policymakers

One of the key success factors in the showcases above was the favourable policy and regulatory framework (particularly feed in tariffs/premiums under the Renewable Energy Sources Act guaranteed for 20 years and providing long-term investment security; low interest loans offered by public promotional banks).

National level

- Fully transpose the RED II with its provisions for RECs
- Assess the barriers and potentials for RECs as requested by the RED II
- Remove administrative and other barriers for RECs and establish an effective enabling framework pursuant to Art. 22,4 of the RED II
- Make use of the European de minimis rules and exempt RECs from auctions/competitive bidding or alternatively create separate bidding segments exclusively for RECs
- Enable energy sharing and the possibility for members of a REC to use and share electricity from their own plants.
- Monitor the development of RECs

d. Energy City Hall REC-1 (IT)

1. Descriptive analysis

1.1. Author of case-study and organisation

Gilda Massa - ENEA

1.2. Name of REC and geographical scope

The REC is named the Energy City Hall REC-1 due to the facts that the photovoltaic panels are installed on the building of the city hall and that it is the first REC of the municipality.

Energy City Hall REC-1 was established by the public administration of Magliano Alpi on 18th December 2020. Numbering 22,300 inhabitants over an area of 32.6 km², Magliano Alpi resides in the province of CUNEO, in the COME RES model region of Piedmont, Italy.

Figure 7 - PV installation on City Hall.

Source: website of the municipality of Magliano Alpi

The municipality of Magliano Alpi is the coordinator and main prosumer of the REC, having made available a 20kWp photovoltaic system, which is installed on the roof of the town hall. Members of the REC comprise the municipality and several private consumers (five families, a library, a gym and schools), who benefit from community services. The mayor is the president of the community, which helps increase confidence in the initiative that is replicating itself as a model in other contexts. Many citizens and small enterprises have asked to become partners, but due to the current MV/LV substation constraints they were unable to join REC-1. Consequently, two new RECs, REC-2 and REC-3 have been established.

REC-1 and REC-2 are aimed at guaranteeing the self-sufficiency of the city hall, the library, the gymnasium and the municipal schools, and exchanging surplus energy with the participating families and small enterprises (which include craftsmen, businesses and professionals who benefit from community services). REC-3 is composed entirely of private members. REC-2 and REC-3 were established at the end of 2021, with an overall PV worth €60,000, involving 7 prosumers and 40 users.

1.3. Objectives, motivation and process for establishment

The main goal for the municipality was to reach the objectives of the Clean Energy for all Europeans Package and it has therefore included in its strategic programming document (DUP) the development of innovative models of territorial development based on energy. This aims to combe the advantages of the so called Superbonus, which provides attractive fiscal incentives for renewable energy communities. To reach this goal, on 28th April 2020, the municipality agreed to the "Manifesto of the Energy Communities for an active centrality of the Citizen in the new energy market", promoted by the Energy Centre of the Polytechnic University of Turin. The focus was on the centrality of the citizen-prosumer and of the Community, as local aggregator, to offer services to its members and bring socio-economic benefits to the local people.

Following the steps defined in the Manifesto, the activity started with a funding of €100,000 photovoltaic panels installed on the city hall, and energy meters that were placed in private apartments, a gymnasium and a library. Now, it is not only private citizens that are involved in the REC, but also local technicians and artisans. Having a wider audience such fosters the narrative of the REC acting as an engine of change towards a green economy.

REC-2 and REC-3 were founded at the end of 2021, providing clear examples of how the model of Energy City Hall could be duplicated thanks to:

- the special competences in Innovative business models,
- digital platform to manage RECs,
- management of RECs in Cities

  and specific designed tools.

Starting from this experience and the three assets described, the REC has joined, as a Living Lab/Testbed, the Smart Grid Interoperability Lab of the Joint Research Center (JRC) of the European Commission[68]. In the context of JPP ERA-Net SES, Living Labs are considered as user-centred and open innovation ecosystems, often operating in a territorial context (e.g., city, region), integrating concurrent research and innovation processes (co-creation), and potentially relying on a public-private-people partnership. Living Labs are expected to support the energy system developers with validation capabilities related to customer/user value of a new service and/or business model design, among others. Furthermore, Testbeds are understood as technological testing, piloting and demo-infrastructures which are connected to a real-life energy system. Testbeds are expected to support the energy system developers with validation capabilities related to technical feasibility and/or interoperability of new technological innovations, among others.

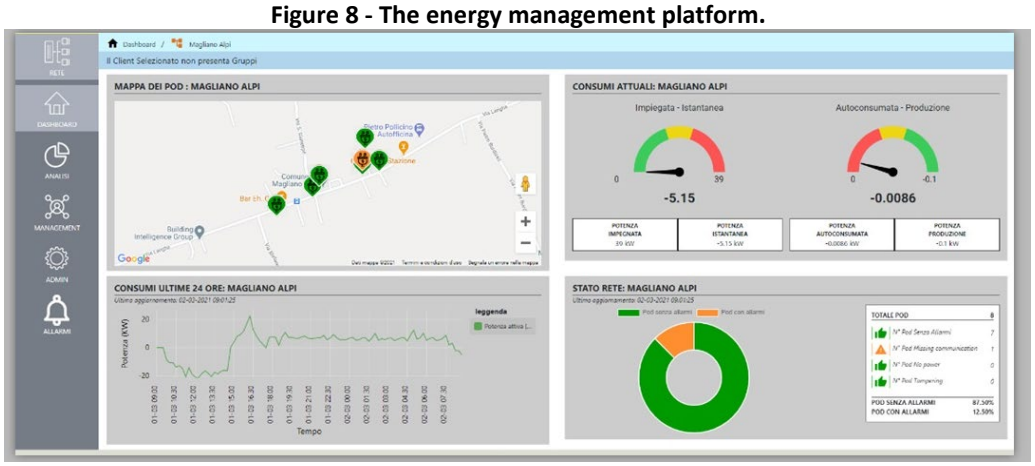
1.4. Activities and technologies

Energy City Hall REC-1 employs technology in the form of PV solar energy generation facilities and two e-mobility charging facilities. A 20kWp photovoltaic system is installed on the roof of the city hall, with the system connected to the building's electricity Point of Delivery (POD). The energy produced and not consumed can be shared with the REC. The two EV charging stations will also be connected to the same system, which can be used free of charge by residents.

The municipality bought the smart meters, which were linked to all the PODs participating in the REC. In parallel with the calculations of the shared energy that the GSE (Italian DSO) will provide, there is a management platform for the analysis of production and consumption energy flows and the management of all energy services.

[68] https://www.eranet-smartenergysystems.eu/Partners/Living_Labs

Figure 8 - The energy management platform.



Source: https://cermaglianoalpi.it

Energy City Hall REC-1 has signed a collaboration agreement with an innovative start-up, an autonomous association of people and public organizations and companies voluntarily united to meet their common economic, social and cultural needs, as well as their aspirations, through a jointly owned and democratically controlled company. The cooperative works for the sustainable development of local communities through choices and solutions approved by its members[69].

1.5. Overview of actors and stakeholders involved

The main actors of Energy City Hall REC-1 are the municipality of Magliano Alpi, the Energy Centre of Politecnico di Torino, local families and small enterprises.

The municipality has the role of promoter, acting in line with its strategic plan and building retrofit and energy communities for value creation and territory revitalisation following the pandemic. The municipality being the leader secures an element of trust that assures stability and facilitates the participation of citizens and SMEs.

Two additional RECs have been established to resolve the technical constraints that limited further accession to REC-1. The Energy Centre is the technical partner for the development of the REC. It aims to build networks at the national and European level, to incentivise the development of new entrepreneurial initiatives in the energy sector via opportunities presented by academic research, innovation and partnership. Companies, R&D business units and public administrations have the opportunity to collaborate, thanks to an atmosphere that encourages their interaction and involvement in scientific innovation and the various social, technological and managerial issues related to energy.

The main stakeholders are Energy4COM[70] and GO-CER (Operational Group - Renewable Energy Communities). Energy4COM is an innovative start up involved in the technical-operational management of activities. The cooperative is engaged in a process of technological and social innovation for a change based on strategies and ideas that satisfy the economic and social development of the reference communities. Meanwhile, GO-CER, a label of Esolution s.r.l, raises citizen awareness around the advantages of energy communities and advises them on local companies and professionals. Thanks to its wide territoriality and participation several actors, GO-

[70] https://energy4com.eu/

CER is able to trigger impactful environmental, economic and social benefits for not only producers and consumers of the REC, but also for the wider area concerned. The stakeholder technically and operationally supports the dissemination of the knowledge developed in Magliano Alpi, to the benefit of other municipalities and business throughout Italy.

1.6. Organisational structure a decision-making model

Energy City Hall REC-1 is organised as an association, with its president the Mayor of Magliano Alpi. It has a Technical Scientific Committee, which addresses and supports technical issues related to the REC's constitution. The Committee is made up of the President, an expert in innovative business models for the energy transition, and six members:

- A member of the Italian Government
- A professor of the University of Naples Federico II
- An SME representative
- GD Comunità Collinare del Friuli
- A JRC expert
- An expert in insular energy systems

GO-CER acts as an operational arm, which, with the support of the Technical Scientific Committee, favours the creation of local supply chains of professionals and business to ensure that the planning, construction and management activities are local in character and stimulate value creation in the context of a recovering economy post-pandemic.

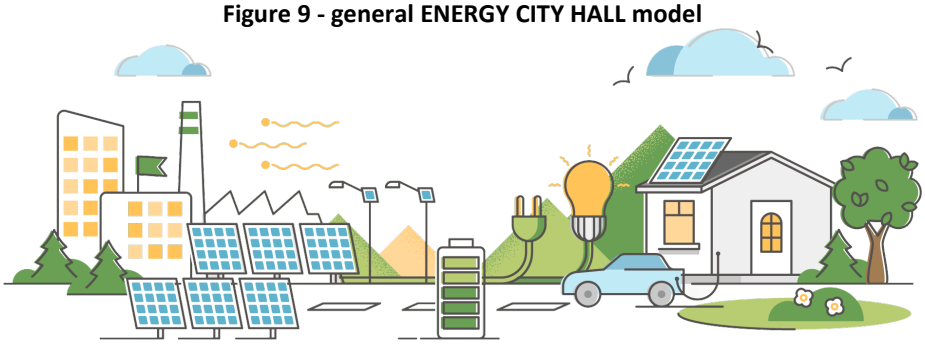
Designers and installers, together with communication and marketing experts, form the Operational Group, with the aim of reaching a large number of private citizens, companies and organisations.

1.7. Financial and investment considerations for establishment and maintenance of REC

The business model of Energy City Hall REC-1 is "Public Authority (PA) driven", in that it is based on an initiative that originates from a public entity (in this case, a municipality) and installs renewable generation plants on a PA building, with the excess energy shared with other users, be they residential users, tertiary, commercial or other public buildings, while respecting the boundary constraints imposed by the law. In this model, alongside the "user driven" model, the PA will turn to external suppliers of technologies and services to the extent that these are necessary for the creation and management of the community.

Utilising a first investment of €100,000, the municipality of Magliano funded the PV installation on the roof of the city hall and bought smart meters to collect and manage data from PODs of the members using the REC. The enlargement of the REC was achieved thanks to a public-private funding of €80,000 for the part concerning the sporting centre, while the industrial facility was financed with €50,000 of private capital.

Figure 9 - general ENERGY CITY HALL model



Source: https://www.abbassalebollette.it/impiantifotovoltaici-news/arriva-la-prima-comunita-energetica-italiana-a-magliano-alpi/

The RECs are starting a cooperation with the Smart Grid Interoperability Lab of the Joint Research Center (JRC) of the European Commission and with the Smart Cities & Communities Laboratory of ENEA, with local energy utilities and several cities that requested support to design, create and manage their own RECs. Pricing will be based on the service/work contribution requested. The test of services, tools and technologies will generally be for free, provided the information outcome is shared. Technical support, data mining and meeting with stakeholders will be priced on a case-by-case basis.

2. Impact analysis

2.1. Environmental benefits

The environmental benefits are due to the reduction of energy consumption. Producing and using electricity more efficiently reduces both the amount of fuel needed to generate electricity and the amount of greenhouse gases and other air pollutants.

It is estimated that the community will be able to save up to 30% of electricity consumption. A charging station for electric vehicles is made available for free for REC members.

2.2. Economic benefits

Energy cost reduction is the main benefit for citizens involved and a percentage of the profit margins will be shared with REC-1 and REC-2 (coordinated by the municipality), to secure necessary resources for coping with energy poverty and providing additional services to citizens. The RECs are also catalysts for local short-supply chains, which have high added value, alongside high cognitive and technological value. The fact that the RECs involve not only private citizens, but also local SMEs, designers and technicians, means that this wide membership promotes the development of the REC within the municipality and the sharing of the model to other municipalities and stakeholders.

2.3. Social benefits

The municipality is supporting the creation of a “COG “(Community Operational Group), a cooperative entity that aims to create a “short supply chain of technicians, designers, installers and maintenance workers”. The RECs therefore represent the catalyst for this process of skill aggregation on the territory, essential for creating development and jobs in the post-pandemic phase.

Among the benefits of RECs, there is a significant reduction in the cost of energy. This reduction will also be conveyed through fair and supportive initiatives to significantly reduce the costs of bills for

the vulnerable classes. Fighting energy poverty by sharing surplus of production with families of vulnerable classes in one of the main aims of local authority.

3. Analysis of drivers and success factors

3.1. Contextual factors enabling success

The enabling factors for a PA-driven model are based on several strategic choices and political developments. The municipality of Magliano Alpi has included in its Single Programming Document (DUP) the development of innovative models of territorial development based on energy, with the aim of combining the advantages of the Superbonus with incentives for renewable energy communities.

The municipality has also joined the "Manifesto of the Energy Communities for an active centrality of the Citizen in the new energy market", promoted by the Energy Centre of the Polytechnic of Turin. Thanks to the incentives already available today for the private sector in the energy field, it is possible to create replicable local projects with added value, favouring their aggregation and creating initiatives that exceed the dimensional thresholds of interest for "large" investors (typically a few dozen million euros). Municipalities, thanks to a responsible use of the resources made available by the State for the transition in the period 2021-2023, can acquire enabling technologies and facilitate the aggregation of renewable energy communities, operating as innovation catalysts for their territories.

3.2. Financial and organisational factors

The municipality of Magliano Alpi is quite complex in relation to its territory and its members involved in the REC; it also shows characteristics of territorial limitation and governability, and is able to operate as a local system devoted to catalysing change and assuring technological and organisational replicability.

Within the new paradigm for energy management, buildings (public, residential, corporate) represent a key element: energy efficiency associated with self-production systems of electricity creates a bidirectional flow of energy between the building and the grid. The aggregation of buildings within a territory can therefore enable private investment thresholds. Bringing together groups or single buildings of a community with innovative (smart) criteria enables them to become "nodes" of an "energy community", making possible new and profitable economic and financial processes.

The investment made to date has exceeded €200,000 and it is notable that it started with an entirely public investment and subsequently an entirely private investment supported the industrial facility. The involvement of citizens and small enterprises in the role of prosumers and users is a growing trend, the last step of which saw the presence of seven prosumers and 40 users.

The governance structure of the association is adequate to manage the decisions of the REC and to plan future growth actions, as well as to promote new interventions in the area. The mayor in his position as president of the association guarantees trust and facilitates the interest of an increasing number of citizens. The membership fee is €25/year.

3.3. Role of local governance and local/regional leaders in implementation

The role of municipalities is central, particularly in the case of Italy with its administrative fragmentation. This fragmentation is an asset, as it facilitates the communication and involvement of citizens, thanks to the proximity between voters and their elected representatives.

The role of municipalities is central, especially in Italy, whose administrative fragmentation in this case is a value because it facilitates communication and involvement of citizens thanks to the proximity between voters and elected representatives. Energy City Hall REC-1 is a PA driven project, which assures citizens to have confidence in the feasibility of its activities. Furthermore, the involvement of an active and conscious public actor can help speed up the authorisation process related to technical installation. As well as the mayor's role as president of the REC, they are also a member of the industry commission of the Senate of the Republic is in the Technical Steering Committee.

3.4. Inclusiveness/participation/social acceptance

Interested applicants can download and complete the form readily available on the website of the municipality. Anyone is able to be an REC prosumer, provided that they have a photovoltaic system built after 1st March 2020 that is connected to the same secondary transformer substation in a specific geographical area (due to technical constraints); if this is not the case, they can still participate as a consumer. Consumers affected by energy poverty can be supported by the RECs; they are connected to the local grid of the REC (dependent on specific boundary constraints) and the extra energy produced by community-owned PV is also shared with them.

Citizens' participation continues to grow, with the expected establishment of two new RECs, REC-4 and REC-5, in 2022. This is an indication that the model implemented is successful and that, above all, the benefits in the economic, social and environmental fields are recognised as valid by citizens and small businesses, who decide to invest and play an active role in the management of energy resources.

3.5. Innovativeness

The municipality of Magliano Alpi proposes itself as a "Pilot Territory", where new business models and new financial products can be effectively tested, according to a "bottom-up" approach that starts from the systematic enhancement of the citizens and small enterprises. Energy City Hall REC-1 provides added value in the form of the innovative business model supported by an energy data management through a digital platform.

The RECs are equipped with an IoT platform to manage energy flows and to allocate shared energy to its members, according to specific rules and requirements tailored to sustainability approaches[71]. The energy communities pursue the objective of providing environmental and socio-economic benefits, in addition to energy related ones, for their members and for the local communities in which they are located. The goal is to change the market by bringing the production and distribution of electricity back into the hands of citizens.

4. Transferability and recommendations

4.1. Transferability

The birth of four new energy communities starting in 2020 highlights that the model chosen is certainly replicable. In terms of transferability, it is necessary to consider all the elements that make up the best practice and place them in the context of reference.

[71] https://www.qualenergia.it/articoli/comunita-energetiche-presentazione-prima-magliano-alpi/
https://www.ilsole24ore.com/art/inaugurata-magliano-alpi-prima-comunita-energetica-d-italia-ADMM5iPB

The governance structure and the business model in place in Energy City Hall REC-1 are elements for transferability. A transfer model will require the analysis of relevant factors, particularly the central approach and role of the municipality is an interesting line for analysis, as well as the steps leading to its creation, strategic documents, and the method of identifying the site and users.

External factors are the technologies in place, data collection and the IOT platform with which the energy production and consumption data are managed. In any transfer plan, it will be necessary to take into account not only the strengths of the Energy City Hall REC-1 project but also the opportunities and threats, as external factors. National or regional legislation are further elements for which transferability cannot act as a direct level. Instead, the project will be able to directly enforce the strengths that characterise it.

4.2. Recommendations

Based on the findings of this best practice case, the main recommendation for REC initiators and developers would be to replicate the innovative business models, and to use a digital platform to manage RECs with specific designed tools. The use of such tools means that private citizens, companies, and public bodies can easily view what occurs when they opt for instant self-consumption. Furthermore, they will be able to enjoy a number of benefits. Firstly, reduced energy bills will be brought about by the fact that energy communities make electricity a common resource, with the aim of maximising the consumption of internally produced energy. This also leads to a cost reduction in the charges related to energy transportation and systems. Additionally, using renewable resources reduces the emissions of greenhouse gases, while the community will also benefit from tax concessions made available by the government for all those who build photovoltaic systems.

Regarding local authorities, they can raise citizen awareness of the energy community approach via driving business models or having an active role in the governance structure. It is necessary to have a specific policy programme and action plan to manage public land and buildings used by RECs, while the environmental impacts of its activities must also be assessed. Administrative and technical support is required to speed up internal procedures for photovoltaic panel installation and other technological solutions exploiting renewable, as well as for the interventions that involve the infrastructure of the electricity grid in the municipal area, where the PA and the DSOs are the main actors.

e. Energy communities in apartment buildings (LV)

1. Descriptive analysis

1.1. Authors of case-study and organisation

Ivars Kudreņickis, Gaidis Klāvs (Institute of Physical Energetics) and Aija Zučika (Latvian Environmental Investment Fund)

1.2. Name of REC and geographical scope

The REC has been established in the village of Jaunmārupe, within the municipality of Mārupe, the first municipality in Latvia to implement energy community pilot projects. The municipality is located on the outskirts of the capital city, Riga, and had around 21,000 residents in 2020. These energy communities cover two apartment buildings and can therefore be labelled as micro-scale projects. Their small geographical coverage is due to their pilot nature, which aims to show the potential for citizens' cooperation through the two autonomous energy communities. The specific location of these pilot RECs is:

- A multi-apartment building (18 apartments, 30 households) in Mazcenu alley (aleja) 15
- A row-houses building (6 sections-apartments) in Lielā iela (Lielā street) 160

1.3. Objectives, motivation and process for establishment

The key motivations for the establishment of the REC were (a) reducing the expenditures of energy for residents as participants of REC, and (b) acting in a climate-friendly way, promoting a green lifestyle, and reducing CO2 emissions.

The design and establishment of the energy communities have been carried out within the framework of two EU Interreg Baltic Sea Region programme (2014-2020) projects: Co2mmunity (Co-producing and co-financing renewable community energy projects) and its follow-up extension Energize Co2mmunity (Real-life implementation of renewable community energy projects)[72]. The project partners are the Riga region planning authority and the municipal government of Mārupe. The Ministry of Economics has also actively followed the implementation of the pilot projects.

The implementation of the pilot projects followed three phases:

1.3.1. Awareness-raising, promotion of social acceptance of the concept of REC to local society: starting in 2018, several events and discussions were held within the framework of the Co2mmunity project in order to raise awareness about energy communities and involve citizens, stakeholders and experts in the project[73].

1.3.2. Construction of the RECs' facilities: in 2019, a feasibility study gave green light to the projects and the two apartment buildings were selected after a comparative analysis of several potential sites[74]. Part of the reason for the final choice was residents'

[72] Energize Community; project website https://co2mmunity.eu/

[73] Co2mmunity project activities in Mārupe municipality: https://www.marupe.lv/lv/viedie-risinajumi/projekts-co2mmunity

[74] Feasibility study on the possibilities for energy efficiency improvement and renewable energy in Mārupe municipality" (*"Priekšizpēte par energoefektivitātes uzlabošanas iespējām un atjaunojamās enerģijas uzlabošanas iespējām Mārupes novadā*"), by IK "eBIOpower" within the Co2mmunity project, December 2019, https://rpr.gov.lv/wp-content/uploads/2020/04/2-Eso%C5%A1%C4%81-situ%C4%81cija-M%C4%81rupe-Co2mmunity-LAT.pdf

awareness, enthusiasm, and willingness to engage and cooperate. Rooftop solar panels (PV and heating) were installed in 2020.

1.3.3. Subsequent dissemination of experience and results of the project: in September 2020, a meeting was held to inform the residents of the municipality of the pilot projects' results. The regular municipal newsletter, received by the residents in their mailboxes, was supplemented by a booklet which encouraged them to consider using alternative energy sources. In September 2021, the talk-show festival "Green, Independent and Powerful" was held in the courtyard of Jaunmārupe Primary School and was dedicated to the development of RECs. During the festival, visitors had the opportunity to listen to the experiences of residents who have already introduced renewable energy production facilities into their households. The festival was attended by representatives from the municipal government of Mārupe, the Solar Energy Association, the Wind Energy Association, the Alliance for Cross-Sectoral Sustainable Development, guest lecturer Christian Andersen (Germany) and others[75]. Also, in April 2022, a discussion on energy communities has been organized within the Mārupe Green Festival.

1.4. Activities and technologies

The activities in the energy system include electricity generation for self-consumption that partially covers residents' energy demand and electricity exchange with the grid. The technology used is solar panels (PV and heating). This has been chosen based on the outcomes of interviews with residents and in cooperation with experts because of its technical simplicity and economic viability.

The three-storey multi-apartment building counts 4 PV panels (1.32 kWp, expected annual production of electricity of 1.3 MWh) and 18 solar thermal panels (27 kW, expected annual production of heat energy of 20 MWh)[76]. The produced electricity is used to cover electricity consumption in the common areas of the apartment building (not for consumption in individual apartments); the produced heat energy is used for pre-heating of hot water for the needs of all residents (the building is connected to the district heating system).

The row-houses building counts 6 rooftop PV systems, each with 4 PV panels with an individual capacity of 330 W. Each PV panel system has its own inverter connected to the inner power grid of the particular section of the row-houses building. Thus, the total PV system comprises 24 PV panels with a total capacity of 7.92 kWp (expected annual production of electricity of 7.8 MWh)[77]. In annual terms, it covers around 30% of annual consumption, and there is net zero electricity supply from the grid in summer months. The produced electricity is used also for the charging of electrical vehicles owned by residents of the row-houses (two vehicles by summer 2021).

[75] Mārupe renewable energy festival: https://co2mmunity.eu/news ; https://rpr.gov.lv/marupes-pilotprojekts-marupe-municipality-pilot-lat-eng/

[76] Data on installed solar heat panels and solar PV panels in multi-apartment building: https://www.marupe.lv/lv/viedie-risinajumi/atjaunojami-energoresursi/sarazota-saules-energija-dati/saules-panelu-sistema

[77] Data on installed solar heat panels and solar PV panels in row-houses building: https://www.marupe.lv/lv/viedie-risinajumi/atjaunojami-energoresursi/sarazota-saules-energija-dati/saules-panelu-sistemas

Figure 10. Rooftop solar facilities at the multi-apartment building

Source: https://rpr.gov.lv/marupes-pilotprojekts-marupe-municipality-pilot-lat-eng/

1.5. Overview of actors and stakeholders involved

Key stakeholders in supporting the pilot projects include the homeowners' associations, which function as the legal and organizational vehicle for residents' cooperation. The regional planning authority of the Riga region assumed the leadership and management role, while the municipal government of Mārupe conducted awareness-raising activities, consultations on legal and technical aspects, and discussions involving all parties. Highly qualified experts contracted by the Riga region planning authority through the Co2mmunity project also played a role. At the same time, the presence and contribution of energy sector professionals living in Mārupe needs to be free-of-charge technical consultations for the pilot projects. The representatives of NGOs, such as the Solar Energy Association, and solar energy companies, have contributed to the development of technical solutions[78].

1.6. Organisational structure and decision-making model

The homeowners' associations function as an organisational structure for the REC, on the basis of "one apartment (member) – one vote". Only apartment owners of the specific building can join the community.

With respect to legal forms, the two pilot projects differ. In the case of the multi-apartment building, the homeowners' association has the legal form of a registered NGO[79], according to the provisions of the Latvia's Associations and Foundations Law[80]. Pursuant to this law, the administrative bodies of an association are the members' meeting (supreme body) and the executive body (board); in addition, other administrative bodies may be provided for as well in the

[78] The interview with the leader of the *Co2mmunity/ Energize Co2mmunity* projects in Latvia

[79] Association "Mazcenu 15". National Lursoft register: https://company.lursoft.lv/lv/mazcenu-15/40008177448

[80] Associations and Foundations Law, (*Biedrību un nodibinājumu likums*), https://likumi.lv/ta/id/81050

statutes of the association. The energy community is therefore legally considered as an activity of the NGO. As the support of 51% of members of the association was required for the installation of rooftop solar panels, the head of the association carried out individual meetings with the apartments' residents explaining the expected benefits. After that, a decision was made at the general meeting[81]. In the case of the row-houses apartment building, owners did not have the association registered as an NGO. Therefore, the status, competences, conditions, and procedures for decision making by homeowners is regulated by the Law on Residential Properties, chapter III "Community of Apartment Owners"[82]. The decision to install the solar PV panels was approved unanimously at the general meeting of the homeowners' community.

Since the installation has been financed by the EU Interreg Baltic Sea Region programme, and in order to comply with the rules of this EU programme, a tripartite agreement was developed. The owner of the equipment (the Riga region planning authority) lends them to the municipal government of Mārupe, which in turn transfers the use to the homeowners' associations, which agree to maintain the equipment.

1.7. Financial and investment considerations for establishment and maintenance of REC

The investment has been publicly financed through a combination of EU funds (Energize Co2mmunity project, 85% of the total) and national funds (15%). The investment cost of each pilot project has been around €15,000 (VAT included). No investment was provided by residents, although they must cover maintenance costs.

2. Impact analysis

2.1. Environmental benefits

Apart from CO2 emissions reductions, additional environmental benefits include reduced air pollution as a result of the decrease in combustible fossil fuels consumption.

2.2. Economic benefits

The key economic benefit is the rebates on the energy bills of residents. Installation of solar PV panels particularly on the row-house building improves knowledge on grid-supplied electricity tariffs scheme and thus promotes the change of electricity consumption habits[83].

2.3. Social benefits

The main social benefit is the residents' increased awareness about the possibility of jointly implementing renewable energy projects. Cooperation of apartment building residents for joint solar energy technologies, especially PV panels, installations is a new phenomenon in Latvia. Importantly, the pilot project in the row-houses building clearly demonstrates the benefits of cooperation compared to individual actions. Namely, all solar PV panels are placed on the roof of the central building of the row-houses, which is the most efficient site from an economic point of

[81] Renewable energy in Mārupe municipality: Experience stories: interview with Pāvels, pilot project in multi-apartment building (*Atjaunojamie energoresursi: pieredzes stāsti: Mārupes iedzīvotājs Pāvels*), https://www.marupe.lv/index.php/lv/viedie-risinajumi/atjaunojami-energoresursi/pieredzes-stasti

[82] Law on Residential Properties (*Dzīvokļa īpašuma likums*), https://likumi.lv/ta/id/221382

[83] Renewable energy in Mārupe municipality: Experience stories: interview with Jānis B, pilot project in row-houses building (*Atjaunojamie energoresursi: pieredzes stāsti: Mārupes iedzīvotājs Jānis B*), https://www.marupe.lv/index.php/lv/viedie-risinajumi/atjaunojami-energoresursi/pieredzes-stasti

view. In contrast to a case in which PV panels were individually placed on the roof of each of sections of the row-houses building, due to both the orientation and restrictions on the use of roofs, total electricity produced would be lower.

3. Analysis of drivers and success factors

1.1. Contextual factors enabling success

A very important reason for the choice of the buildings was the building residents' community culture and willingness to engage in a joint partnership. For instance, the residents of the multi-apartment building, before the REC project, already had 10 years of cooperative experience in maintaining and exploiting the building through the homeowners' association. In both cases there is a local leader – a motivator within the residents' community who has knowledge on energy issues as well as project management skills. The existence of local leaders is a crucial success factor. Another factor of the success is the residents' ability to co-operate with the municipal government.

For both cases, the possibility to act in an environmentally friendly way was an important driving factor. In March 2021, a local survey examined the environmental attitudes of the local residents of Mārupe. The results illustrate the importance that factors like the use of renewable resources, climate and environment, and the promotion of green lifestyle have for citizens[84].

Infrastructural factors also played a role. The installation of roof-top solar technologies is understood as a way of further developing and upgrading the buildings' technical performance. The row-houses building is a relatively new one. The multi-apartment building was built in 1981 and has been renovated in 2018, thus the installation of roof-top solar technologies can be regarded as the continuation of the building's good management practice. The types of roofs for both buildings do not require large scale additional technical constructions to install solar roof-top technologies.

[84] Results of 2021 local survey: https://www.marupe.lv/index.php/lv/viedie-risinajumi/atjaunojami-energoresursi/aptaujas-rezultati

Figure 11. Rooftop solar facilities at the row houses building

Source: https://rpr.gov.lv/marupes-pilotprojekts-marupe-municipality-pilot-lat-eng/

1.2. Financial and organisational factors

A key organisational success factor was the existence of an appropriate legal form for cooperation within the scale of the apartment building, provided by Latvia's legislation. With respect to financial factors, access to public funding (EU and national) was key, as well as the implementation and ownership model created by public authorities (see section 1.6). Additionally, the role of highly experienced experts-consultants with regards to the choice of the technical solution and well-based economic justification has been important.

1.3. Role of local governance and local/regional leaders in implementation

The involvement of the municipal government, including its strong leadership role, was the most important success factor, as it created trust for the energy community concept and helped to communicate the benefits. Mārupe positions itself as a green municipality focused on smart solutions and actively organises public campaigns regarding green energy. Mārupe adopted in 2020 its Sustainable Energy and Climate Action Plan (SECAP) under the Covenant of Mayors. Green Energy Weeks were organised in September 2020 and 2021, and recently, in April 2022, the Mārupe Green Festival took place.

Throughout the Co2mmunity project, a range of events were organised to involve both the particular communities of pilot projects' buildings and the public in general. Importantly, the concept of energy community was discussed not only within the citizens' audience, but in the wider context. The municipal government provided strong leadership and involved all parties in the discussion, what allowed for the use of the expertise of high-level professionals, NGOs and local businesses/associations. The residents' communities could count on the expertise of specialists of

the municipal government. All supporting parties - representatives of the region, municipality, experts and technology companies - took part in the meetings with local residents, thus confirming the willingness of all parties to support the implementation of the REC pilot projects.

There is no institutional infrastructure supported by the government to consult for REC development. Nonetheless, the Riga region planning authority is very interested in the development of energy communities and is looking for ways to support it. Even after finishing the project, collaboration between the Riga region planning authority and the Mārupe municipality continues.

1.4. Inclusiveness/participation/social acceptance

All residents of the particular apartment buildings participate in and benefit from the described pilot projects. The activities in the frame of the Co2mmunity project helped to ensure social acceptance and participation. In 2018, a local survey was conducted and a discussion on the development of community energy projects was organised. It showed there was high interest in using innovative solutions to reduce energy consumption in residential buildings. A range of events were organised to involve both the residents of apartment buildings and the public in general. In September 2019, a series of meetings and discussions were held with the Co2mmunity project's experts, the municipal government and a wide range of stakeholders. Crucially, since October 2020, the real-time electricity generated through the installations is monitored and made publicly available. This promotes the concept by sharing its results with wide audience and effectively disseminating the pilot project experience.

1.5. Innovativeness

Being the first REC pilot projects in Latvia, they are highly innovative in terms of technology and organization. The pilot projects show a possible pathway and set out measures for the implementation of further REC (pilot) projects in apartment buildings.

The social innovation created by the pilot projects is the promotion of community thinking and identity. This could lead to the development of similar local initiatives in other sectors. Information on community projects (not only in the field of energy) is scarce and illustrates that community projects are still underdeveloped in Latvia.

4. Transferability and recommendations

2.1. Transferability

Transferability of external factors is high, particularly in the national context. The described pilot projects show a roadmap (possible pathway and set of measures) for the implementation of other REC (pilot) projects in apartment buildings. The pilot projects highlight the role of municipal government policies, local leaders and contextual aspects for the success of the REC.

Regarding the transferability of internal factors, it should be considered that (a) different technical or economic solutions may be appropriate for certain apartment buildings and therefore a feasibility study before REC development should be based on a case-by-case basis, and (b) the pilot projects have benefitted from very specific EU funding (horizontal EU programme), something that is highly unlikely for future projects and the widespread adoption of RECs. At the same time, the investment co-financing from the national EU Cohesion Policy Programme or national green investment scheme, as the more known financial programmes, might be possible at least for continuing of REC pilot projects.

The Riga region planning authority contracted in 2021 a study to develop energy community projects in multi-apartment buildings[85]. In this study, several other possible sites were identified. SWOT and economic-technical feasibility analyses were carried out for three different types of apartment buildings. This analysis has been submitted to the Ministry of Economics to serve as a source of information in the development of both regulatory and financial support instruments.

As underlined by this study, electricity sharing already could be provided in those apartment buildings which have a single connection point to the power distribution grid. Although such apartment buildings constitute a minority of the total, this shows that the technical framework exists to implement several pilot projects if residents are willing and motivated to engage in cooperation.

In general, transferability of the case is closely linked with the establishment of an overall enabling framework for RECs. The transposition of the RED II including a legislative framework for renewable energy communities (planned amendments to the Energy Law) as well as the transposition of IEMD provisions regarding citizen energy communities (planned amendments to the Electricity Market Law), including relevant governmental regulations to be issued pursuant to these Laws, are crucial for the REC development in Latvia. Among others, there should be defined the overall support mechanism for RES-electricity purchasing and provided the delegation of the function of the REC development management to specific state authority. There should be a diversity of REC support instruments.

2.2. Recommendations

The following success factors could be recommended to replicate:

- political leadership of municipal government,
- cooperation between different levels of administrative governance (in this particular case it was the cooperation between regional planning authority and municipal government),
- embedding REC development in a wider context by involving all local parties/stakeholders,
- the previous experience of co-operation among the residents, the already existing self-organisation form of residents and the local leader,
- availability of public funding to secure REC development,
- using diversity of instruments (informative, economical, etc.) to promote the REC concept in the local society.

[85] "Study on the identification of projects for RECs and their technical and economicin feasibility evaluation: final version" (*Atjaunojamās enerģijas kopienu projektu identificēšana, to īstenošanas tehnisko un finansiālo aspektu novērtējums: gala versija un pielikumi*), by Sia "eBIOpowers" within the Energize Co2mmunity project, 2021. Presented in the experts on-line workshop organized by the Ministry of Economics and Riga Planning Region, 26th October 2021.

f. Røverkollen housing cooperative (NO)

1. Descriptive analysis

1.1. Author of case-study and organisation

Karina Standal – CICERO

1.2. Description and geographical scope

The community energy project Røverkollen is a housing association that has installed rooftop PV panels on the parking building (for residents' private cars) and a battery for storage. The main purpose is to provide electricity for charging Electrical Vehicles (EVs) of residents. The system is complemented by a smart EV charging system. Røverkollen is a housing cooperative[86] established in 1974 and consists of 246 apartments/shareholders in 5 buildings. Røverkollen is situated in the North-Eastern part of the city capital Oslo, in Norway. Røverkollen is part of the suburb Romsås which was developed as an expansion of Oslo after the Second World War. Most buildings in Romsås date back to the late 60s early 70s. The community energy system was established in conjunction with the H2020 project Green Charge in September 2018.

Figure 1. Rootop PV at Røverkollen housing cooperative

Source: Courtesy of Knut Bjørheim/Teknisk Ukeblad

1.3. Objectives, motivation and process for establishment

The overall objective of the Røverkollen community energy system is to provide environmentally friendly electricity for charging residents' EVs at reduced costs. However, there were motivational drivers implicated in the decision.

[86] Housing cooperative (Borettslag in Norwegian) is a legal entity in Norwegian law: A housing cooperative is similar to the legal form cooperative but is subject to the law on housing cooperatives: (in Norwegian): https://lovdata.no/dokument/NL/lov/2003-06-06-39).

One main driver was the anticipated regulations that require housing associations to provide charging infrastructural for EVs. These regulations were signalled in (and later implemented) as a response to municipal and government incentives for EVs for private transport and the rapid increase in EVs in Norway, especially urban areas. In August 2021, 8 out of 10 new cars sold in Norway where EVs. In order to achieve ambitious emission targets, up to 200,000 electric cars must be charged in Oslo. And when 70 per cent of the inhabitants live in an apartment, a significant development of charging infrastructure is needed. Røverkollen had previously installed 4 charging stations in the outside parking area (open to residents and others).

Another main driver associated with the coming regulations on charging infrastructure for EVs were the anticipated increased electricity costs for the housing cooperative and residents. In housing cooperatives all shared expenses are billed in a monthly rent. Electricity costs have traditionally been considered low in Norway and there is no electricity demand gap for renewable electricity generally. However, electricity prices are expected to rise considerably as fossil fuels are phased out in Europe. In addition, a new grid tariff will be implemented in 2022. The new grid tariffs will make it more costly for consumers with high electricity consumption, such as housing cooperatives that have many residents that charge their EVs at home. Further, the grid tariffs will make it more costly to consume energy during peak loads (such as the afternoon). EV charging in the afternoons will likely coincide with such peaks.

The last, and perhaps most decisive driver was the participation as a pilot site in the EU H2020 project Green Charge. The Green Charge project aims at developing and testing out innovations for making local zero emission transport systems based on electric vehicles running on renewable energy[87]. These innovations include technologies, business-models and user knowledge. The Green Charge project commenced in September 2018 and will end in February 2022. For Røverkollen the participation in the Green Charge project meant that a considerable part of the costs was covered by the project. In addition, the participation enabled knowledge resources through collaboration with important actors such as the Oslo municipality and national and international research community.

The decision to participate in the Green Charge project was taken at the level of the housing cooperative steering board. Such boards are comprised of residents elected by a majority of vote among other residents at general assembly. Normally, large investments in housing cooperatives are decided in general assembly meetings, but building upgrading is considered as operation and management and thus can be decided directly by the steering board.

1.4. Activities and technologies

The technology utilised in Røverkollen is an integrated system with rooftop PV, battery storage and EV charging system accommodating for 230 EVs. With favourable solar conditions the installed rooftop PV capacity is about 72 kW, with an annual generation of about 55,000 kWh[88]. The battery helps shave the power peaks, but also to contribute with lower kW price for own production. The consumption is in the evening and at night and the production is in the day. Excess produced electricity is sold out to the grid. In winter there is no production, but the battery is used to shave power peaks. On each floor of Røverkollen's garage, there is therefore a distribution box. When many EVs are charged simultaneously the power is distributed evenly for all cars. In order to better assess electricity production and electricity needs, the facility at Røverkollen also receives weather data. Every 15 minutes, the weather forecast is updated for the next 24 hours, and based on this and expected consumption, a plan for power management is made over the next 24 hours.

[87] For more information please see the project website: https://www.greencharge2020.eu/
[88] https://magasin.oslo.kommune.no/byplan/lade-bilen-hjemme-ja-takk#gref (In Norwegian)

An important part of the Røverkollen system and its function as a Green Charge research pilot is the implemented smart EV-charging system. This system provides research data on residents EV charging practices. This EV charging system is based predictive planning. The residents provide information on when they need their EVs charged in a mobile App. This allows the system to balance input from the produced electricity and the needed electricity consumption from the grid to ensure optimal energy efficiency and avoiding peak demand. In other words, residents will not experience 'slow' charging when many EVs are charging at the same time (depleting the grid capacity), but instead the EVs are charged 'chronologically' according to the time preference indicated by the residents.

1.5. Overview of actors and stakeholders involved

The main stakeholders involved in the Røverkollen energy system are the community of residents and the housing cooperative steering board (also residents). The system is based on residents providing needed information for it to work optimally. Further, the steering board constitute the main actors responsible for operation and maintenance, at least when the Green Charge project is ended in 2022.

Other actors involved are the consortium partners in the Green Charge project. The project is coordinated by the Norwegian research institute SINTEF. The other Norwegian partners are the municipality of Oslo and the University of Oslo. The consortium partners also include relevant tech companies; ZET -Zero Emission Transport, E-Smart Systems, (AI systems) and Fortum Charge and Drive (power company).

1.6. Organisational structure a decision-making model

Røverkollen is a housing cooperative (Borettslag (BRL) in Norwegian), which is a common legal form for many residential apartment buildings in Norway. A housing cooperative is similar to the legal form cooperative but is subject to the law on housing cooperatives (see footnote 1). The law on housing cooperatives states that shareholders should be natural persons (with some exceptions) and all household members constitute one share only. Each household owns a share in the housing cooperative. The housing cooperative is managed by a steering board of elected residents. The shareholders' democratic rights are safeguarded through the annual general assembly where major decisions are made. Residents own their apartments but pay a monthly housing rent to the housing cooperative. The housing rent consist of shared costs for electricity and heating consumption, operation and maintenance of buildings, mortgage costs and other services provided to residents.

1.7. Financial and investment considerations for establishment and maintenance of REC

The details of the investments and costs for Røverkollen are not public information. A significant part of the investment costs was covered by the Green Charge project.

2. Impact analysis

2.1. Environmental benefits

It is difficult to estimate the precise environmental impact of Røverkollen community energy system. Norway's electricity production is approximately 98% renewable, however, Norway imports fossil-based electricity from Europe when energy demand is high (or prices low). Increased local PV electricity production thus potentially decrease the need for electricity import during sunny days in spring, summer and autumn. The main environmental impact is in postponing a grid upgrade

as more and more of private transport in Røverkollen, and the Oslo area, is electrified. Further, the aim to shave peak loads will also reduce the need for grid upgrades. The significance Røverkollen makes in this case is also the research knowledge Røverkollen provides as a pilot site in the Green Charge project. If this knowledge can facilitate the uptake of similar models in the Oslo area (or urban Norway) the future environmental impact is potentially high (avoiding grid upgrades and fossil-based electricity import).

2.2. Economic benefits

The community energy system provides residents with a low-cost resource (solar PV) for charging their EVs. The information on reduced costs is not publicly available and will vary significantly according to electricity prices. However, in the winter season 2021/2022 electricity costs in Norway has had a dramatic increase due to a combination of lack of water in the hydropower basins and increasing energy costs in Europe. The increased costs are calculated to 127 % increase during the last 12 months[89]. In addition, the geopolitical conditions and the war in Ukraine is aggravating and prolonging the situation (even if water basins fill up). The economic costs to households have been high and devastating for low-income households. For housing cooperatives, the increased costs may have serious negative impact.

Further, new price mechanisms for grid tariffs (as described earlier in section 1.3) will be introduced. The new grid tariffs will make it more costly for consumers with high electricity consumption, such as housing cooperatives that have many residents that charge their EVs at home. Further, the grid tariffs will make it more costly to consume energy during peak loads (such as the afternoon). EV charging in the afternoons will likely coincide with such peaks. The Røverkollen system is designed to reduce peak loads and thus enable reduced grid tariff costs for the residents/housing cooperative.

2.3. Social benefits

One apparent social benefit for the Røverkollen community energy lies in its potential to reduce costs that enable residents' life quality. Further, as the energy system also provides economic benefits for the housing cooperative the financial gain can be distributed to other dimensions such as building or landscape upgrades, sports and children's facilities etc. Further, the local energy production and participation in the Green Charge project has potential for building sense of community and shared environmental identity.

However, the main social benefit for models such as Røverkollen is how energy upgrades of buildings often provide other consequential effects such as greater living comfort, environmental private transport and associated housing value increase. Low-income urban households in Norway often live in old housing cooperatives with low housing value. Public support for renewable community energy in housing cooperatives thus enable social distribution. However, there are potential negative social consequences also. The decision-making process of majority vote of residents in the general assembly means that residents that do not want to be part of the community energy cannot opt out. New residents that just made a considerable investment buying their apartment or low-income residents will perhaps have the greatest difficulty in covering the increased shared costs to come.

[89] Statistics Norway, electricity prices: https://www.ssb.no/energi-og-industri/energi/statistikk/elektrisitetspriser (In Norwegian)

3. Analysis of drivers and success factors

3.1. Contextual factors enabling success

Some contextual factors have had an impact on the establishment of Røverkollen community energy.

As mentioned in section 1.3 one main driver was government ambitions for electrification of the transport sector. In order to achieve ambitious emission targets, up to 200,000 electric cars must be charged in Oslo. Since 70 per cent of the inhabitants live in apartments, significant development of charging infrastructure is needed. The right to charge an EV and rechargeable hybrid car is now statutory for housing associations as directed in the Housing Cooperative Act (section 5-11a) and Ownership Section Act (Section 25a). These regulations were signalled in (and later implemented) as a response to municipal and government incentives for EVs for private transport and the rapid increase in EVs in Norway, especially urban areas. In August 2021, 8 out of 10 new cars sold in Norway where EVs. The Røverkollen steering board had already set up four charging stations in the street parking area before the established their own electricity production. At the time they decided to participate in the Green Charge project the demand for EV charging was not high in Røverkollen, but they anticipated that it would increase.

Another main driver were the anticipated increased electricity costs for the housing cooperative and residents. As described in section 1.3 and 2.2 electricity costs have traditionally been considered low in Norway, but electricity prices have for long been signalled to rise considerably as fossil fuels are phased out in Europe. In addition, the government of Norway has for several years signalled that new grid tariffs will be implemented in January 2022 (now delayed to June 2022). The new grid tariffs will make it more costly for consumers with high electricity consumption, such as housing cooperatives that have many residents that charge their EVs at home. Further, the grid tariffs will make it more costly to consume energy during peak loads (such as the afternoon). EV charging in the afternoons will likely coincide with such peaks. The anticipated increase in energy costs made the investment more relevant for Røverkollen.

3.2. Financial and organisational factors

The organisational form of the Røverkollen community energy is the legal form of a housing cooperative. A housing cooperative is similar to the legal form cooperative but is subject to the law on housing cooperatives (see footnote 1). The law on housing cooperatives states that shareholders should be natural persons (with some exceptions) and all household members constitute one share only. Each household owns a share in the housing cooperative. The housing cooperative is managed by a steering board of elected residents. The shareholders' democratic rights are safeguarded through the annual general assembly where major decisions are made. Residents own their apartments but pay a monthly housing rent to the housing cooperative. The housing rent consist of shared costs for electricity and heating consumption, operation and maintenance of buildings, mortgage costs and other services provided to residents. There is a considerable decision-making barrier for housing cooperatives to become community energy projects. For Røverkollen, the fact that the decision could be made by the steering board alone reduced this barrier.

The financial details of Røverkollen community energy are not public information but the financial support directed from the Green Charge project reduced investment cost barriers.

3.3. Role of local governance and local/regional leaders in implementation

The Oslo municipality had a central role in the Green Charge project and thus also an instrumental role in the establishment of Røverkollen. The Oslo Municipality is a partner in the Green Charge

consortium and led a work package on 'Pilots in Living Labs'. These pilots were Røverkollen, as well as pilots in the cities of Barcelona and Bremen (smart charging and car sharing of electrical vehicles). Their role as work package leader meant that they coordinated the work on all three pilots. The municipality also contributed with economic support for purchasing PV panels, stationary battery and charging equipment.

3.4. Inclusiveness/participation/social acceptance

The Røverkollen community energy project is only open to the residents of Røverkollen (246 apartments) and not to other households in the area. There are several housing cooperatives in the suburb area where Røverkollen is located. The experience of Røverkollen could potentially promote this model also to neighbours. Due to the housing cooperative model residents that do not want to be part of the community energy cannot opt out. A major barrier for the acceptance of such models are the financial costs to residents. Most often, large investments of this kind have to be decided on in the general assembly through majority vote. Investments in renewable community energy is long-term, but for many housing cooperatives the turnover rate of residents is high, making it difficult to gain support for such decisions. If the community energy made a considerable reduction of electricity costs or increases the associated housing value the acceptance probably increase. New residents that just made a considerable investment buying their apartment or low-income residents will perhaps have the greatest difficulty in covering the increased shared costs to come. As found in D2.3 Synthesis report of case studies on divers and barriers in five selected regions getting acceptance for community energy in housing cooperatives often depend on 'local champions' that have particular skills in technology and leadership.

3.5. Innovativeness

The community energy system at Røverkollen is a pilot living lab in the H2020 Green Charge project which combines RES-based electricity production, storage and smart EV charging. It is an innovative approach to addressing multiple local needs and societal goals (increased production of RES electricity, facilitating the uptake of EVs and reduced emissions from transport, cost-efficient home charging facilities for residents in apartment buildings with limitations in the local grid, smart EV charging systems which can help avoid peak demand and costly grid infrastructure investments). The pilot will provide knowledge on this form of energy systems in urban Norway. In terms of social innovation, the project brings together residents in the Røverkollen housing cooperative.

4. Transferability and recommendations

4.1. Transferability

The community energy model implemented in Røverkollen is highly relevant for urban housing cooperatives in Norway taken the framework conditions concerning political commitment to electrifying the transport sector and the increased electricity costs. Several housing cooperatives and associations have already initiated renewable community energy projects similar to Røverkollen.

In terms of the transferability of internal drivers and factors, the establishment of a renewable energy community like Røverkollen (PV electricity production and smart charging of EVs) could in practice be replicated in housing associations or housing companies elsewhere in Europe (depending upon legislation/regulations). The present context of high electricity prices is likely to be a high internal driver, this may become an impediment as these prices will fluctuate. However, the present situation in Europe makes high electricity prices a likelihood on a more long-term basis.

The transferability of external drivers and factors is, however, dependent on support schemes at national or local level to reduce the barrier concerning up-front cost of investment. Per now there are limited opportunities for such grants. The government has signalled new regulations[90] that grant housing associations rights as prosumers (in line with detached or semi-detached households). In the proposed regulations prosumers can produce electricity up to 500kW. They will also be allowed to share self-produced electricity between units within the same property. This will reduce several regulatory and financial barriers for community energy in housing associations and housing companies. A considerable increase in models such as Røverkollen should therefore be expected.

4.2. Recommendations

As described concerning transferability an important driver for housing associations and housing companies for PV electricity production and smart charging of residents' EVs are reduced energy costs. Røverkollen is mainly based on economic support through the Green Charge project. Based on the findings of this best practice, the main recommendation for potential initiators and developers in Norway would be to explore opportunities for economic support from the state agency ENOVA and or from local municipalities. Further, housing associations in Norway have opportunities for getting guidance and support concerning legal aspects, regulations and opportunities for loans through institutions such as OBOS, NBBL, USBL etc. In addition, a recommendation is to seek knowledge exchange with housing associations and housing companies that have experience as renewable energy communities. The above-mentioned institutions could facilitate such an exchange.

Local authorities can also play an important role as facilitators by engaging in projects such as Røverkollen and thus facilitate knowledge for themselves and relevant actors. Most importantly, local authorities can facilitate through assigned funds and support schemes for renewable energy communities as well as provide setting quantitative and qualitative targets that help promote renewable energy communities and who promote their role in a flexible and smart energy system.

On national level the new signalled regulations will facilitate development of projects such as Røverkollen. It is therefore a strong recommendation that the state agency ENOVA develops similar support schemes for renewable energy communities as they have for private homeowners who want to become prosumers. This would mean simplified procedures for applications for funding as well as guaranteed support of parts of the investment made. Further, ENOVA or the regulator NVE should provide a national guide for renewable energy communities as has been done for small-scale hydropower.

[90] NVE (2021) Renewable sharing scheme power generation: Proposed amendments to the Regulations on the control of grid activities and regulations on power sales and online services (in Norwegian). Norwegian Water Resources and Energy Directorate. https://www.nve.no/media/12625/forslag-til-forskriftsendring-deling-av-produksjon-3666137_1_1.pdf

g. Energy Region Michałowo (PL)

1. Descriptive analysis

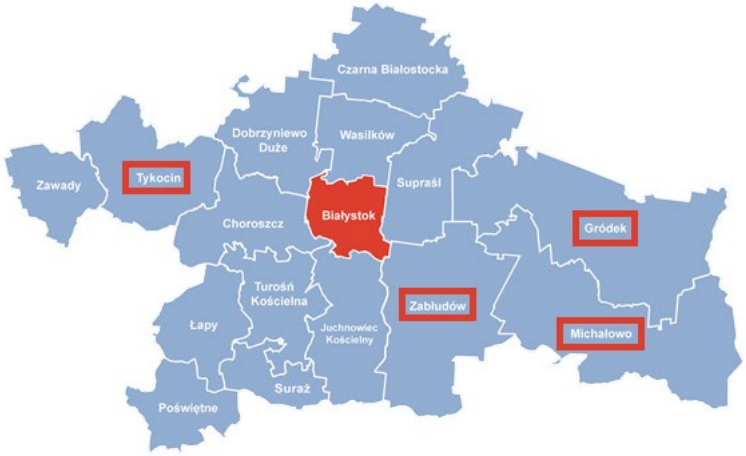
1.1. Author of case-study and organisation

Anna Dyląg - KAPE

1.2. Name of REC and geographical scope

The Energy Region Michałowo (Podlaskie Voivodeship, Bialystok County, municipality of Michałowo), was initiated in 2015 and launched on 12th June 2017. It is a local energy market with balanced energy demand and production, which establishes cooperation of a local energy producer with consumer entities.

Figure 1. Bialystok county and municipalities belonging to the energy cluster



Source: https://pl.m.wikipedia.org/wiki/Plik:POL_powiat_bia%C5%82ostocki_-_gminy.png

Figure 2. Location of Podlaskie Voivodeship.

Source: https://pl.wikivoyage.org/wiki/Wojew%C3%B3dztwo_podlaskie

The energy cluster is developing very dynamically; 2018-2019 already saw the joining of the municipalities of Zabłudów, Michałowo , Gródek and Tykocin, as well as the cultural centre of Michałowo and the "Jawor" Nursing Home managed by the Białystok district. Alongside the Michałowo municaplity (agricultural in nature), the REC also encompasses other municipalities that implement a number of cluster objectives and projects. These include: ensuring regional energy security, eliminating energy poverty, creating favourable conditions for sustainable development of local entrepreneurship or improving air quality, and boosting regional tourist attractions.

Figure 3. Plan of energy cluster's infrastructures.

Source: Strategy for achieving climate neutrality through expansion of district heating network in Michałowo

1.3. Objectives, motivation and process for establishment

Zielona Energia Michałowo sp. z o.o. is the main producer of electricity and heat, in cooperation and utilising the experience of the company IEN Energy, which is responsible for balancing and energy management. In the first quarter of 2017, the initiative to develop an energy cluster was launched. The cluster then formalised its activities on 12th June 2017.

The key objectives of the energy cluster were to increase the build a local energy system based on renewable energy sources and raise community awareness on the topic in the Michałowo area. The construction of the system was carried out in close interaction with the local community involved in the project implementation. This entailed a comprehensive programme of activation of the local community through knowledge transfer in the field of renewable energy sources, energy efficiency and the shaping of pro-ecological attitudes.

The cluster places emphasis on the social dimension of its activities, and there is therefore another project in Michałowo concerning the development of energy utilities (electricity and heat). To this end, a small, local electricity distribution network will be created and a DSO will be established. At the same time, it is foreseen to expand the coverage of heat demand in public buildings in the town of Michałowo by building a local distribution heat network.

The aforementioned projects will activate the local community and enhance development of the region by creating incentives for new investments. Additional aspects that have significant social

implications include the cluster programme for energy efficiency improvement, the cluster programme for construction of local RES in the prosumer formula and the construction of a local congress and education centre for renewable energy sources in Michałowo.

1.4. Activities and technologies

The cluster comprises a 0.6 MWe agricultural biogas plant and a 0.66 MWe photovoltaic plant owned by the private cluster. Currently, the biogas plant is undergoing modernisation through the construction of two fermentation tanks, a tank for storing the digestate and silos for the substrate. A second agricultural biogas plant with a 0.6 MWe unit is also under construction. The entire system will be connected to the existing heating network as an independent installation. Altogether, there will be 1,860 kW of renewable energy sources in operation in Michałowo (2 x 600 kW biogas plant plus 660 kW photovoltaic farm), which makes this municipality almost energy independent.

The municipalities belonging to the energy cluster are also implementing a program of local renewable energy sources under the "Prosument" formula, with advanced thermo-modernisation projects and exchange of lighting. The project includes launching an umbrella program of PV installations and heat pumps in public and residential buildings.

The municipality of Tykocin is building PV installations on sites with a total capacity of over 260 kWp. The Gródek municipality plans to install a solid fuel boiler house which will provide heating and hot water for the school and kindergarten buildings. It is planned to use pellets for heat supply. Total capacity of generating units needed to cover the demand is 440 kW and 101 kW. This action will result in a reduction of CO2 emissions by 100%, and of primary energy consumption - by over 8082 GJ/year, i.e. almost 95%, and in avoidance of emissions of almost 729 mg CO2/year. The municipality of Michałowo, on the other hand, is planning to build a passive energy-efficient building for an ultra-modern kindergarten for 175 children, which will be used for environmental education[91].

In the scope of new technologies there will be implemented projects for local development of electromobility, i.e., access points for fast charging of electric vehicles directly with energy from RES and purchase of public transport powered by electricity. In addition, in cooperation with Warsaw University of Technology (research unit) R&D projects will be implemented in the scope of developing innovative tools for electricity management in the cluster at the OH (virtual trading) and OHT (physical control of generation units, energy consumption and storage in the cluster) level. In addition, the cluster will implement the project "Energy cluster as an element of increasing national energy security".

1.5. Overview of actors and stakeholders involved

Stakeholders that were key in realising the energy cluster "Energy Region Michałowo " were private companies and municipalities. The initiators of the agreement were Zielona Energia Michałowo Sp. z o.o. (the main electricity and heat producer) and IEN Energy Sp. z o.o. (the cluster coordinator). Both entities have made efforts to comprehensively implement tasks related to the construction of the local energy market. The municipalities involved cover Michałowo , Zabłudów, Gródek and Tykocin; Michałowo is noteworthy in its grassroots initiatives from local entrepreneurs and government representatives that have been actively participating in the energy transformation for a long time.

The energy cluster leads Research and Development activities in cooperation with Warsaw University of Technology. One project concerns a study on the impact of energy clusters on national

[91] https://magazynbiomasa.pl/klaster-energii-michalowo/

energy security. In order to set up a Data Processing Centre, the energy region cooperates with EKO Dane sp. z o.o.

1.6. Organisational structure a decision-making model

At the top of the hierarchy there is a coordinator, who has the key position in the cluster. The coordinator is the link between local energy producers and consumers, and it will also be the entity responsible for knowledge transfer to the cluster. Citizens are engaged in projects realized in the cluster, but they do not own shares in the REC and therefore do not have any decisive power.

The base of cluster functioning is a civil law agreement, started on 12th June 2017 by Green Energy Michałowo and IEN Energy, two companies from the energy industry. It defines the rights and duties of each member and laid out the founding of the cluster:

- Zielona Energia Michałowo – leader of the cluster, main electricity and heat producer on the basis of an agricultural biogas plant
- IEN Energy – coordinator, which is responsible for electricity trading, knowledge and experience transfer between the cluster members, and development and updating of the cluster documentation
- Municipalities – energy consumers, whose local energy law goals are consistent with those of the cluster and relate to the reduction of greenhouse gas emissions, increasing the share of energy from renewable sources, reduction of final energy consumption and energy efficiency.
- Each partner takes decisions according to its own needs, but these should be in line with the objectives of the energy cluster. Management meetings are held several times a year to discuss current issues and planning.

1.7. Financial and investment considerations for establishment and maintenance of REC

Many investments were made thanks to the financial support of institutions such as:

- Provincial Fund for Environmental Protection and Water Management in Białystok (WFOŚIGW),
- Regional Operational Programme of Podlaskie Voivodship (RPO).

The first section of the district heating network in the town of Michałowo was built in 2015 and is dedicated to supplying heat to the school and swimming pool. This section was built by a local enterprise, Zielona Energia Sp. z o.o., which at the same time is a producer of heat via a renewable source (biogas plant - PLN 10 million - co-financed from ROP and WFOSIGW).

In 2018, a strategic decision was taken by the municipality to build a structural district heating network by the local government.

Municipal investments include the installation of RES facilities for the municipality's own needs (PLN 1.1 million - ROP co-financing), the installation of energy-efficient lighting in the municipality (PLN 0.3 million - ROP co-financing), the construction of an energy-efficient heat network and the installation of a pollution measurement system (PLN 4.2 million - ROP co-financing).

Residents of the commune of Michałowo can also obtain a grant of 65% of the investment value for the purchase and installation of photovoltaic and solar collectors for their homes (1.3 million - co-financed from the ROP).

There are also plans to build a kindergarten as a passive building, a local activity centre and a conference and exhibition centre - 3 buildings within the RES Demonstration Centre (PLN 22 million)[92].

Figure 4. Conference and Exhibition Centre

Source: https://Michałowo .eu/projekt-centrum-pokazowe-oze/

2. Impact analysis

2.1. Environmental benefits

The activities carried out so far have made it possible to reduce GHG emissions in the municipalities belonging to the cluster. The municipality of Michałowo , as part of the energy cluster, developed a document "Zielone Michałowo 2025 - A strategy for reaching climate neutrality". The strategy is based on an expanding heat network and biogas plants, both existing, under construction and planned. Connection to a heating network based on RES will likely result in lower energy costs and will entail environmental benefits in the form of reduced GHG and other emissions.

2.2. Economic benefits

The REC covers 50% of the energy demand of the cluster's members. Within 10 years, demand is expected to be 80% covered[93]. The energy cluster encourages the increasing of RES energy production in the buildings of members and citizens. The expansion of the REC to encompass more of the towns will mean the utilisation of currently unused roofs and public land, and therefore the provision of economic value to them.

[92] https://michalowo.eu/projekt-centrum-pokazowe-oze/
[93] https://klastermichalowo.pl/

Some local and regional companies have been involved in the construction of this local project, thus conferring economic value to the region, both in terms of profit and employment.

2.3. Social benefits

The construction of the energy cluster is implemented in close interaction with the local community, with a comprehensive program of activation of the local community through the transfer of knowledge regarding renewable energy sources, energy efficiency and shaping of pro-ecological attitudes. The cluster places emphasis on the social dimension of its activities, therefore another project is to provide the area of the town of Michałowo with energy utilities (electricity and heat). For this purpose, a small local electricity distribution network will be created and a DSO will be established. At the same time, it is planned to expand the coverage of heat demand in public buildings in the town of Michałowo by building a local distribution heat network. The above-mentioned projects are to activate the local community and cause development of the region by creating incentives for new investments. Further projects important from a social point of view are the cluster programme for energy efficiency improvement, the cluster programme for construction of local RES in prosumer formula and the construction of a local congress and educational centre for renewable energy sources in Michałowo.

3. Analysis of drivers and success factors

3.1. Contextual factors enabling success

Eastern Poland belongs to one of the most underdeveloped areas in the country as regards to energy infrastructure. Apart from the insufficient number of transmission and distribution networks, a significant problem is the lack of reserve power supply in the macro region in case of power line failure. The power infrastructure of Michałowo is characterised by a high degree of exploitation. The medium and low voltage network in non-urbanized areas is in the worst condition. Consequently, these areas are characterised by significantly lower quality parameters of supplied electricity than the rest of the country, by increased failure frequency and limited possibilities of connecting new consumers. This results in low profitability of investments for distribution power companies. These phenomena have a negative impact on the investment attractiveness of the area and constitute a barrier for the development of entrepreneurship and intensification of innovation processes.

The key motivation for the Michałowo cluster was the need to improve the economic efficiency of the existing agricultural biogas plant in the municipality of Michałowo. At the same time, a municipal swimming pool was established in the town by a large school complex, which incurred very high costs of heat and electricity. Due to the previously described infrastructural problems in the energy sector in the region and the possibility that these problems could be solved, cooperation between energy companies and municipalities was established.

3.2. Financial and organisational factors

Many investments were made thanks to the financial support of institutions such as:

- National Fund for Environmental Protection and Water Management – for prosumers
- Provincial Fund for Environmental Protection and Water Management in Białystok biogas plant
- Investments in thermal building renovations in the municipality
- Regional Operational Programme of Podlaskie Voivodship biogas plant

- Construction of an energy-efficient heat network
- Installation of a pollution measurement system
- Renewable Energy Sources Demonstration Centre

The Michałowo REC members do not pay fees to the energy cluster. They are, however, obliged to implement the objectives of the energy cluster financing them with their own resources or obtaining them from available sources.

3.3. Role of local governance and local/regional leaders in implementation

The local government as a consumer of the produced energy, has a key role in enabling the success of this REC. First of all, energy companies like Zielona Energia sp. z o.o. and IEN Energy sp. z o.o. relied on the administrative support of the municipality, which allowed for quick and efficient administrative procedures. Close collaboration with the municipal government has also been key for the expansion of the REC to the whole Białystok county.

Municipal buildings were thermally refurbished and photovoltaic panels were installed on the roofs. In addition, the role of local government units is to raise awareness among cluster residents in order to save electricity and heat, to raise interest in projects implemented in the cluster and assigning appropriate rank to these projects.

3.4. Inclusiveness/participation/social acceptance

The cooperation parties are entrepreneurs and local authorities. The residents of the region are indirect beneficiaries of all activities undertaken in the cluster such as:

- modernisation of street lighting
- thermal modernization of municipal buildings
- replacement of boilers in public buildings with more efficient ones in cases where connection to the planned heat network is not reasonable

The main role of the energy efficiency project will be the reduction of the cluster's demand for electricity and heat. An additional effect can be the improvement of public knowledge in the field of energy efficiency and increase of safety of inhabitants in the city.

Another form of citizen participation is to participate in the planned local RES congress and education centre in Michałowo, which aims to create a place where there will be knowledge transfer and interaction with the local community in building energy awareness and development of the cluster.

3.5. Innovativeness

In terms of new technologies, local electromobility development projects will be implemented, i.e., access points for fast charging of electric vehicles directly with energy from RES and purchase of public transport powered by electricity. In addition, in cooperation with the Warsaw University of Technology (research unit), R&D projects will be launched in the scope of developing innovative tools for electricity management in the cluster. Furthermore, within the cluster, the project "Energy cluster as an element increasing energy security of the country" will be implemented - aspects such as war, cyber security, terrorism, extreme weather events, raw material security or transition to off grid operation will be studied.

The above activities may become model solutions for other municipalities in the region and in the country.

4. Transferability and recommendations

4.1. Transferability

In terms of the transferability of internal drivers and factors, the establishment of an energy cluster could in practice be replicated elsewhere in Europe taking into account the country's or region's legislation.

It would be useful to make better use of dedicated areas for energy purposes by initiating cooperation between the municipal authorities and local enterprises that could produce energy.

An important issue that can be transferred is the model of the REC organisational structure, which connects local energy producers and consumers. This allows for transfer of knowledge and experience of the energy market to the cluster, and its development.

A significant element for other regions is to increase energy security and availability, to enhance employment opportunities, to raise energy and environmental awareness and to stimulate economic activities in rural areas. Furthermore, reducing energy costs, developing local electromobility solutions and innovative tools for electricity management are additional elements which may have transfer potential.

Further actions that can be replicated include increasing awareness of RECs activities aimed at consumers in the form of training, conferences, organisation of RES/low-carbon technology fairs, as well as education and formation of pro-environmental attitudes from an early age.

With respect to the transferability of external drivers and factors, public financial assistance could be easily replicated elsewhere. The energy region Michałowo obtains funding from sources that are available to all actors in Poland.

4.2. Recommendations

Based on the findings of this best practice case, the main recommendation for REC initiators and developers would be to replicate the form of cooperation between municipalities and business and exploiting local energy potential.

In the face of the energy transition towards district heating, there is an opportunity to reconcile the residents' needs for heat with the municipality's position as a local authority performing its duties in an exemplary manner. Providing cheaper heat for residents, especially co-operatives, while at the same time reducing emissions can increase citizens' confidence in the municipal government.

In the perspective of the next 20 years, it is ultimately possible to supply all residents - but generation sources must be taken into account. At present, with the plans of nearby generators, after agreement with the municipality and expansion of the network, it is possible to supply power to collective housing. In addition, it is worth emphasizing that this priority may result in a substantial environmental benefit with a single connection.

h. Energy community “Agra do Amial” (PT)

1. Descriptive analysis

1.1. Author of case-study and organisation

Isabel Azevedo – INEGI

1.2. Name of REC and geographical scope

Agra do Amial is a Renewable Energy Community (REC) established by the local authority in the municipality of Porto, which is located in the target region Região Norte (Portugal). The REC is developed in a local neighbourhood of around 20 km2, comprising a social housing condominium of eight building blocks (with 181 dwellings) and a public school. Source: *AdEPorto*

presents the geographical coverage of the REC, through an aerial view of the neighbourhood.

Figure 12 – Geographical coverage of the REC Agra do Amial

Source: AdEPorto

The participation in the energy community will be open to all the inhabitants of the social housing condominium, being limited to the local neighbourhood. Nevertheless, as the community is still under development and participation is voluntary, it is not yet possible to specify the total number of members.

1.3. Objectives, motivation and process for establishment

The concept of this energy community was developed by the municipality of Porto, as part of a wider innovation project, Asprela+Sustentável, with the aim of creating the most sustainable neighbourhood in Europe, having energy as the core but including also other subjects as environmental issues and circular economy. Specifically, the establishment of the community has three main objectives: (1) increase the RES-electricity generated locally; (2) mitigate energy poverty, through the reduction of energy costs and the promotion of energy efficiency; and (3) promote the inclusion of vulnerable citizens in the local community. Additionally, this REC is also

expected to serve as a Living Lab to test the solution to be replicated to the remaining municipal social housing (total of 12 500 dwellings) in the municipality of Porto.

The REC development process started in 2020, with the preparation of the application for funding under the EEA grants, with the collaboration of different technology providers, RTOs, an energy cooperative and a local energy agency. The tendering for the installation of the PV panels is currently under way, and the REC is expected to be launched in the first half of 2022. In 2021, the initiative has been recognised by the National Regulatory Entity (ERSE) as a "pilot project", which allows for the testing of new regulatory models, additional to what has been already established. The establishment of the REC as a legal entity and the definition of the internal rules are still undergoing.

1.4. Activities and technologies

The REC of Agra do Amial will perform several activities in the energy system – from generation to energy sharing and supply, as well as energy services. The REC will comprise electricity generation from PV panels installed in the roofs, which will be mostly consumed within the community and the excess will be sold to the grid. The goal is to maximize the use of the renewable energy locally produced within the community, through the use of storage units. The REC will also provide energy services associated with Energy Efficiency and Demand Response to its members, to maximise the use of local generation and to promote the participation of the community members in the provision of energy services. Moreover, the REC will also include EV-charging services.

Figure 13 – Schematic representation of the technologies installed as part of the REC

Source: AdEPorto

In order to perform these activities, the REC will have two generation units of solar PV: one installed in the school's roof, with 13 kWp; and a second one in the roofs of the social housing building blocks, with 101 kWp. It will also comprise two storage units, to support in the balance between generation and consumption: one 15kVA/21kWh second-life (previously used in electric vehicles) Li-ion storage unit in the school; and one 100kVA/133kWh Li-ion storage unit in the social housing building blocks. Finally, three electric-vehicle charging stations will be installed in the neighbourhood, in a parking area dedicated to the residents from the social housing dwellings.

1.5. Overview of actors and stakeholders involved

There have been several actors and stakeholders involved in the creation and implementation of the REC. The local public authority and associated entities (incl. local energy agency) have had a leading role, with the support from RTOs, technology providers, energy cooperative and local stakeholders.

The Municipality of Porto is the main promotor of the initiative, also covering the initial investment. It is the public authority responsible for Porto municipality, with 231 thousand inhabitants and a geographical area of almost 42 km2, and has relevant competences in buildings energy performance and social welfare. It assumed the commitment to create a living lab for decarbonisation that goes further, allowing to study innovative solutions that have an impact on the energy transition, decarbonisation and on the mitigation of energy poverty. Other local entities, under the umbrella of the Municipality of Porto, are also involved in the project, namely the entity in charge of the social housing management, to support in the engagement process of the local inhabitants and in the characterization of the existing building stock.

AdEPorto, the local energy agency, is responsible for the technical coordination of the innovation project that comprises the implementation of the REC. AdEPorto was responsible for the electricity production and supply studies and coordinates all the remaining stakeholders involved.

Moreover, several technology providers, associated with electric mobility, energy management solutions, storage and other, have been involved in the implementation of the REC. These entities are responsible for the provision of the different technologies, as well as for testing innovative solution of management and operation of the community.

The inhabitants of the social housing blocks are also expected to be involved, as they will be invited to adhere to the community. The engagement process is currently ongoing.

1.6. Organisational structure a decision-making model

Not defined yet

1.7. Financial and investment considerations for establishment and maintenance of REC

Part of the REC's initial investment is supported by the Municipality of Porto (local authority), covering the purchase and installation of the PV panels in the social housing blocks and in the school. This is estimated to be approximately 100,000 € (equivalent to 850€/kWp). The local authority also provides the space (roofs) for the installation of the generation units; the social housing blocks are owned and managed by the municipality, who is also responsible for the management of public school buildings.

Moreover, the initiative also counts on public funds from an EEA grant, which cover the purchase and installation of the storage units and of the electric vehicle chargers, and the costs associated with the development of the platform that will be used to manage the RECs operation. Even though the overall budget of the innovation project is around 1.5 million €, the amount is not fully allocated to the development of the REC, including also activities associated with the characterisation of energy poverty and with the promotion of more sustainable lifestyles (including food and waste).

The participation of local citizens in the REC is free of charge and open to all the households from the social housing blocks. When in operation, the electricity generated will be distributed to its members (local inhabitants) in order to reduce their energy bills and, consequently, mitigate energy poverty. The distribution model is yet to be defined. The surplus will be sold to the grid.

2. Impact analysis

2.1. Environmental benefits

The initiative includes, as part of its activities, the establishment of gamification strategies to increase the awareness of the local community on energy efficiency and the need for energy

transition. This is expected to bring environmental benefits to the local community in the long-term, by promoting a more sustainable behaviour.

2.2. Economic benefits

The REC will lead to rebates on the energy bills of the low-income households, residents in the social housing building blocks who will integrate the community. In the first five years of operation, the electricity generated will be distributed free-of-charge to the members of the community. Once the Living Lab period ends, the electricity produced locally will be supplied to the REC members at a rate lower than the one from traditional suppliers. Overall, the REC implementation is estimated to lead to an average reduction of 9% in the participants' yearly energy expense.

The REC is also expected to increase visibility and attractiveness of the neighbourhood, attracting the establishment of new businesses, which will result in local economic benefits in the long-term.

2.3. Social benefits

The REC is expected to promote the participation of lower income groups in the energy transition, as members of the community. Moreover, it also aims at building the capacity of local inhabitants on energy and indoor air quality to improve their living conditions and implement quick-win energy efficiency measures.

Furthermore, the proposed concept also aims to increase the integration of the population living in the social housing blocks with the population living in the surrounding area. The dissemination of the REC outputs and the involvement of the community are part of the measures established to accomplish this goal.

3. Analysis of drivers and success factors

3.1. Contextual factors enabling success

The local context comprises factors that facilitated the development of this initiative, especially associated with the political context. The Municipality of Porto has demonstrated a strong commitment towards climate change mitigation and adaptation, since 2008, being one of the first signatories of the Covenant of Mayors initiative. The associated targets, established by the municipality's Sustainable Energy and Climate Action Plan (SECAP), include the investment in local decentralised generation. Moreover, the local authority is the main promotor of the initiative, having a key role in pushing the development of the REC. Local political actors were responsible for the initiation of the process.

3.2. Financial and organisational factors

Regarding financial factors, the local authority is responsible for the initial investment associated with the installation of solar PV panels, both in the school and in the social housing building block. Complementarily, the REC development is also supported by an innovation project, financed by an EEA grant. Being a relatively new concept, this additional support is key to allow experimentation and promote the development of pilot RECs. This ensured the support of different stakeholders in the implementation of the REC and the establishment of the operational procedures, which are key as this is a new concept without considerable experience in the country. In Portugal, there are several RECs being developed as part of innovation projects funded through EEA grants.

The REC organisational structure is not fully defined.

3.3. Role of local governance and local/regional leaders in implementation

As referred previously, the local authority had the initiator role in the development of the REC, with the provision of the initial investment as well as the provision of publicly owned buildings for the installation of the PV generation units. This fact can be considered as an advantage, as it prevented the need for coordination between different actors. In addition, their leadership also facilitates the adhesion of local inhabitants to the initiative.

3.4. Inclusiveness/participation/social acceptance

The REC, being developed within a social housing neighbourhood, is necessarily focused on involving socially and economically vulnerable subjects. The community has dedicated activities to promote the participation of the 181 families, which also comprise awareness and information activities to increase the family energy-related knowledge and capacity to act.

There will also be activities targeting the young consumers, with the implementation of a monitoring, management and gamification system in the public schools.

3.5. Innovativeness

The REC encourages innovative practices for the mitigation of energy poverty. The involvement of lower income groups, using the REC concept as a way to promote better practices on energy use and mitigate energy poverty, can be seen as innovative.

Moreover, the involvement of the municipality is also innovative, with the municipality being the main promotor and investor of the REC. While directly investing in electricity generation from RES, the municipality is indirectly acting towards the mitigation of energy poverty and the inclusion of most vulnerable groups in the energy transition. This may be an effective approach to involve local authorities/municipalities in the implementation of RECs, as they own and manage a large number of buildings (administrative and social housing).

4. Transferability and recommendations

4.1. Transferability

The potential for transferability of this solution is high, both within the city of Porto and in other municipalities in Portugal.

Internal factors, such as having the local authority as the main promotor, are highly transferable in the country. Indeed, municipalities are the owners and/or managers of a significant number of buildings, including social housing building blocks and schools, having a large available area to install PV generation units. Moreover, the investment in electricity generation from renewable energy sources at the local level can contribute to the mitigation of energy poverty, one of the core social policy objectives of local authorities. Furthermore, the model of participation of individual citizens, acting mostly as passive participants in the community, may also increase the success of implementation of community initiatives in Portugal, as least while RECs are not widely disseminated as a concept. The engagement of local citizens may be easier if the local authorities take the first step.

External factors, as the existence of co-funding and the support from external stakeholders, have also potential for transferability. The support from local energy agencies and R&D centres in the development of the REC concept is desirable and realisable in other geographies, given the increasing competences of local agencies and the interest of R&D centres in being involved in

energy community initiatives, which can be used as living labs to test innovative technologies and activities. Moreover, there also financing opportunities available, as the EUCF and EEA grants, which can be used to lever the development and implementation of these type of initiatives.

4.2. Recommendations

The analysis of this best practice results in recommendations for both potential promotors and developers or RECs and for national and EU policy makers, in order to foster the replication of this type of initiative in Portugal and in other geographies.

The first refers to the advantage of combining the creation of an energy community initiative with the mitigation of social and/or environmental issues already present in the community. This association of the REC with the mitigation of local issues, such as energy poverty, may foster the interest of the local community in the project, increasing the level of engagement of individual citizens. This is crucial, especially if there is still some mistrust regarding the concept. Moreover, this link between local issues and the local energy projects can leverage potential synergies.

Secondly, the collaboration with local and national stakeholders in the concept development and implementation may be relevant, as potential promotors or participants in the REC may not have the necessary competences to decide on the technological and legal approach. Especially in contexts where the concept is still immature, research and development companies, local energy agencies, and even legal experts, could have an important role in support local promotors in the design of the most adequate approach (adapted to the local context and needs). In addition, this may promote experimentation of innovative solutions in terms of technology choice, activities performed and even legal forms.

Finally, this best practice demonstrates the relevant role that local authorities may have in the promotion and dissemination of REC initiatives. Thus, it is important that policies at national and EU level can push local authorities to have this role, as promotor or facilitator of RECs.

i. COMPTEM-Enercoop (ES)

1. Descriptive analysis

1.1. Author of case-study and organisation

Francisco Rueda Guerrero and Pouyan Maleki - ECORYS

1.2. Name of REC and geographical scope

The REC is called COMPTEM (which stands for Community for the Municipal Energy Transition) and comprises all members of the historical local energy cooperative Enercoop, in the municipality of Crevillent, which is in the COME RES model region of Valencia (Spain). The first installation was built in the neighbourhood of El Realengo. Although the REC covers all members of Enercoop, the first installation of El Realengo currently only covers the small neighbourhood of El Realengo, which is constituted by approx. 65 households (250 people). All citizens in the vicinity of the installation are capable and entitled to participate in the initiative. Eventually, the activities of the REC will expand to the whole village of Crevillent (30,000 inhabitants). The municipal government has already assigned through a public tender the concession of 21 public spaces (covering an area of 15,000 m2) for this expansion. Nevertheless, participation in the REC is voluntary and therefore it is difficult concretely predict the number of members that will eventually benefit from the initiative. As Enercoop has decided to transform itself into a REC, the current number of members of the cooperative (11,000) are members of the REC, even if not all of them can benefit from the installations yet.

Figure 14. REC installation

Source: Grupo Enercoop

1.3. Objectives, motivation and process for establishment

The process for the constitution of the REC COMPTEM was officially initiated in November 2019 and the first physical installation was inaugurated in September 2021. It was the initiative of the historical local energy cooperative Enercoop with the collaboration of the local government. The

number of renewable generation installations will eventually expand to provide benefits to the whole village of Crevillent throughout the period 2021-2030.

The main objectives of this pilot project and its expansion are (1) collaborate towards the green transition by achieving a 100% renewable origin in the electricity mix of Crevillent by 2050, (2) produce rebates in the electricity bills of users, (3) democratise the access and management of regular citizens to energy [94].

1.4. Activities and technologies

The technology that the REC COMPTEM uses is PV solar energy generation facilities with Li-ion energy storage and 4 e-mobility charging facilities. The community carries out a wide range of activities. Its key one is the collective self-consumption of electricity generated through renewable energy sources. The cooperative has installed PV solar energy generation facilities in public and private building roofs as well as in previously un-used public plots of land. The current PV installation comprises 300 solar panels in a 600m2 areas with a capacity of120 kWp and producing 180,000 kWh per year, which amounts to around 50% of the electricity consumption of the 65 households in the vicinity[95].

Figure 15. Peak PV capacity and storage capacity

Source: Grupo Enercoop

Another important technology of the REC is the energy storage system, which is achieved by means of a medium capacity storage facility of lithium-ion with a 240kWh capacity. Moreover, four e-mobility charging facility have also been installed for local electric vehicles, with two fast charging stations (2x50kW + 1x43kW in each station) and two semi rapid charging facilities of 22kW (2x22kW in each station). Furthermore, the community also has a simplified compensation mechanism, in which excess energy is released into the general grid for a compensatory payment as regulated by the RD 244/2019. Activities to increase energy efficiency and to allow for peer-to-peer electricity sharing using blockchain technology are also carried out by the REC, with the final aim of optimising

[94] Memoria 2020. Grupo Enercoop, 2021. Link: https://www.grupoenercoop.es/wp-content/uploads/2021/06/Memoria-Enercoop-2020.pdf & https://www.youtube.com/watch?v=J2Ytl-PHPhs

[95] Grupo Enercoop website. Grupo Enercoop, 2020. Link: https://www.grupoenercoop.es/el-ayuntamiento-de-crevillent-y-grupo-enercoop-situan-a-el-realengo-como-punto-de-partida-para-la-comunidad-energetica-comptem/

energetic and economic flows. Finally, the community carries out informative and dissemination activities, including the creation of a mobile application tool to inform members about their energy consumption, as well as public digital information panels for the divulgation of knowledge about the energy sector in order to empower citizens.

1.5. Overview of actors and stakeholders involved

There were several key actors in the process of the creation of COMPTEM. First of all, the historical local energy cooperative Enercoop. The nearly 100-year-old cooperative generates, distributes and commercialises 100% renewable energy for its 11,000 members in the locality of Crevillent[96]. Indeed, Enercoop was critical in the establishment of COMPTEM, as it was the initiator and main actor driving its development. It also owns the installation and manages it. The cooperative is also responsible for commercialising the electricity of the REC to the community's members.

It is important to note the strong collaboration with the local government. In this sense, the local municipal authority conceded for an initial period of four years the previously unused plot of municipal land on which the installation has been built. Moreover, local authorities facilitated all administrative procedures. Furthermore, the H2020 European project MERLON has also been central, as it has contributed and indirectly funded all the development of the project work[97]. Moreover, the project has provided important technical value, including the prosumer app, the energy optimisation software, the blockchain technology and more.

Moreover, the regional government of Valencia financed the e-mobility installation, and the regional cooperative bank Caja Rural Central a credit financing 25% of the initial investment[98]. The regional government of Valencia, through a specific funding scheme for energy communities, has recently contributed to the development of another four collective self-consumption installations. Of course, the households participating in the REC are absolutely necessary for its success and, in this sense, the neighbours' association of El Realengo has been very supportive of the initiative.

1.6. Organisational structure a decision-making model

The organisational form of COMPTEM is that of a cooperative (Enercoop), being its costumers also members and owners. There are currently 11,000 members in the REC, out of which approximately 65 households are currently benefitting from the first installations. The cooperative company is a non-for profit (surpluses are reinvested or donated to charitable activities), becoming a member or abandoning the cooperative is voluntary, and members democratically and equally participate in the cooperative's decision independently of the amount of capital any member has contributed. Similarly, members can take part in the decision of the cooperative on the basis of 1 member 1 vote. The administrative bodies (Council and Control body) are democratically elected by members. There are no dividends or profits for members since the cooperative is a non-for-profit company.

The plot of land continues to be of public municipal ownership and the energy installations are left to the REC. Given that the land continues to be of public ownership, the legal form in which the installation has been built is through that of a transfer, assigned through a public tender. Enercoop can exploit this land and the installation it has built.

[96]Grupo Enercoop website. Grupo Enercoop, 2020. Link: https://www.grupoenercoop.es/introduccion/

[97] Grupo Enercoop website. Grupo Enercoop, 2020. Link: https://www.grupoenercoop.es/el-ayuntamiento-de-crevillent-y-grupo-enercoop-situan-a-el-realengo-como-punto-de-partida-para-la-comunidad-energetica-comptem/

[98] COMPTEM website. Grupo Enercoop, 2020. Link: https://www.grupoenercoop.es/el-ayuntamiento-de-crevillent-y-grupo-enercoop-situan-a-el-realengo-como-punto-de-partida-para-la-comunidad-energetica-comptem/

1.7. Financial and investment considerations for establishment and maintenance of REC

The total original investment for this pilot REC was €400,000. 75% of this (€300,000) came from EU funds through the H2020 project MERLON. The remaining 25% (€100,000) was provided through a loan from the local cooperative bank Caja Rural Central [99]. This means that none of the citizens in the REC has had to make any disbursement. The loan will be repaid through the rebates in the energy bills of members. Therefore, members will not see any change in their energy bill with respect to now for the next 7-8 years in exchange of not having to face any investment costs. This has allowed the cooperative to further incentivise potential members as participation did not require any initial payment.

The initial investment has also been kept relatively low thanks to not having to invest in the plot of land. Indeed, the space on which the installation was built is a plot of public municipal land that was previously unused. Thus, the local authority has assigned use of the plot for the installation of the facilities. This has meant a reduction in what would be the usual investment costs for such a facility and has also added value to a previously useless space.

2. Impact analysis

2.1. Environmental benefits

The pilot project was next step in the ecological transition of Crevillent and is framed within the objective of the municipality to reduce its energy related CO2 emissions by 50-55% by 2030 and to become carbon neutral by 2050 (mainly through the expansion of the REC) [100]. The project also led to the ecological revitalisation of previously unused public land by transforming it into a green space with sport facilities.

2.2. Economic benefits

The REC covers 50% of the energy demand of the 65 households of the vicinity and produces rebates in the energy bill of members of an estimated 15-20% thanks to the use of renewable energy technology, the reduction of grid losses and the optimisation energy flows[101].

The pilot project has given value to a previously unused plot of land, in which, apart from the PV solar panels, green spaces and sport facilities have been built. The expansion of the REC to the whole village will mean the use of currently empty roofs and public lands, and therefore the provision of economic value to previously useless spaces.

Some local and regional companies have been involved in the construction of this local project, what has produced economic value in the village and the region, both in terms of business profit and employment.

[99] Memoria 2020. Grupo Enercoop, 2021. Link: https://www.grupoenercoop.es/wp-content/uploads/2021/06/Memoria-Enercoop-2020.pdf & https://www.youtube.com/watch?v=J2Ytl-PHPhs
[100] Memoria 2020. Grupo Enercoop, 2021. Link: https://www.grupoenercoop.es/wp-content/uploads/2021/06/Memoria-Enercoop-2020.pdf
[101] Memoria 2020. Grupo Enercoop, 2021. Link: https://www.grupoenercoop.es/wp-content/uploads/2021/06/Memoria-Enercoop-2020.pdf and https://www.youtube.com/watch?v=J2Ytl-PHPhs

2.3. Social benefits

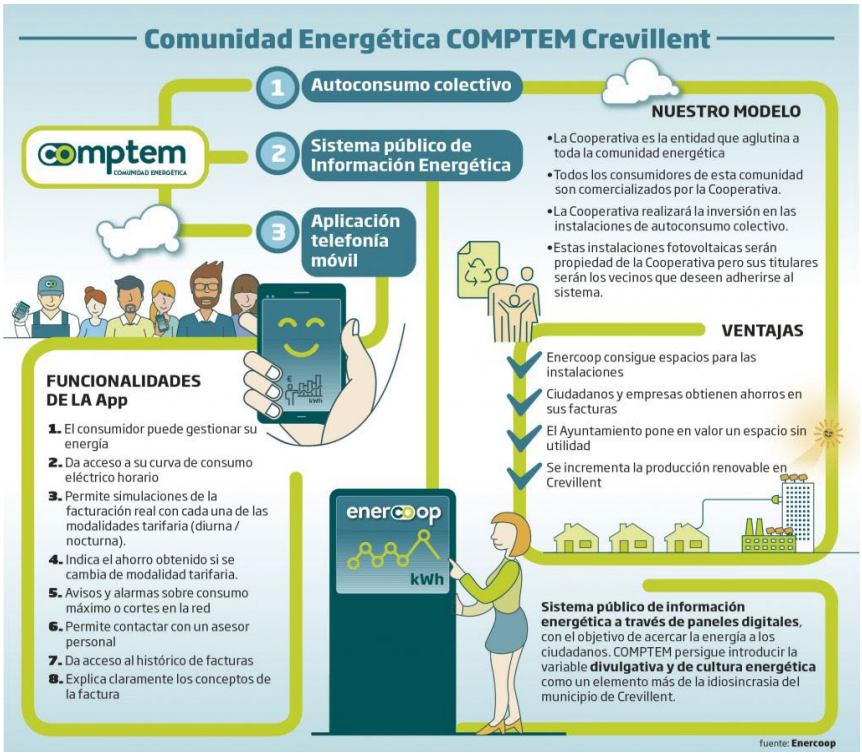
The knowledge of the concrete social/community benefits are limited until now. There has been citizen participation in the design of the space that this first pilot project occupies, which also includes green spaces and sports facilities.

3. Analysis of drivers and success factors

3.1. Contextual factors enabling success

Some contextual factors have had an impact on the success of the initiative. Given the long history of the local energy cooperative company Enercoop in the municipality, local citizens are used to understand electricity generation and distribution as a community activity. This has made the social acceptance of the REC significantly stronger. There has also been a strong political will, both of Enercoop and the municipal government, to reach a 100% renewable energy origin in the electricity mix of Crevillent by 2050. The REC COMPTEM has been understood by both entities as the key initiative to reach that goal. Moreover, the fact that there was an already existing historical energy cooperative has made all administrative and technical aspects easier, as the main enabler was already familiar with these factors.

Figure 16. Informative flyer for citizens



Source: Grupo Enercoop

3.2. Financial and organisational factors

The organisational form of the REC as an energy cooperative (and the fact that members are already very familiar with this organisational form given that the cooperative has been functioning for a long time) has been one of the success factors. Through this energy cooperative, consumers are

also members, and therefore owners of the REC. The cooperative organisational structure makes it very easy to transition towards a REC.

Moreover, an initial investment cost for members that could have reduced support for the establishment of the REC has been avoided. Members of Enercoop did not have to make any payment for the establishment of the REC as the 25% of it that was not funded by EU grants was financed by Caja Rural Central through a loan. The rebates in the energy bills of members that the REC produces will be used to repay the loan. Additionally, the transfer of public municipal land and the EU financing have been important factors.

3.3. Role of local governance and local/regional leaders in implementation

Although it cannot be said that the local government took the leadership tole, its support has been key in enabling the success of this REC. First of all, the developers relied on the administrative support of the local municipality, which allowed for quick and efficient administrative procedures. Most importantly, the transfer of municipal land for the installation of the facility has allowed to count with a space in which to carry out the REC activities. The regional government of Valencia gave also some support by providing the two e-mobility charging stations.

Close collaboration with the municipal government will also be key for the eventual expansion of the REC to the whole village, as local authorities will allow for the installation of PV solar panels on local government roofs and will assign public municipal land for the construction of larger solar energy generation facilities.

The REC did not depend on a previously established, functioning infrastructure of institutional support, but rather benefitted from a more ad-hoc assistance by local and regional authorities. It is important to note that COMPTEM is not only a pilot project at the local level, but also at the national level. Most institutional support schemes have been created after this REC was built.

3.4. Inclusiveness/participation/social acceptance

Although the REC itself covers a great number of citizens, the first activities developed give coverage to a very limited number of citizens (65 households). This necessarily limits broad participation, inclusiveness and wider social acceptance. Nonetheless, given that no initial individual investment was needed, all citizens, including vulnerable ones, can participate irrespective of their income or savings. Decision-making processes are democratic and on the basis of one-member-one-vote. Moreover, citizens of the neighbourhood have directly participated in the design of the space on which the PV installation was installed, which also includes green areas and sport facilities.

The project has enjoyed a relatively wide and strong degree of social acceptance, made official through the backing of the neighbours' association El Realengo[102]. Among the factors that have created community acceptance for the REC are the revitalisation of a previously unused plot of land by building the PV facility but also by including sports facilities and green areas; and the rebates of 15-20% in the energy bill that members of the REC will benefit from. Moreover, the community's contribution to local carbon neutrality and the fact of not being it necessary to make any initial investment by members have also increased its acceptance.

3.5. Innovativeness

COMPTEM may not be especially innovative with respect to other European RECs. Nonetheless, the constitution of this pilot project is itself considered innovative because it is the first successful one

[102] Comunidad energética de Crevillent, el futuro del autoconsumo. El Independiente, 2021. Link: https://youtu.be/uvYsQmgtC44

in Spain. This has attracted the attention of several institutional actors (among them the Ministry for the Ecological Transition) that see it as an example of the way forward for energy transition in Spain.

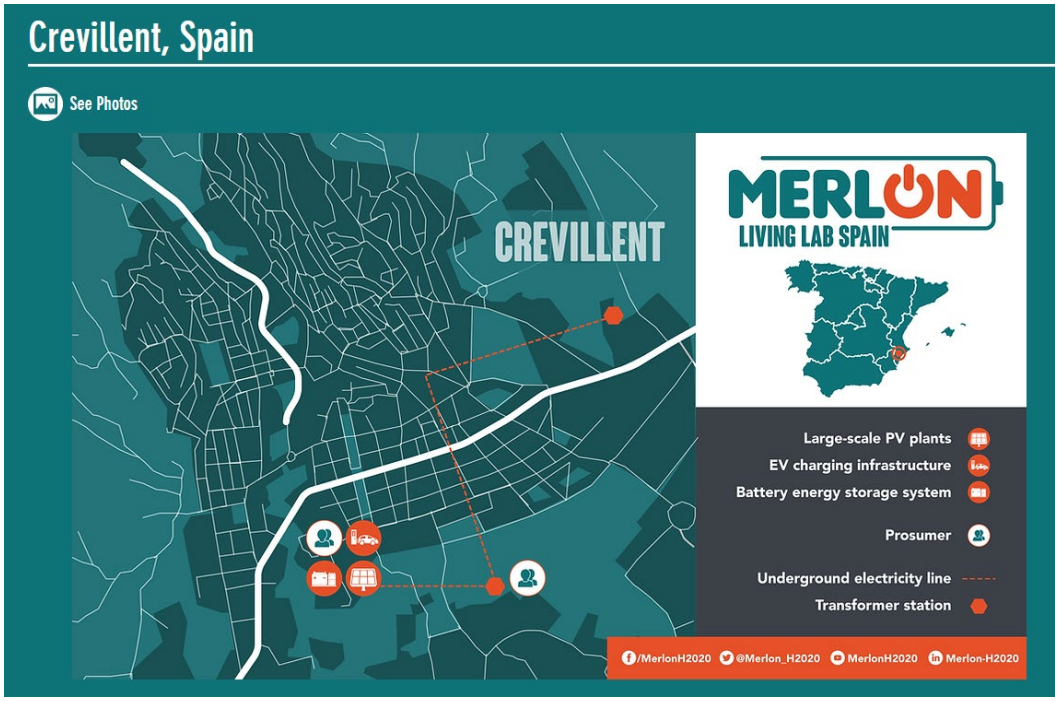
Moreover, the development process has included several relatively innovative practices, including the business model (i.e., no up-front investment for members) and cooperation with local government (i.e. transfer of municipal land). The REC has been able to find a suitable organisational form (cooperative) and a successful financing structure that has allowed for the social acceptance of the project and the enthusiasm of the cooperative members. Additionally, some innovative activities have been conducted, including the information divulgation app and street panels.

4. Transferability and recommendations

4.1. Transferability

In terms of the transferability of internal drivers and factors, the establishment of an energy cooperative of prosumers could in practice be replicated elsewhere in Europe taking into account the country's or region's legislation. Nonetheless, it is true that this case has benefitted from a historical local tradition of cooperative energy activities, something that is most commonly not the case in most other setups, and hence making transfer (and replication of success) more difficult. Moreover, the financial model (by which the installation is financed through a loan to be repaid by members through rebates in energy bills) could easily be replicated elsewhere and there is not, in principle, any impediment for the transferability of this practice. This model allows for the establishment of a REC without imposing on members an initial cost that could reduce citizens' willingness to participate, erode social acceptance and impede vulnerable groups to take part.

Figure 17. Contribution of H2020 project Merlon



Source: H2020 project MERLON

With respect to the transferability of external drivers and factors, public financial assistance could be easily replicated elsewhere. COMPTEM has greatly benefited from EU funds through the H2020 project MERLON, which has financed 75% of the investment, thereby significantly reducing cost for members. Subsidies, grants and other types of funding for RECs could be offered in other contexts by EU, national, regional or local authorities. Of course, this will in the end depend on political willingness, budgetary constraints and policy priorities of such public support providers. The transfer of public municipal land could also be replicated elsewhere. This has been an important enabler of the REC because it has reduced investment costs and provided a space for the installation. Nonetheless, the transferability of this practice will ultimately depend on the availability of unused public municipal land, which might be much more restricted in other contexts, such as dense urban areas.

4.2. Recommendations

Based on the findings of this best practice, the main recommendation for REC initiators and developers would be to replicate the financial model used by COMPTEM to pay for the cost of the installation. By taking a loan to be repaid through members' rebates on the energy bill, the developer/initiator is eliminating one of the main barriers of constituting a REC: the unwillingness of potential members to make an initial investment. By allowing citizens to participate without having to make any up-front payment, the developer would be increasing social acceptance, attracting a larger number of members and allowing vulnerable individuals to participate irrespective of their income and savings.

With respect to local authorities, it is recommended that they assign unused municipal land to RECs. This allows developers to significantly cut investment costs and provides an environmental, economic and social value to previously useless land. Similarly, it is recommended that municipal governments assign appropriate and available roofs of public buildings to be used by RECs. Moreover, local authorities are encouraged to simplify their administrative procedures (e.g., licensing procedures and building permits) for these cases and provide the necessary support to unexperienced developers throughout the bureaucratic process. Regional and national authorities are also encouraged to assign their unused roofs and land (if any) for the installation of REC projects. It is recommended that regional and national authorities establish institutional support schemes for RECs, including financial but also administrative and technical support. This can include subsidies, grants, favourable loans, impact studies, feasibility studies, etc. This necessarily includes a complete transposition of RED II into national legislations. It is recommended for EU authorities to continue funding pilot REC projects, as these are able, within the safe environment enabled by the EU, to make an example in their own territories and find innovative ways to adapt the REC concept to their own.

j. Energy Gardens (NL)

1. Descriptive analysis

1.1. Author of case-study and organisation

Sandor Löwik (Natuur en Milieufederaties)[103], Erik Laes (TU/e)

1.2. Name of REC and geographical scope

The REC initiative is called 'Energy Gardens' (Energietuinen). Energy Gardens is a concept developed by the Dutch 'Nature and Environmental Federations' (Natuur en Milieufederaties, NMF), which is a non-profit organization that aims to design and realize multifunctional and biodiverse energy parks for and with the local community. Three pilot Energy Gardens started in 2019 and more Energy Gardens projects are getting started. The three pilot locations are: Mastwijk (province of Utrecht), Assen-Zuid (province of Drenthe) and Wijhe (province of Overijsel).

Figure 18. Location of Energy Garden "de Noordmanshoek" (Olst-Wijhe)

Source: Energietuinen.nl

The scope of the three pilots is as follows:

<u>Mastwijk</u>

- Total surface 20 ha.

[103] All information contained in the best practice portrait is taken from the project website (www.energietuinen.nl) and has been validated by the project coordinator, Mr. Sandor Löwik.

- Solar installation 12 ha.
- Peak capacity 10,9 MW
- Yearly electricity production for 3.000 households

Assen-Zuid

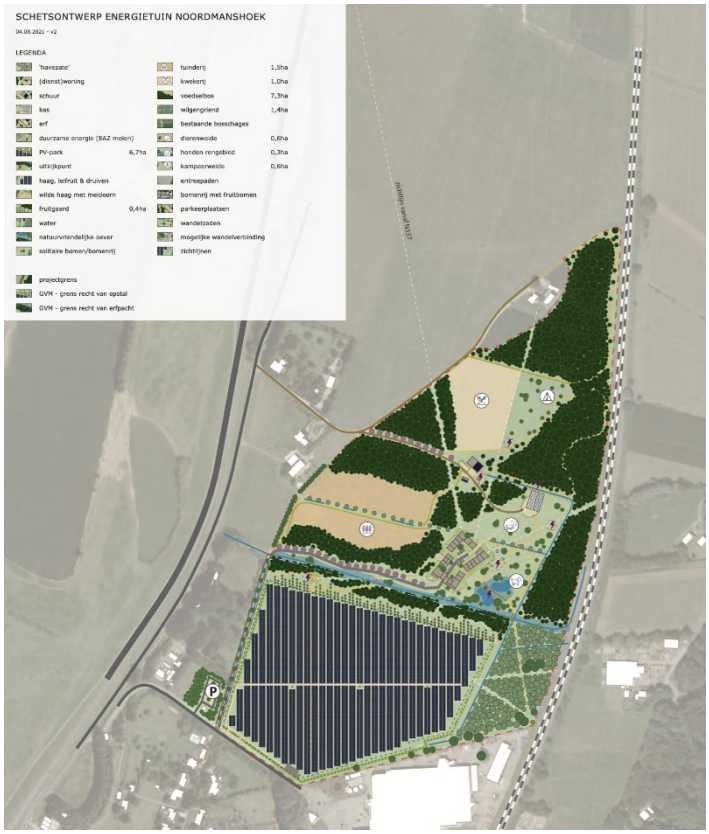
- Total surface 53 ha.
- Solar installation 23 ha.
- Peak capacity 21,3 MW
- Yearly electricity production for 6.000 households

Wijhe

- Total surface 25 ha.
- Solar installation 8 ha.
- Peak capacity 7,8 MW
- Yearly electricity production for 2.300 households

The Energy Garden concept has a national ambition and aims to be spread as widely as possible, through communication and education activities. For instance, in the meantime NMF has also been contacted for the realization of an Energy Garden in Gelderland, and this project is now also underway.

Figure 2. Conceptual design for Energy Garden "de Noordmanshoek" (Olst-Wijhe)



1.3. Objectives, motivation and process for establishment

In 2019 the NMF submitted the Energy Gardens concept for a project subsidy to the national postcode lottery. Three potential locations for the realization of the concept where also submitted together with the application, together with local parties who were open to the idea (cf. *supra*). The postcode lottery finances good causes with the sale of lottery tickets, and Energy Gardens received a subsidy of €1.6 million for a period of 5 years. If everything goes as planned, the three pilot projects should therefore be finalized in 2024.

The main motivations for Energy Gardens are:

- to involve local citizens and stakeholders directly from the start in the design of the project to capture the main local natural landscape and cultural-historical values in the project area;
- to create and maintain a renewable energy generation project with multiple functionalities (due to scarce land), co-owned by the local communities.

Overall, these motivations help to promote acceptance for large renewable energy projects in landscapes and promote biodiversity.

The main driver in the process of establishing is the NMF who owns and promotes the Energy Garden concept. However, in each project there are multiple leading stakeholders involved. In all cases a local energy initiative, a municipality, local nature and environmental volunteer groups are involved, and in some a commercial developer (interested in investing in renewable energy as a profitable activity).

1.4. Activities and technologies

For now, the Energy Gardens focus on ground-mounted solar PV panels. The actual solar power installations in the pilot locations have not yet been built. Data about planned capacities are however available. The energy garden in Mastwijk will have a capacity of 10.9 MW, Assen Zuid of 21.3 MW and De Noordmanshoek in Wijhe of 7.8 MW. The main activities in the energy system are therefore currently limited to electricity generation and supply (electricity produced by the solar power installations is sold to the electricity grid). In the future activities such as energy storage and energy sharing will also likely become possible. Each Energy Garden is open to the public, offers recreational and educational activities, is a nice place to recreate and is very well embedded in the landscape.

1.5. Overview of actors and stakeholders involved

There are several key actors in the process of the creation of an energy garden. Each energy garden is realized in partnership with NMF, who is responsible for organization of local participation in the design and implementation of the energy garden. NMF also often functions as a local point of contact for citizens. Next to NMF, each project is mainly driven by the project developer(s). These are different for each location:

<u>Mastwijk</u>

- Project is realized on remediated landfill site
- Waste company (Afvalzorg) is owner of the landfill site
- A local energy cooperative has been created as a result of the participative process

<u>Assen-Zuid</u>

- Municipality owns the project land

- Commercial project developer: Engie
- Cooperative project developer: Bronnen van Ons

Wijhe

- Municipality owns the project land
- Project development is led by a local foundation called 'De Noordmanshoek'

Of course, the households participating in the design, realization and exploitation and in each energy garden project are absolutely necessary for its success.

1.6. Organisational structure and decision-making model

There is no unique organizational structure and decision-making model for an Energy Garden project. A lot depends on who will be the project developer. Nevertheless, a 'common ingredient' will always be the involvement of a local initiative, as the Energy Gardens support the national policy goal of reaching 50% local ownership of land-based renewable energy projects. Some Energy Gardens are entirely owned and developed by an energy cooperative, some are owned and developed together with a commercial partner. Another possibility is that ownership will be opened up to citizens by crowdfunding. In any case, also a local fund will be set up from the profits of the Energy Garden project.

1.7. Financial and investment considerations for establishment and maintenance of REC

An initial project subsidy was secured from the postcode lottery to the amount of €1.6 million. This money will be used in the three pilot projects to pay for:

- Process support (participative co-design of the energy gardens)
- Part of additional furnishing (educational packages, additional plants, picnic areas)
- Dissemination activities (networking, communication, training, sharing)

The solar parks require investment by (a) project developer(s). Project developers should not aim for the highest financial gain possible. If the municipality has the initiative (land ownership) then other functions can be added (municipalities can generally borrow at very low interest rates). Local energy cooperatives are also often satisfied with a lower financial return (they commonly offer a 4% return to people who sign up).

In the Netherlands, there is a specific operational subsidy for renewable energy communities called the 'Cooperative Energy Generation' (SCE) subsidy. Its paid out in form of an amount of money per kWh produced. Each year a basic amount is set for each type of installation. The basic amount is the amount per kWh produced, which is necessary to make the installation profitable. The basic amount for the year in which a cooperative applies for the subsidy is valid for the entire subsidy period of 15 years. So, there is long-term certainty about the return on investment:

- The subsidy per kWh received is the difference between the basic amount and the correction amount;
- The correction amount is the market price for energy. If the energy price rises, the cooperative will receive less subsidy and if the energy price falls, the cooperative will receive more subsidy. The basic energy price is the lower limit of the corrective amount;
- The energy produced must have been certified by CertiQ (Guarantees of Origin) in order to be eligible for subsidy.

2. Impact analysis

2.1. Environmental benefits

Next to contributing to local energy and climate agendas, enhancing ecological value and biodiversity is one of the pillars of Energy Gardens. For each Energy Garden specific ecological design sessions lead to special attention to local species, such as birds, reptiles, insects and flowers. Local nature and environmental volunteers are consulted and involved in the design and practical maintenance and monitoring of biodiversity. Energy gardens are built e.g. on unused industrial terrain, or in one case on a remediated landfill.

2.2. Economic benefits

Several economic benefits relate to energy production and distribution, such as financial participation with shares or certificates in the project by citizens and local companies, employment for local companies, and a local fund ('omgevingsfonds') for the local community. Compared to commercial projects, economic benefits are more limited, since additional costs for the development of the ecological functions of the energy gardens has to be taken into account. Typically, an energy cooperative will offer about 4% profit to its members.

2.3. Social benefits

The Energy Garden in itself adds value to the community, since it is open to the public, offers recreational and educational activities, is a nice place to recreate and is very well ecologically and landscape embedded. By involving volunteer groups in management and maintenance, the Energy Garden is co-owned by the community. Involving local nature and environmental associations for maintenance and monitoring of biodiversity, the community keeps ownership over nature and landscape.

3. Analysis of drivers and success factors

3.1. Contextual factors enabling success

Some contextual factors have had an impact on the success of the initiative. The Netherlands is a densely populated country, and land for new project developments is scarce. The 'national spatial planning vision'[104] states that solar panels should preferably be installed on the roofs and facades of buildings. If this is not possible, unused sites in built-up areas are then preferred. In order to meet the (stringent) regional energy targets, it may turn out that locations in rural areas are also needed. In that case, preference is given to seeking smart combinations of functions. Although nature and agricultural areas are not entirely excluded, preference is given to land with a different primary function other than agriculture or nature, such as water treatment plants, landfills, inland waterways or land managed by the state, including, where possible, verges of railroads and freeways. In addition, the Netherlands has a cooperative tradition (over 600 energy cooperatives were active in 2020) and has adopted a national policy goal of 50% ownership by the local society of land-based renewable energy capacity by 2050. The combination of a national preference for multi-functional land use and local ownership works in favour of the Energy Gardens concept.

[104] https://www.denationaleomgevingsvisie.nl/home/default.aspx

3.2. Financial and organisational factors

The Energy Garden concept does not prescribe a specific form of governance, other than stipulating that the concept should be co-owned by the local environment. The most important factor in promoting a sense of co-ownership is the fact that local citizens are invited to participate from the very start of the design process of the Energy Garden. The final project plan is therefore the result of co-design with local citizens and is therefore mostly widely supported by the locals.

With regard to financial ownership, there is no unique model. Some Energy Gardens are entirely owned and developed by an energy cooperative, some are owned and developed together with a commercial partner. Another possibility is that ownership will be opened up to citizens by crowdfunding. It is also important that the project owner is ready to accept some additional costs for adding the ecological functions to his project, which has a negative impact on profit margins.

3.3. Role of local governance and local/regional leaders in implementation

An Energy Garden project is usually beneficial for local/regional leaders (because it helps them in implementing their local energy and climate agendas) but is not necessarily led by local/regional leaders. A lot depends on who is the owner of the land on which the project will be developed. This party will be in the 'drivers' seat' of the project development and will also be the most important point of contact for the locals. Of course, a good partnership with local governments is a plus.

3.4. Inclusiveness/participation/social acceptance

The Energy Garden projects have no specific provisions for enhancing inclusiveness beyond what a normal energy cooperative would do. This means that mostly highly educated people with an interest in sustainability will participate. However, the educational program on energy generation and biodiversity is aimed towards school children and illiterate people.

The process of participative design has led in all three pilot projects to strong social engagement and acceptance. No formal objections have been filed to the required permits. Citizens also have taken initiative to realize additional functionalities, such as an "innovation energy path" with exhibitions of novel energy solutions to inform and educate visitors of Energy Gardens.

3.5. Innovativeness

The Energy Garden project is innovative in making solar parks accessible to the public with functionalities such as recreation and education and applying participatory design processes in which local values define the design principles and energy generation is regarded as an ingredient to increase environmental and social value, thereby involving local communities and citizens from the start in true co-creation processes.

4. Transferability and recommendations

4.1. Transferability

In terms of the transferability of internal drivers and factors, first the motivation to reconcile the development of renewable energy projects with the creation of ecological value is the main driver of the Energy Garden concept. Therefore, landscape value and the protection of biodiversity should be high on the political agenda of the region/country adopting the concept. It also helps to have a strong national environmental movement as a trusted partner of government. Second, local ownership of projects has to be high on the public agenda. This is not just about collection good ideas through local consultations, but about really creating co-ownership by allowing local citizens

as partners in designing the plans for the local Energy Garden. That way, they experience how their ideas are taken into account (or why certain ideas are rejected on good grounds). In the Netherlands, citizens are typically sceptical towards just accepting authority. That is why participatory design is so important. The local environment must feel that the energy garden really is theirs. In countries with a more authoritarian culture, this aspect of creating support through co-design is perhaps less prominent.

With respect to the transferability of external drivers and factors, public financial assistance (the initial project subsidy by the national postcode lottery) could probably be replicated in other countries. Subsidies, grants and other types of funding for Energy Gardens could be offered in other contexts by EU, national, regional or local authorities. One could think in particular of e.g., European research funds (e.g., INTERREG, Horizon 2020). Of course, this will in the end depend on political willingness, budgetary constraints and policy priorities of such public support providers. Also, land scarcity for project developments is a real issue in the Netherlands – hence the importance of multi-functional land use. In other countries where land is more commonly available, this will be less of an external driver towards adopting the concept of Energy Gardens.

4.2. Recommendations

Based on the findings of this best practice, the main recommendation for Energy Garden initiators and developers in other regions/countries would be to develop the Energy Garden concept and adapt it to the specificities of national/regional contexts. This could for instance be done by applying for funding to set up Energy Garden pilot projects in the context of an EU research project (with NMF as a partner or member of a steering committee).

With respect to local authorities, it is recommended that they assign unused municipal land to the development of an Energy Garden. This allows developers to significantly cut investment costs and provides an environmental, economic and social value to previously useless land. Regional and national authorities are also encouraged to develop guiding principles for the choice and use of land for renewable energy projects. Multi-functional land use should be encouraged in the development principles and could also be taken up by local governments as a requirement in public tenders.

CONTACT

COME RES Project
info@come-res.eu
www.come-res.eu

PARTNERS