



PROSEU

Prosumers for the Energy Union:  
mainstreaming active participation of  
citizens in the energy transition

Integrated lessons learned for renewable  
energy prosumer futures across Europe

(Deliverable N°7.3)

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## Summary of PROSEU

PROSEU aims to enable the mainstreaming of the renewable energy Prosumer phenomenon into the European Energy Union. Prosumers are active energy users who both consume and produce energy from renewable sources (RES). The growth of RES Prosumerism all over Europe challenges current energy market structures and institutions. PROSEU's research focuses on collectives of RES Prosumers and will investigate new business models, market regulations, infrastructural integration, technology scenarios and energy policies across Europe. The team will work together with RES Prosumer Initiatives (Living Labs), policymakers and other stakeholders from nine countries, following a quasi-experimental approach to learn how RES Prosumer communities, start-ups and businesses are dealing with their own challenges, and to determine what incentive structures will enable the mainstreaming of RES Prosumerism, while safeguarding citizen participation, inclusiveness and transparency. Moving beyond a case by case and fragmented body of research on RES Prosumers, PROSEU will build an integrated knowledge framework for a socio-political, socioeconomic, business and financial, technological, socio-technical and socio-cultural understanding of RES Prosumerism and coalesce in a comprehensive identification and assessment of incentive structures to enable the process of mainstreaming RES Prosumers in the context of the energy transition.

## Summary of PROSEU's Objectives

Eight key objectives at the foundation of the project's vision and work plan:

- **Objective 1:** Document and analyse the current state of the art with respect to (150-200) RES Prosumer initiatives in Europe.
- **Objective 2:** Identify and analyse the regulatory frameworks and policy instruments relevant for RES Prosumer initiatives in nine participating Member States.
- **Objective 3:** Identify innovative financing schemes throughout the nine participating Member States and the barriers and opportunities for RES Prosumer business models.
- **Objective 4:** Develop scenarios for 2030 and 2050 based on in-depth analysis of technological solutions for RES Prosumers under different geographical, climatic and socio-political conditions.
- **Objective 5:** Discuss the research findings with 30 relevant stakeholders in a Participatory Integrated Assessment and produce a roadmap (until 2030 and 2050) for mainstreaming RE Prosumerism.
- **Objective 6:** Synthesise the lessons learned through experimentation and co-learning within and across Living Labs.
- **Objective 7:** Develop new methodological tools and draw lessons on how the PROSEU methodology, aimed at co-creation and learning, can itself serve as an experiment with institutional innovation.
- **Objective 8:** Create an RES Prosumer Community of Interest.

## PROSEU Consortium Partners

Logo	Organisation	Type	Country
	FCiências <sup>ID</sup> ASSOCIAÇÃO PARA A INVESTIGAÇÃO E DESENVOLVIMENTO DE CIÊNCIAS FCIENCIAS.ID	Private non-profit association	Portugal
	U.PORTO FEUP FACULDADE DE ENGENHARIA UNIVERSIDADE DO PORTO	University	Portugal
	ICLEI EURO Local Governments for Sustainability	Small and medium-sized enterprise	Germany
	CLIENTEARTH	Non-governmental organisation	United Kingdom
	UNIVLEEDS	University	United Kingdom
	DRIFT	University	the Netherlands
	UNIZAG FSB	University	Croatia
	LEUPHANA UNIVERSITÄT LÖNEBURG	University	Germany
	ECO-UNION	Non-governmental organisation	Spain
	IÖW INSTITUTE FOR ECOLOGICAL ECONOMY RESEARCH	Private non-profit limited company	Germany
	CE Delft Committed to the Environment	Small and medium-sized enterprise	the Netherlands

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## Executive summary

This deliverable reports on the work carried out in PROSEU WP7 “Living Labs: Lessons learned and recommendations for mainstreaming the participation of citizens in the Energy Union, specifically, in task 7.3 “Meta-analysis, lessons learned and recommendations for Living Labs”.

The purpose of this document is to make available the results of the evaluation of the 15 PROSEU RES Living Labs developed over two years in nine EU countries (Belgium, Croatia, France, Germany, Italy, Portugal, Spain, the Netherlands, and the UK). This evaluation is based on the feedback received from Living Labs participants (i.e., collective prosumers, stakeholders) and PROSEU researchers and practitioners involved. Additionally, inputs from relevant actors working on or interested in RES prosumerism at the EU level and abroad, who participated in the 4<sup>th</sup> international workshop on Participatory Integrated Assessment (PIA) of Incentive Structures organised by PROSEU (in the context of WP6), have been analysed and incorporated into the evaluation.

The joint evaluation of the PROSEU RES Living Labs together with the inputs gathered in the final PIA workshop allowed us to assess the co-creative approach followed in the project, identify good practices and challenges both in Living Lab practices and prosumerism activities, and to provide a set of lessons learned and recommendations for other researchers and prosumer initiatives willing to engage in co-creation activities to promote collective RES prosumerism in Europe. For the prosumers and stakeholders involved, the participatory and co-creative methodology applied was intended to be useful to enlarge their knowledge and networking opportunities through their engagement in co-learning activities with other prosumer initiatives, stakeholders, and researchers in their regions and at the EU level.

The detailed evaluation of the PROSEU Living Labs showed that the methodological approach followed was well received by all actors involved. In general terms, it responded to the needs and aspirations of the participants and facilitated the development of local communities of practice around the energy transition. It was also found that this research design promoted dialogue and knowledge exchange, fostered engagement with broader diversity of stakeholders, and enlarged the networks of the prosumer initiatives involved. This last aspect is of importance since prosumer initiatives are not working in isolation and are rather depending on their local ecosystems and actor networks to develop their projects, acknowledging this can bring benefits and support the expansion of prosumerism. Taken together, the good practices identified, lessons learned, and recommendations extracted from this evaluation seem to provide a strong argument for reproducing the Living Lab methodology in energy transition research, as well as in other fields.

On the negative side, factors such as limited availability, lack of monetary compensation for participating, lack of financial support to develop their own activities, or not having an immediate gain in participating, hindered the interest of some stakeholders. Other challenges and difficulties experienced were associated with the internal dynamics of the participating organisations (e.g., volunteer work), but also with internalities within the development of the Living Labs (e.g., limited time to discuss and decide), as well as external factors affecting the initiatives and/or the Living Labs, such as the need to adjust national regulations, the transposition process of new EU Directives, or Brexit. One of the main external issues affecting the Living Labs was, of course, all problems derived from the COVID-19 pandemic (lockdown and economic downturn). The COVID-19 outbreak had an impact on the objectives and ambitions of some Living Labs participants, who found it difficult to maintain the same level of involvement. Nevertheless, the conversion of in-person into online meetings (due to the pandemic) offered the

opportunity to develop online methods and facilitation tools that can be used in other projects, thus combining online and in-person participation to reduce emissions (i.e., from travel to the workshop locations), but also to increase citizens' participation, in the case of citizens with online literacy.

Apart from the PROSEU Living Labs, the 4th international PIA workshop provided an excellent opportunity to share ideas concerning opportunities and challenges for developing business and financial models, technological solutions, overcoming legal challenges, and strengthening community building dynamics at the EU level. Among other key insights, the PIA participants acknowledged that the complexity of regulatory frameworks is a challenge for developing new business and financial models; identified the need for rolling out smart meters for an effective implementation of collective self-consumption and renewable energy communities (paying special attention to data access and data security issues); discussed the opportunities for collective self-consumption and renewable energy communities that the (ongoing) transposition of the Winter Package policies, including the REDII (articles 21 and 22) and the Internal Electricity Market Directive (articles 15 and 16), will provide once transposed to national legislations; finally, it was recognised that developing community building is critical for implementing new prosumer models, being of particular interest to extent it to more vulnerable and disenfranchised communities, as well as acknowledge the role of the municipalities in connecting different communities and pushing forward the replication and upscaling of energy communities.

This document will further detail these findings in the following way: Section 1 provides a literature review of relevant work on the role of Living Labs in energy transition research. Section 2 introduces the PROSEU Living Labs and describes the main challenges addressed and actors involved, the Living Lab process, and the interlinkages between this work (WP7) and the work conducted under WP6. Section 3 describes the materials and methods used in the analysis conducted to assess the PROSEU co-creation approach. Section 4 shows the identified good practices, challenges and difficulties experienced, while section 5 describes the main lessons learned extracted. Section 6 provides some recommendations for implementing co-creation activities to promote collective RES prosumerism in Europe. Section 7 is dedicated to the discussion of the findings and the interlinkages between the Living Labs research (WP7) and the Participatory Integrated Assessment of Incentive Structures (WP6). Finally, section 8 provides the main conclusions extracted as well as suggestions for further research.



## 1. Living Labs in Energy Transition Research

The energy transition has been the most relevant research topic in sustainability transitions research. In this research field, RES Prosumerism emerges as a cluster of interrelated innovations that defy, challenge, and have the potential to fundamentally alter the dominant centralised and fossil-fuel based energy system (Wittmayer et al., 2020). The dynamics of long-term socio-technical regime shifts (or transitions) emerge through co-evolutionary processes, between numerous innovations and structural changes, which are far from being controllable, linear, and predictable processes. Within the Multi-level Perspective (MLP) on transitions, such transformative changes imply a series of co-evolving interactions between the dominant socio-technical regime (e.g., a centralized fossil-fuel based energy system), niches or socio-technical innovations (e.g., RES prosumerism) and a landscape or contextual and exogenous factors (e.g., climate change) (Geels, 2011). Thus, renewable energy prosumerism is itself understood as an “emerging set of evolutionary niches – radical alternatives that deviate from the rules and incentives of the dominant socio-technical system” (Pel et al., 2019, p.17).

PROSEU departs from a leading research question which is to understand what the incentive structures for mainstreaming RES prosumerism are. This question has been addressed through a transdisciplinary approach to gain insights into the directionality of the energy transition, with prosumerism playing a central role. Such participatory and transdisciplinary approach has been undertaken through, on one hand, the participatory integrated assessment of incentive structures for mainstreaming prosumerism (WP6, D6.1, D6.2 and D6.3) and, on the other hand, through a Living Labs bottom-up approach (WP7).

As the mainstreaming of RES prosumerism implies a transformative change of the energy system and considering that this change cannot be easily managed or controlled, but requires robust transdisciplinary insights and a multitude of participatory visions for the future (Loorbach & Rotmans, 2010), the involvement of both frontrunners (e.g., prosumers) and regime actors (e.g., utilities, governments, etc.) is critical for advancing with research on the socio-technical dynamics of the transition, and specifically on the role prosumers play (Wierling et al., 2018).

Thus, transition research has proposed several transdisciplinary approaches, including real-world laboratories (Engels & Walz, 2018; Loorbach & Rotmans, 2010; Schöpke et al., 2018), which inspired PROSEU’s Living Labs. This approach offers insights into how prosumerism emerges through real-world experiments, enables gaining new knowledge on prosumers, but as well to exchange knowledge directly with real-life innovators, engaged in the co-production of knowledge that feeds directly into transition dynamics. Living Labs are thus a prefigurative approach, in the sense that they are a means to gain new knowledge while simultaneously advancing with real-life changes (Engels & Walz, 2018). This is critical for transitions, as the complex dynamics of societal change cannot easily be stirred nor managed, but rather require a co-creation approach that emerges through the active involvement of multiple social actors in co-constructing desired futures (Loorbach et al., 2017).

## 2. PROSEU Living Labs

PROSEU’s Living Labs were developed as a place-based approach to enable understanding how prosumers and other stakeholders (e.g., local governments, financial agents, utility companies, local communities, etc.) are working together to carry out real-world experiments, which result in new knowledge and new practices steered by collective visions of a shared desired energy future. Thus,

PROSEU's Living Labs are largely framed by sustainability transitions' real-world laboratories research (Renn, 2018; Schöpke et al., 2018).

Specifically, the PROSEU Consortium partners worked with collective prosumers initiatives and stakeholders across Europe to co-create solutions that help them overcome legal, technological, financial, or cultural barriers to engage in RES prosumerism through mutual learning activities. Following a participatory approach, the PROSEU team established 15 Living Labs in nine EU countries (Belgium, Croatia, France, Germany, Italy, Portugal, Spain, the Netherlands, and the UK) which allowed the project to reach a better understanding of the existing incentive (and disincentive) structures that enable (or hinder) the mainstreaming of prosumerism in those countries from a bottom-up perspective. For the prosumers and stakeholders involved in the PROSEU Living Labs, this interactive methodology was intended to be useful to enlarge their knowledge and networking opportunities through their engagement in co-learning activities with other prosumer initiatives, stakeholders, and researchers in their regions and at the EU level.

The application of this methodology also shed light on the relevance of a wide diversity of prosumer-related initiatives and stakeholders to refine our initial conceptual definition of prosumerism as a socio-technical innovation, that exists in the form of ideas, objects, and actions (Pel et al., 2019). Indeed, prosumerism as sphere of socio-technical innovation encompasses the active participation of citizens in the energy transition as prosumers (i.e., from individual prosumers and collective self-consumption initiatives, to renewable energy communities), but also the active participation of many other stakeholders, including local governments, civil society organisations and the financial sector, particularly the alternative finance sector (i.e., see Holstenkamp et al., (2020)), to name a few. There is a wide-ranging potential for the participation of a diversity of citizens and stakeholders in the energy transition, that goes beyond the prosumer model (i.e., as a producer and self-consumer of energy from renewable sources), and which nevertheless co-constructs a socio-technical innovation and a movement (Campos & Marín-González, 2020) which we call RES prosumerism.

Throughout the project (March 2018 - February 2021), 60 interventions (i.e., moments in time when Living Lab participants and PROSEU researchers and practitioners involved in the Living Labs met to discuss, learn, and co-create innovative solutions to address the identified challenges related to RES prosumerism) were carried out. These interventions involved more than 660 people across Europe, including, among others, collective and individual prosumers, researchers, industry representatives, policymakers, citizens' organisations, etc. and aimed at generating new insights while attempting to solve very practical problems facing prosumers today.

Previous deliverables (D7.1 and D7.2) have already described the stories and outcomes generated from the co-creation activities developed within each of the RES PROSEU Living Labs. This report closes the work carried out with the Living Labs by presenting the results of their evaluation, which is a final and necessary stage of the Living Lab process. As in any other participatory research experience, evaluation is essential for an impact assessment of the actions, processes and methods developed. Therefore, PROSEU team members conducted an assessment of the interventions undertaken to identify good practices as well as challenges and difficulties experienced during the Living Labs. It was also critical to assess the Living Labs' capacity for the co-production of knowledge, for sharing ideas and solutions, and for building and expanding prosumer and stakeholder networks. Additionally, as PROSEU's methodology focused largely on understanding the directionality of the transition through the mainstreaming of prosumerism as a central future of transition pathways, Living Labs offered a hands-

on real-life approach to understand the needs, visions and solutions of prosumers and their stakeholder networks for advancing further with the transition, thus complementing PROSEU's participatory assessment of incentive structures.

The findings reported in this document can be useful for future Living Labs that focus on RES prosumerism but also to other researchers and practitioners willing to develop Living Labs in any topic of interest. A final set of lessons learned, and recommendations were also distilled and are presented in this report.

## 2.1 Challenges and actors involved

Living Labs represent a powerful research methodology for sensing, validating, and refining complex solutions in real-life contexts. Through the establishment of collaborative working environments, the involvement of citizens, users, or consumers in the development of products, applications or services offers a unique opportunity to create and validate innovation (Ballon & Schuurman, 2015; Schumacher & Feurstein, 2007). Thus, the PROSEU Living Labs have been environments for exploration, experimentation and evaluation of ideas, projects, products, and tools, which hold the potential to gather multiple societal agents to work in a common goal that responded to specific local or community challenges (see for instance Campos et al., 2019). Thus, the diversity of stakeholders involved in the PROSEU Living Labs worked together to co-create solutions for new, or already existing, prosumer initiatives. The PROSEU Living Labs have responded to the diverse needs and challenges identified at the beginning of a series of participatory workshops which followed a co-creation and mutual learning approach. This included the co-creation of technical tools and financial analyses, business models, networking opportunities, increase engagement and awareness, or the enlargement of participants' knowledge on the current legal changes that affect prosumers at national and EU levels.

The PROSEU deliverables D7.1 *"Co-learning and co-creation experiences with renewable energy prosumer Living Labs across Europe"* (Hinsch et al., 2020) and D7.2 *"Prosumers inspiration book"* (Hinsch et al., 2021) provide a comprehensive description of all 15 PROSEU Living Labs, the stakeholders involved, and the activities carried out to try to overcome commonly identified barriers by Living Labs participants. Table 1 summarises the main challenges addressed in the PROSEU Living Labs.

Table 1 Main challenges addressed in the PROSEU Living Labs

Country	Living Lab name	Main challenge addressed
Belgium	Getesnippers Living Lab	To evaluate the feasibility of a valorisation chain for sustainable heat using residue biomass from landscape conversion and maintenance work
Belgium	KDN United Living Lab	To discuss the potential to create a community building integrated with RES with local community involvement
Croatia	Island of Silba Living Lab	To assess the feasibility of a clean water supply through desalinisation through PV involving the local community

Croatia	One-stop-shop Living Lab	To develop a tool, particularly in cooperation with stakeholders from banks, which will serve prosumers in the future by showing the bankability of individual PV installations on household's roofs
France	Promotion of prosumerism Living Lab	To better understand the economic (and legal) models used by members of Energie Partagée (EPA) to start a self-production scheme through third-party investment and/or external management schemes
Germany	Sub-Urban Heat Transition Living Lab	To engage citizens with the development of a local district heating network and to evaluate the extent to which residents, but particularly a local school would be willing to engage with the project
Germany	Northeast Lower Saxony Living Lab	To evaluate the possibilities to market a regional electricity product and to widen the citizen-led projects outreach
Italy	The Santorso Living Lab	To provide citizens with support to enlarge their scope of action with regard to RES (biomasses, sustainable electric mobility).
The Netherlands	Buurtwarmte Living Lab	To support the development of neighbourhood energy cooperatives aimed at providing sustainable heating to their members
The Netherlands	Aardehuis Living Lab	To find the institutional barriers around prosumerism in the eco-village, and to co-create solutions together with relevant stakeholders to overcome these obstacles
Portugal	Wines of Alentejo Living Lab	To mainstream the adoption of RES amongst Alentejo's viticulture industry by accelerating a wider adoption of RES and promote the setting up of collective self-consumption schemes among Alentejo's wineries
Portugal	Sao Luís Energy Community Living Lab	To encourage and facilitate the setup of energy communities in Odemira, Alentejo
Spain	Self-Consumption Living Lab	To explore the best possible business models for energy cooperatives and their members which would also incentivise the maximum uptake of prosumerism in Spain over the next years
United Kingdom	Bristol Energy Cooperative Living Lab	To explore new potential business models to guarantee further exploitation of larger-scale renewable energy plants even without a fixed remuneration guaranteed under the previous FiT system

United Kingdom	Bristol Energy Company Living Lab	To investigate how emerging business models, such as “heat as a service” could contribute to the UK’s net-zero ambitions for the built environment
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As already described by Hinsch and colleagues in D7.1, the Living Labs involved multiple stakeholders from several industries and sectors (e.g., food production, energy production and distribution, banking, policymaking, and well as NGOs and other civil organisations), from both urban and rural areas (from big cities to small villages), who are facing distinct challenges to develop their current or envisioned RES prosumer projects.

To ensure effective partnerships and a successful internal organisation of all the actors involved in Living Lab activities, the project established four different roles and responsibilities within the Living Labs:

- The *Living Lab Focal Point*: main reference and contact person within the initiatives invited to be part of the Living Labs; s/he was responsible for engaging with the PROSEU team and co-designing the activities to be carried out at the different events that took place within the context of the Living Labs;
- The *Living Lab Stakeholders*: other organisations or individuals who took part in the Living Labs, together with the ‘Focal Point’ (i.e., Living Lab participants);
- The *PROSEU Focal Point*: main contact person from PROSEU in each Living Lab;
- The *PROSEU research team*: PROSEU team members involved in Living Lab activities.

Table 2 provides an overview of the prosumer initiatives and organisations who were most involved in the PROSEU Living Labs activities (i.e., Living Lab Focal Points, Living Lab Stakeholders, and PROSEU partners in charge of the Living Labs). The stakeholders listed below represent the core of the Living Labs, with many more having been engaged as participants.

Table 2 Prosumer initiatives, organisations and PROSEU partners involved in the Living Labs

Country	Living Lab name & country	Living Lab participants and PROSEU partners involved
Belgium	Getesnippers Living Lab (BE)	Interleuven (Living Lab focal point), ECO2 agrobeteercentrum, Province of Vlaams-Brabant, Regionaal Landschap Zuid-Hageland, Municipality of Holsbeek, and ICLEI Europe (PROSEU)
Belgium	KDN United Living Lab (BE)	KDN United Holsbeek (Living Lab focal point), Interleuven, Municipality of Holsbeek, Energy, Innovatiesteunpunt, ICLEI Europe (PROSEU partner) and ClientEarth (PROSEU)
Croatia	Island of Silba Living Lab (HR)	Local citizens and members of local council (Living Lab focal point), Island Movement (Pokret Otoka), Vodovod ltd Zadar, and University of Zagreb (PROSEU)

Croatia	One-stop-shop Living Lab (HR)	Cooperative for Ethical Financing (Living Lab focal point), Private users interested in integrated PV, Commercial banks representatives, and University of Zagreb (PROSEU)
France	Promotion of prosumerism Living Lab (FR)	Energie Partagée (Living Lab focal point), Enercoop, CIRENA, Hespul, EnerCit'IF, and eco-union (PROSEU)
Germany	SubWW - Sub-Urban Heat Transition Living Lab (GE)	Umweltzentrum Stuhr-Weyhe (Living Lab focal point), TU Berlin, Municipality of Weyhe, Gemeindewerke, two public schools, a supermarket, residents of the district of Leeste, and IÖW (PROSEU)
Germany	Northeast Lower Saxony Living Lab (GE)	BürgerEnergie Buxtehude eG (Living Lab focal point), and Leuphana University of Lüneburg (PROSEU)
Italy	The Santorso Living Lab (IT)	Santorso Municipality (Living Lab focal point), Buona Pratica Santorso, Sportello Energia - Legambiente, other surrounding municipalities, citizens, and ICLEI Europe (PROSEU)
The Netherlands	Buurtwarmte Living Lab (NL)	Thermobello (Living Lab focal point), 'Blauwvinger energie' (Zwolle), local energy cooperative 'WOW' (Wageningen), Local foundation 050 buurtwarmte, and DRIFT (PROSEU)
The Netherlands	Aardehuis Living Lab (NL)	Vve Aardehuizen (Living Lab focal point), Enexis, Saxion, RVO, Fresh, Energiecooperatie goed veur mekare, Gen-NL, University of Twente, EnergieSamen, Escozon Cooperative, Project Kompasie/Double Dialogue, Blauwvinger Energie/EnergieSamen, Zelziuz Pentascope/Club van Wageningen, Cleantech Regio Development, Endona, Oost NL, DRIFT and CE Delft (PROSEU)
Portugal	Wines of Alentejo Living Lab (PT)	Wines of Alentejo (Living Lab focal point), Herdade do Esporão, Sogrape, Herdade das Servas, Adega de Borba, Adega Mayor, Adega Reynolds, University of Lisboa RES experts, and FC.ID (PROSEU)
Portugal	Sao Luís Energy Community Living Lab (PT)	São Luis Transition Town (Living Lab focal point), Coopérnico energy cooperative, Tamera Ecovillage, Minga Cooperative, residents of São Luis and nearby villages, Junta de Freguesia (local parish administration), Odemira municipality, energy specialists (University of Lisboa) and FC.ID (PROSEU)

Spain	Self-Consumption Living Lab (SP)	Som Energia (Living Lab focal point), Amigos de la Tierra, Hola Luz, ecoserveis, Barcelona Energia, Energética Coop, Estabanell Energia, Endesa Distribución, Operador Energética Pamplona, Goiener, IDEA, and eco-union (PROSEU)
United Kingdom	Bristol Energy Cooperative Living Lab (UK)	Bristol Energy Cooperative (Living Lab focal point), University of Leeds (PROSEU)
United Kingdom	Bristol Energy Company Living Lab (UK)	Bristol Energy Company (Living Lab focal point), University of Leeds (PROSEU)

## 2.2 A three-stage process: exploration, experimentation, and evaluation

The PROSEU Living Labs were understood as networks of RES prosumers and stakeholders that encompassed collective prosumer initiatives as well as individual citizens involved in RES collective entities (Hinsch et al., 2020). As spaces for co-creation, the PROSEU Living Labs draw on the methodological approach suggested by Malmberg and collaborators (2017), who distinguished three innovation development stages as the main building blocks of Living Lab activities. Based on this approach, the interventions conducted within each of the PROSEU Living Labs followed this common structure:

- 1<sup>st</sup> intervention (Exploration) - Needs-assessment which aimed at:
  - Establishing a common understanding between Living Lab participants and the PROSEU team and designing possible future states;
  - Getting to know the state-of-the-art and frame the challenges and institutional barriers to be addressed by the Living Lab;
- 2<sup>nd</sup> and 3<sup>rd</sup> interventions (Experimentation) - Development of co-creation activities; these two interventions aimed at:
  - Designing and testing of solutions, tools, services, etc. that addressed the specific needs and barriers identified in each of the Living Labs from a diversity of perspectives (i.e., financial, technological, socio-cultural, legal aspects);
- 4<sup>th</sup> intervention (Evaluation) - This was an assessment of the Living Lab activities, process, and outcomes which helped us to understand the good practices and difficulties experienced within the Living Labs, and extract key lessons learned and recommendations for prosumers and other researchers and practitioners. This final session also included a final presentation and wrap-up of the solutions, products, and ideas developed through the 2<sup>nd</sup> and 3<sup>rd</sup> interventions.

While previous WP7 PROSEU deliverables (D7.1 and D7.2) were based on the first set of interventions (needs-assessment and the co-creation activities developed in the 15 PROSEU Living Labs), this report presents the results of the joint evaluation conducted in the Living Labs (4<sup>th</sup> intervention), which includes the feedback collected from Living Lab Focal Points, Living Lab Stakeholders, and the PROSEU



researchers in charge of the Labs (see Table 2). As detailed in the methodology (section 2), a qualitative evaluation was conducted to assess the suitability, effectiveness and impact of the activities conducted to meet the needs identified.

### 2.3 Interlinkages with WP6

Apart from D7.1 and D7.2, other PROSEU deliverables (D6.1 and D6.3) have looked at the Living Lab findings to find out enabling conditions and institutional barriers in practice (de Geus et al., 2021; Pel et al., 2019).

Within the work of WP6, a series of 4 international workshops were organised to develop the PROSEU Participatory Integrated Assessment (PIA) of Incentive Structures. The goals of the PIA workshops were: i) to discuss some of the findings derived from WP3 (policy recommendations), WP4 (financing and business models) and WP5 (technological solutions), as well as socio-cultural aspects linked to prosumerism; ii) to identify the main barriers and opportunities for mainstreaming RES prosumerism in Europe; and iii) to develop a roadmap to 2030 and 2050. The 4<sup>th</sup> international workshop aimed at disseminating, validating, and collecting feedback from relevant stakeholders on the work done in the first three workshops (in the framework of WP6) and collect inputs on the outcomes derived from the work with the Living Labs (WP7).

Therefore, this evaluation also incorporates and analyses the feedback from relevant actors working on or interested in RES prosumerism at the EU level and abroad, who participated in the 4<sup>th</sup> international workshop on Participatory Integrated Assessment (PIA) of Incentive Structures.

The joint evaluation of the PROSEU Living Labs together with the inputs gathered in the final integrated assessment of incentives structures workshop allowed us to assess the co-creative approach followed in the project, identify good practices and challenges both in Living Lab practices and prosumerism activities, and to provide a set of lessons learned and recommendations for other researchers and prosumer initiatives willing to engage in co-creation activities to promote collective RES prosumerism in Europe.

## 3. Methodology

### 3.1 Data collection

The PROSEU Living Labs took place in nine countries across Europe (Belgium, Croatia, France, Germany, Italy, Netherlands, Portugal, Spain, and UK), and involved more than 660 participants. To evaluate the impact of the Living Lab activities conducted, distil the main lessons learned, best practices, and innovative solutions for prosumers, as well as deliver fundamental recommendations for initiatives and other researchers willing to develop co-creation activities in the field of RES prosumerism, we collected qualitative data from four groups of actors: 1) Living Lab Focal Points (i.e., people who belonged to the PROSEU Living Labs and acted as the main reference and contact person for the duration of the project); 2) Living Lab Stakeholders (i.e., organisations or individuals who took part in the PROSEU Living Labs); 3) PROSEU researchers and practitioners involved in the Living Labs (presented as 'PROSEU teams' in the following sections), and 4) stakeholders who participated in the PROSEU 4<sup>th</sup> International PIA workshop called "*Prosumerism in Europe: Barriers today, Pathways ahead*" celebrated in October 2020. This workshop included the participation of Living Lab members and relevant stakeholders working in the



development of prosumerism in Europe at the local, regional, national and EU levels (e.g., representatives of energy cooperatives, national climate agencies, national and regional energy agencies, researchers, experts in municipal energy, among others).

Data collection was based on two different methods: i) a qualitative evaluation in the form of an open-ended questionnaire with specific questions for each group of actors conducted during the last Living Lab interventions (section 2.1.1), and ii) a workshop (the PROSEU 4<sup>th</sup> International PIA workshop) that included two separate sessions (see the programme in Annex 1), one of them focusing on the PROSEU Living Labs. Both data collection methods were adapted to the COVID-19 lockdown and converted into online formats.

### 3.1.1 Evaluation reporting template

A reporting template was used as a guideline to collect data throughout the entire development of the Living Labs. PROSEU partners in charge of the Living Labs provided the requested information after each one of the 4<sup>th</sup> interventions conducted. For the 4<sup>th</sup> intervention, corresponding to the evaluation stage, a separate evaluation reporting template was produced to include specific questions (Table 3) to be addressed to each of the three kind of actors involved in Living Labs activities, i.e., Living Lab Focal Points, Living Lab Stakeholders, and PROSEU researchers and practitioners who managed and participated in the Living Labs. The Living Lab Focal Points were considered as a separate target group because of their higher level of engagement and specific role of facilitation carried out between Living Lab Stakeholders and PROSEU researchers and practitioners. Results in Section 4 show this distinction between target groups.

The evaluation reporting template was designed to register the qualitative data collected on the Living Lab co-creation process, outcomes and main lessons learned. To collect that information, multiple methods were applied, e.g., online self-managed questionnaires, informal discussions occurring during the 4<sup>th</sup> intervention (evaluation stage), phone calls or email exchanges.

Table 3 Questionnaire for Living Lab participants and PROSEU teams

Target group	Questions
Living Lab Focal Points	Do you think the key objectives (set out at the needs assessment stage) were reached as expected? Did the LL go beyond these objectives?
	How did the Living Lab help solve the needs/challenges identified at the beginning?
	Following the activities in which you participated, what do you think are the most important strengths and weakness of the LL?
	How do you think the Living Lab benefitted the stakeholders involved?
	In your opinion, will the Living Lab continue to exist after the project's closure? If yes, who do you think will be leading it?
	Did you feel you had a role in Living Lab's co-creating the LLs activities? How much did you feel involved?

	Do you think the project involved the right people? Was it inclusive? If not, who do you think was missing?
	What is the main lesson learned from all the interventions? (i.e., if the LL process had been a story what key lesson would you take from it?)
<b>Living Lab Stakeholders</b>	Was your initial objective reached? How did the Living Lab help solve the needs/challenges identified at the beginning?
	Following the interventions where you participated, how and to what extent did you reconsidered your objectives and ambitions?
	What is the main lesson learned? i.e., if the LL process had been a story, what key lesson would you take from it?
	Do you think the project involved the right people? Was it inclusive? If not, who do you think was missing?
	Suggestions for the future
<b>PROSEU researchers and practitioners (PROSEU teams)</b>	Was the objective set by the Living Lab reached?
	How do you think the Living Lab benefitted the stakeholders involved?
	Do you think you managed to co-create the interventions with LL stakeholders? Why and if yes how?
	Do you think the LL involved the right people? Was it inclusive? If not, who do you think was missing and why?
	What were the main challenges and opportunities in carrying out the interventions? (list at least 2 challenges and 2 opportunities)
	If the LL had been a story someone had told you, what are the main lessons learned you would take from that 'story'? (provide at least two key ideas that you gained from the Living Lab experiences):
	What suggestions do you have for the future of the initiative promoted through the Living Lab?
	What suggestions do you have for future research with Living Labs (e.g., management strategies, methods, communication, etc.)?

### 3.1.2 The PROSEU 4<sup>th</sup> International PIA workshop

The 4<sup>th</sup> International workshop on Participatory Integrated Assessment (PIA) of Incentive Structures was co-organised within the framework of PROSEU WP6 and WP7 and took place (in an online format) in October 2020. This workshop had two main objectives which were addressed in two separate sessions during the event. The morning session (with around 60 participants) was dedicated to learning about

hands-on solutions for current prosumer dilemma's through the experiences of the PROSEU Living Lab participants. Specifically, it aimed at reflecting on the work conducted within the PROSEU Living Labs, focusing on the main challenges addressed, the lessons learned, and to what extent and how the Living Labs helped to overcome (or not) barriers to collective RES prosumerism in their local contexts. The discussions were expanded to other stakeholders not directly involved in Living Labs, which had the opportunity to share similar problems and opportunities to develop prosumerism all over Europe and beyond, creating in this way new synergies and opportunities for collaboration and innovation.

The session was divided into four breakout rooms and organised around the following topics:

- Developing Business and Finance Models
- Developing Technical Solutions
- Overcoming Legal Challenges
- Community Building

The key questions that led the discussions were: *What were the main challenges of the PROSEU Living Labs and to what extent have their members overcome them together? What have the Living Labs learned? Do you think that similar solutions/approaches would work in your context?*

The afternoon session was dedicated to the work carried out in WP6, i.e., discussion around the co-created roadmap (2030-2050) for mainstreaming prosumerism in the European Union, the 'critical choices' that can shape the future of prosumerism, and what recommendations emerge from the PROSEU project. The results of this session are integrated in D6.3 (de Geus et al., 2021).

## 3.2 Data analysis

Data analysis was executed combining deductive and inductive approaches to the qualitative data gathered from the evaluation reports and notes taken during the online workshop. The initial pre-identified categories were related to the main objectives of this report, i.e., the identification of good practices, lessons learned and recommendations for prosumer initiatives and other stakeholders to promote collective RES prosumerism in Europe. The subsequent inductive coding approach allowed us to identify the six major themes that describe the experience of Living Lab participants and PROSEU researchers after being enrolled in the Living Labs, i.e.:

1. Participatory approach and co-creation dynamics within the Living Labs
2. Stakeholder engagement in the Living Labs
3. Outcomes achieved
4. Internal dynamics (of the initiatives/ or the Living Labs) and external factors
5. Role and background of the PROSEU team involved in the process
6. Opportunities identified and challenges experienced

Figure 1 provides a visual summary of the methodological approach followed.

In what follows, the results of the analysis are provided in relation to each of the major themes identified. The thematic codes were introduced in tables, next to key quotations from participants illustrating these findings. The PROSEU Living Lab Focal Points and PROSEU Living Lab Stakeholders are presented as Living Lab participants.

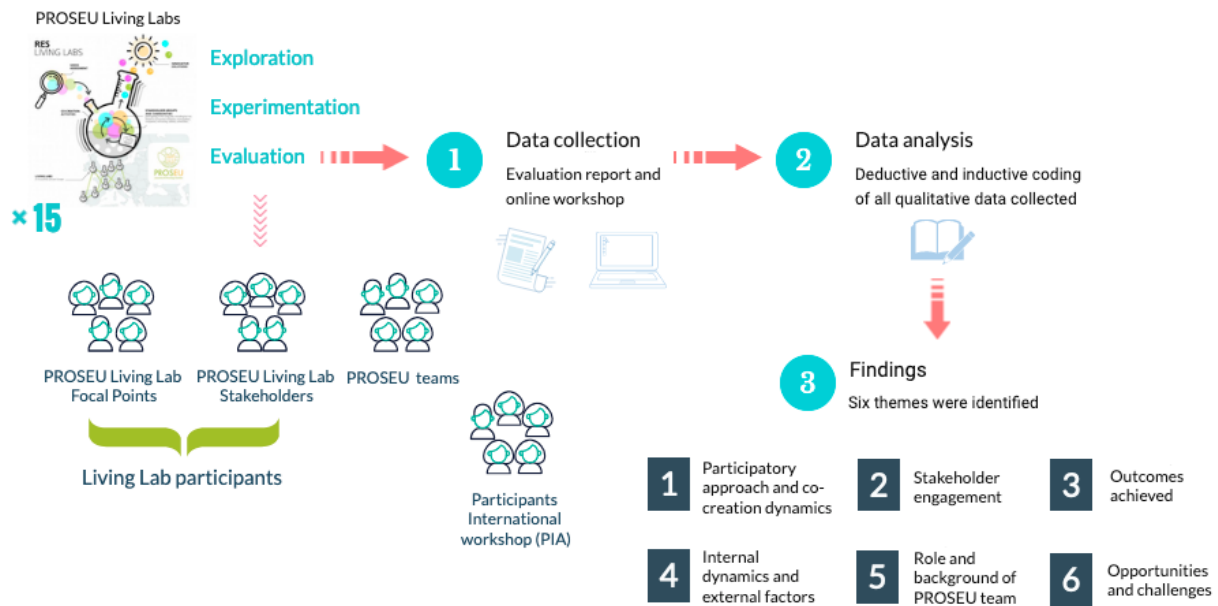


Figure 1. Summary of the methodological approach followed

## 4. Good practices and difficulties experienced

Throughout the 60 interventions conducted within the 15 PROSEU Living Labs, their members (Living Lab Focal Points, Living Lab Stakeholders, and PROSEU teams involved) experienced useful and very productive moments where creativity, knowledge sharing, and learning, were boost, but also some difficulties that make them more aware of the challenges that developing (both) RES projects and Living Lab activities entail.

In the following subsections, a detailed analysis of the six abovementioned themes (i.e., Participatory approach and co-creation dynamics; Stakeholder engagement; Outcomes achieved; Internal dynamics and external factors; Role and background of PROSEU researchers; and Opportunities and challenges) is presented in light of the good practices and challenges identified by Living Lab participants and PROSEU teams involved.

### 4.1 Participatory approach and co-creation dynamics

Overall, from the perspective of participants (i.e., Living Lab focal points and Living Lab stakeholders), the participatory and co-creation approach was well received and facilitated the development of local communities of practice around the energy transition. The fact that the Living Labs research was streamlined through a series of pre-determined steps (from the initial needs assessment to the final evaluation), rather than a more unstructured action-research process, was considered a strength supporting the targeted **design of solutions, models, and innovations** to address the needs identified.

As for the challenges and difficulties experienced, in some case participants found presentations were too complex to be followed by non-experts. Highly technical topics and concepts (from technological terms to legal aspects) represented a barrier for some of the participants involved. Some participants aimed at broadly disseminating the content learned to the whole community as they understood this

knowledge is of interest for many people, so they required specifically clear and simple messages. It is important, then, that the Living Labs’ interventions are closely aligned with a **robust communication approach**, including using simple language and supported by visual tools that simplify messages and ensure easy comprehension.

For the PROSEU teams involved, **mutual learning and sharing of experiences** within a transdisciplinary team was highlighted as a good practice. Key difficulties and challenges encountered were, on one hand, the **high workload and intensity** of participatory research, and, on the other hand the need for additional workshops and events, aside from the planned four interventions. This may seem contradictory but can be understood as two sides of the same coin. Living Labs are a form of action-research which is, as other action-research approaches very time consuming. However, a fixed number of meetings or ‘interventions’ is not easy to pre-determine since, depending on the experience, more or less meetings may be needed to achieve the desired outcomes. Often a pre-determined number of meetings can constraint both researchers and practitioners (also hindering the innovation potential of the Living Lab) who need to pack into a tighter schedule several activities, which otherwise could be more dispersed in time.

#### 4.1.1 PROSEU Living Lab participants

Table 4 Participatory approach and co-creation dynamics (Living Lab participants)

Themes	Living Lab Focal Points	Living Lab Stakeholders
<b>Good practices (things that worked well)</b>	It enabled Living Lab participants to approach their work in a holistic and more structured manner, promoting the generation of new ideas for their next steps and potential stakeholders to involve in the future	Collective brainstorming and think about the greater picture
	Some Living Lab focal points found co-creation so useful that are expecting to follow through with this approach in their projects	The “visionary exercise” was found very useful to enable participants to think of the future of the project in a holistic way
	The collaborative search for partners/stakeholders helped to get the right and needed input but also to gain contacts and created a bigger network important for the Living Labs	A holistic approach (including technical, economic, social, and environmental solutions) can contribute to seeking for other more acceptable and secure solutions
	The Living Lab strengthened the resilience of the project, which would probably not have continued during the COVID-19 pandemic (if not for the PROSEU partners, which developed new possibilities)	Involving stakeholders in the discussions helped to detect issues that were not taken into account. Thus, the proposed solutions were improved and more adapted to the local reality.

<b>Challenges and difficulties experienced</b>	Large-scale representativeness of the territory and large competencies of people involved in the participatory process	It was seen as a creative and constructive, and an opportunity to clarify the aim of the project and show the potential of renewables (e.g., heating supply) to reduce CO2 emissions
	The process made it possible to see potential solutions and activate contacts to move forwards with the Living Lab goals	It provided different possibilities and formats to participate citizens
	Co-creation approach was very successful in, for instance, thinking about a possible role/position for small(er) scale and citizen owned and operated heating systems	This approach helped them to direct their goals and energies and provided examples from other countries that could be also use in their context
	Activities conducted were useful and informative	Inspiration from a diversity of practitioners and academics involved in the interventions
	The structured identification of the Living Lab needs allowed for a targeted design of the following intervention formats and contents	
	Bringing together different stakeholders and sharing knowledge and innovation	
	Lack of financial resources for the Living Lab partners meaning limited potential for engagement	Keep the focus as concrete as possible from the beginning
	Lack of clear objectives of the Living Lab	Some presentations were too complex or technical to be followed by non-experts

Living Lab Silba island (Croatia): *"We felt like we have a role in co-creating Living Lab activities and we felt very involved"* [Focal Point]

Living Lab Aardehuizen (Netherlands): *"[the organization of the interventions, co-created between the Living Lab focal point and the PROSEU partners] was smooth and flexible, with online temperature checks, if one was too busy, the other could chip in a bit more, there were no tight straightjackets" (...)* *"[the PROSEU team] provided something to hold on to. It had an added value. This comes across more serious to people you invite to a gathering." (...)* *"normally the difficulty is with translating academic levels to practice and vice versa. That went very well"* [Focal Point]

Living Lab Santorso (Italy): *"The (Living Lab) interventions supported us to better direct our goals and energies and to understand that initiatives in other countries that seem far distant from our context and too technical, are instead possible also here. We did not start with a defined objective but rather with a positive and open attitude toward any possibility scale up our activities; now the simple good will of the beginning took more defined shapes"* [Stakeholder]

### 4.1.2 PROSEU teams

Table 5 Participatory approach and co-creation dynamics (PROSEU teams)

Themes	PROSEU teams
<b>Good practices (things that worked well)</b>	The PROSEU co-creation approach provided stakeholders with an opportunity to reflect on what they are doing through an innovative methodology that complemented their own processes by opening new ways of interaction and discussion
	Mutual learning process that allowed the PROSEU team members to dive deep into some of the crucial aspects in shared self-consumption and community energy, such as business models and legal schemes
	Interaction between different stakeholders were extremely useful to better understand the requirements of prosumerism, the barriers, solutions and impacts
	Living Lab participants (e.g., local people) acted as a source of valuable and specific place-specific information
	There was collaborative decision-making concerning the interventions conducted
	New collaborations and synergies were established as a result of the participatory and co-creation approach followed: big pools of ideas were created
	Combination of different resources: PROSEU partners had the time, people and resources, also broad contacts and technologies, whereas the Living Lab participants offered a deep knowledge of their region and relevant local contacts
	Living Labs offered a unique opportunity to get together stakeholders who usually do not have the chance to discuss how working together can increase regional renewable energy production and promote low-carbon industry processes (e.g., wine industry in the Alentejo region in Portugal)
	Local knowledge on key aspects (e.g., legal, financial, technical) was encouraged on a new level and therefore also local communities' capacities to act
	<b>Challenges and difficulties experienced</b>
More participatory and co-creative activities (e.g., workshops) could have been done, support on reflexive monitoring was also missing in some Living Labs	
The Living Lab was not 'assembled' by the PROSEU team but an existing initiative that was willing to cooperate with us in action research	

Living Lab São Luís (Portugal): *"we involved our key focal point representatives in the preparation of the workshops, from setting together the goals, who to invite and agenda of each to the facilitation process. We developed all the interventions together. Even the last one, which was online (due to the pandemic situation) was still co-developed with them. The program was previously shared and co-produced using*



online shared documents. A member of the community was integrated to provide graphical support" [PROSEU team]

Living Lab Buurtwarmte (Netherlands): "Coming from needs to formulating interventions was not an easy step and was then based on our suggestions – more co-creation would have been helpful here and might have also led to more satisfaction at the end of the LL" [PROSEU team]

## 4.2 Stakeholder engagement

A key finding was that the **Living Labs’ research design fosters inclusion** because it implies an ongoing mapping and engagement of different stakeholders, while responding to the needs and aspirations of the Living Lab participants. Nevertheless, despite being an approach that fosters inclusive participatory processes, participants found, in some instances, that more stakeholders should have been involved. Participants also found it **difficult to engage some stakeholders** especially those that, although important for the Living Lab process, did not feel they had an immediate gain in participating.

The PROSEU teams considered equally that the methodology enabled the involvement of a wide diversity of stakeholders, and as well a **stakeholder dialogue and knowledge exchange** (as different experts provided inputs to the participatory process) leading to an increased understanding of the key issues being addressed by the Living Lab. However, teams found it challenging to keep stakeholders engaged throughout the process, particularly schools and citizens. It was difficult to also to appeal to business-driven interests, while addressing the Living Lab needs. Limited time, **lack of financial interest and/or monetary compensation** for participating hindered the interest of some stakeholders.

### 4.2.1 PROSEU Living Lab participants

Table 6 Stakeholder engagement (Living Lab participants)

Themes	Living Lab Focal Points	Living Lab Stakeholders
Good practices (things that worked well)	The step-by-step approach followed to engage further potential stakeholders who might join the project in the future was found adequate	The Living Lab interventions conducted (e.g., public events) succeeded in gathering diverse publics interested in the energy transition
	Engaging municipalities was found useful	
	Living Labs were very inclusive and involved the right people	
	Stakeholders benefited from knowledge inputs and contacts of potential partners	
	Excellent networking opportunity: diversity of actors including local governments, community energy organisations, businesses, citizens, academia and the third sector	
	The Living Lab process provided an occasion to overthink and adjust their public relations’ activities to generate more awareness of the project	



<b>Challenges and difficulties experienced</b>	Engaging people who do not see an immediate impact on them was difficult	Important players in the region did not participate in the process which was problematic and frustrating for the projects
	Stakeholders from some key sectors (e.g., agriculture) were not involved because the timing was not the most suitable	Low number of participants and hesitation to engage in the event, although still exist the motivation to run future participatory formats in the future
	Some key players were missing in some Living Labs (e.g., private companies, grassroots initiatives, large property owners, participants of the working class, landowners, entrepreneurs, potential investors, local governments and local administrations)	More stakeholders from local administrations, local communities, potential investors, local landowners, and people suffering energy poverty should have been involved
	Difficulties to engage and motivate some participants	

Living Lab Getesnippers (Belgium): *“the overall interventions from PROSEU were good, but where exactly is the support from Europe? Europe is not going to get the local stakeholders together. You can send an invite, but it’s up to the local players to invite local players. Nice to hear that Europe wants to support this, but some of the best practice examples (from other European countries) were too far from our own context. Should have worked more with other cities in the region, but also from more advanced regions”*  
 [Stakeholder]

### 4.2.2 PROSEU teams

Table 7 Stakeholder engagement (PROSEU teams)

Themes	PROSEU teams
<b>Good practices (things that worked well)</b>	The involvement of multiple stakeholders (e.g., end-users, experts and researchers, local communities, etc.) enriched the process and directed the outcomes towards locally feasible solutions
	Inclusiveness of diverse stakeholders with different interests, backgrounds, age, and gender
	The involvement of specific stakeholders was a unique opportunity to create links that will continue after the process ends, widening the impact of the PROSEU project as well
	Inviting institutions that have the mandate to take decisions on their area (e.g., local, regional or national governments) gives the great opportunity to really implement what discussed
	The expertise offered by the diversity of stakeholders led to an increased understanding of the issues addressed
<b>Challenges and difficulties experienced</b>	Keep all stakeholders engaged throughout the length of the process; some groups are especially difficult to engage, e.g., citizens and schools (students, teachers, families)

	Low interest of certain stakeholders (e.g., regional and national governments, grid operators, etc.) which derived in a lack of high-level representatives and/or lack or difficulties to get relevant data (e.g., for modelling purposes)
	Relevant stakeholders were not identified (e.g., investors, local government representatives, local families dealing with energy poverty)
	Resistance to change of some stakeholders (e.g., changes in lifestyle, environmental and social impacts on their current way of living)
	Getting in touch with stakeholders not directly involved in the Living Labs was difficult (e.g., commercial bank representatives)
	Inclusiveness of diverse stakeholders with different backgrounds, negative aspects: low technical level, less concrete results and answers (although accessible to all)
	Lack of cultural diversity within the Living Labs
	Deal with different stakeholders' expectations of the interventions or the entire process
	Limited time and lack of financial support hindered stakeholders' participation
	Working with the competitive mind set of some stakeholders (business-driven interests): it was difficult to address both the Living Lab needs while at the same time being appealing to local business-oriented stakeholders

Living Lab Wine of Alentejo (Portugal): *"The aspect of 'working together' is itself a challenge, since each producer tends to seek out for solutions that his/her company can implement on their own, with minimal costs and reasonable benefits. However, the Living Lab has shown that when encouraged to do so, business competitors in this sector can find ways to collaborate well and plan projects together, in fact a key conclusion of the Living Lab participants is that they had to work together in order to scale up the adoption or renewable energy in the region"* [PROSEU team]

Living Lab in Spain: *"(...) as the Living Lab stakeholders were not really part of the PROSEU project, it made it complicated to define each party's role and ensure the full engagement of Living Labs participants without financing their dedication"* [PROSEU team]

### 4.3 Outcomes achieved

The objectives of the vast majority of the PROSEU Living Labs were reached. Most of the Living Lab participants and the PROSEU teams involved stated during the evaluation phase that **knowledge exchange, learning, and networking opportunities** have increased after being involved in the PROSEU Living Labs.

For participants, the PROSEU Living Labs were a **source of inspiration, information, and knowledge**. Through their active participation in Living Labs' activities, they were able to receive and share knowledge of pre-existing and new projects, concepts, and solutions; information on renewable energies and the energy transition in general, and on legal, financial and technological aspects, in particular; while promoting or enabling the adoption or co-development of new tools (e.g., an online calculation tool), plans (e.g., accelerating the development of renewable energy communities) and materials (context-

specific data on costs and technological options). For the PROSEU teams involved, promoting networking opportunities with a broader range of actors, raising awareness and energy literacy on energy issues as well as willingness to work for sustainable futures, or co-create tailor-made solutions to **help citizens to actively contribute to the energy transition**, were some of the most relevant outcomes highlighted.

Interestingly, unforeseen outcomes include helping to reinforce a sense of togetherness and of a collective European Union effort. The extensive conversations and Living Lab interventions specifically focussed on regulatory aspects (i.e., to exchange information on the revised EU Directives – REDII and the Internal Electricity Market Directive - and their provisions on renewable energy communities, collective self-consumption, and citizen energy communities) increased **participants’ awareness of an EU-wide action**. It became clearer for participants that advancements in their country went hand in hand with advancements in other EU countries, and that collective prosumer initiative models were very much grounded on a collective EU project.

On the negative side, the challenges identified are associated with the **lack of external support to develop RES projects**, including, for instance, support from EU and national levels to create a support framework conducive to local government action. The COVID-19 outbreak had also an impact on the objectives and ambitions of some Living Labs participants, who found it difficult to maintain the same level of involvement. Indeed, moving from the outcomes of the co-creation and participatory process to concrete and tangible solutions implemented was a key challenge, especially in the face of the pandemic, but also due to other **external restrictions** (i.e., need to adjust national regulations, the transposition process of new EU Directives, Brexit, etc.).

### 4.3.1 PROSEU Living Lab participants

Table 8 Outcomes achieved (Living Lab participants)

	Living Lab Focal Point	Living Lab Stakeholders
Good practices (things that worked well)	Local communities realized that they could become more sustainable in their practices (e.g., water supply)	The Living Lab raised awareness of residents to seek for alternative and more efficient solutions which gain long-term prosperity for the entire community
	The Living Lab brought inhabitants closer to terms such as “sustainability” and “renewable energy sources”	The Living Lab provided with the necessary information to help participants make informed decisions regarding PV solutions
	Products for relevant and diverse end-users that will generate more interest in prosumerism, e.g., an online calculation tool that will help potential prosumers in assessing the feasibility of their (RES) projects also helpful for financial institutions who can further develop their financial services for prosumers	The Living Lab showed the example of other similar initiatives (i.e., cooperatives) and it served as inspiration for further new marketing interventions to be developed in the future
	Attract and inform people in the region about prosumer solutions	The Living Lab provided a set of concrete options and pathways to reach their objectives

Provide relevant information and establish first contacts between project members and potential partners	The Living Lab opened room for discussion on topics that are in the interests of the whole community and have the potential to have the community directly involved
Provide guidance with technical interventions that will enable it to move forward to find solutions for the uptake of sustainable energy production and use at local scale	The Living Lab was an important source of inspiration on topics that sound far away and experiences that seemed hard to be replicated in their own territories
Boost of the already existing working groups, enlarging its participation to the surrounding municipalities	The Living Lab was perceived as a great achievement in terms of strengthening of governance and empowerment of the municipalities involved
Promote interest in starting energy communities	The Living Lab had an indirect effect: it helped to reinforce an EU sense
Living Lab participants were informed and sensitized for the possibility of a heating grid and given the opportunity to voice their wishes for the framework of such an implementation (e.g., organisational structure)	After participating in the Living Lab, local actors have more confidence and a direction towards planning sustainability at local scale
Living Lab results constituted a valuable base for the further work of the project and impulse further research and planning	The interventions conducted within the Living Labs showed multiple ways to prosume and that policy (e.g., at the municipal level) must be flexible and open to diversity
The Living Lab allowed to integrate a participatory dimension and expand the discussion to a wider audience	The Living Lab responded to the specific needs and challenges posed by technological, regulatory and operational/organisational barriers through, for instance, creating new business models or crowdfunding new installed capacity, modelling different scenarios, and sharing knowledge on different technological options
The process offered new ways of viewing the challenges from a different perspective, gathering relevant players into the discussion	
The Living Lab enabled reflecting about new possibilities and new pathways, in many cases, surpassing Living Lab partners' expectations	
Acquisition of new technical, legal, and organisational knowledge within the community, for instance, practical knowledge on renewables and the energy transition in general	
Enlargement of the community's support networks capacity building and dissemination	
Accelerating the development of renewable energy communities	
Establishment of new goals for collaborative projects in the region	
Production of a study that shows different technological pathways for new energy	

	<p>communities (in Portugal), which provides key context-specific data on costs and technological options (involving the wine sector as well as other players)</p>	
	<p>The Living Lab shed light on institutional barriers around prosumerism and, although it was not able to overcome them, it identified specific needs to be addressed (e.g., better connection to the grid operator; make peak shaving financially attractive for households (i.e., levelling out peak use of electricity by industrial and commercial consumers by reducing the amount of energy purchased from utility companies during peak hours of energy demand); improve knowledge of residents; increase use out of experimental regulation; increase the recognition of the initiative and spread their way of living)</p>	
	<p>The Living Lab helped to improve the relation with the grid operator of one of the initiatives involved in the process</p>	
	<p>New and/or extended networking opportunities emerged, e.g., accessibility to collaborate with other projects in the future</p>	
	<p>Knowledge and access to knowledge increased thanks to the Living Lab interventions, e.g., on experimental regulation policies from other prosumers and institutional actors, and other PROSEU researchers</p>	
	<p>The Living Lab increased the public awareness (publicity) of some of the initiatives involved</p>	
	<p>The Living Lab increased the sense of innovative space: institutional context seemed less rigid than expected</p>	
	<p>Cross-pollination between different PROSEU teams helped to developed tools and studies that enlarged the knowledge of the initiatives in specific aspects e.g., CO2 footprint of the initiatives, local modelling scenarios, etc.</p>	
	<p>The Living Lab provided new knowledge on the CO2 footprint of one of the eco-villages involved in the Living Labs (compared with new constructions, its emissions are lower even though they use biomass)</p>	
<p><b>Challenges and</b></p>	<p>Lack of legal tools at the EU to compel local governments to cooperate</p>	<p>The interventions conducted within the Living Lab provided useful insights and</p>

<b>difficulties experienced</b>	It is not clear whether the local actors will be able to implement the concepts and processes planned without external support	networking opportunities, but it was clear that the Living Lab would not alter the fundamental issues facing the sector. It was indeed helpful in highlighting those issues but not able to solve them
	There is a need to work on political discourse and to increase public participation to prevent resistance and frustration caused by weak acceptance	
	The sessions provided interesting findings although limited actionable outcomes (e.g., fundamental economics of issues currently faced by the Living Lab partners)	
	The objectives and ambitions of some Living Lab partners had to be adjusted and “scaled down” due to limited time availability of relevant stakeholders and the outbreak of the COVID-19	
	Some objectives were not reached because they depend on external factors (e.g., collaborations with the grid operator, or help and financial incentives from governmental organisations)	

Living Lab Santorso (Italy): *“We are happy with what we reached: our Living Lab is growing, and we are taking into consideration, also thanks to the path thread during PROSEU, to activate an Energy Community to support our citizens. Starting from a very blurry ideas on possible futures with no clear way forward, the intervention proposed us a set of concrete option and pathways to reach them well framed into the European context”* [Stakeholder]

Living Lab São Luís (Portugal): *“The key contributes have been first the support on the technical aspects, as well as legal and organisational, through the workshops and information exchange. Second, by setting up practical workshops where applied knowledge was shared and demonstrated (e.g., on the use of different solar energy options, their applications and costs)”* [Focal Point]

Living Lab Aardehuizen (Netherlands): *“The workshop broke the ice. The workshop made P1 excited, and then I could approach him with a question. The day led to a network feeling. [P1] saw what kind of project we are, because of massive attendance he realized it is a movement which is going to be substantial”* [Focal Point]

Living Lab in Spain: *“Thank you very much for providing the document [describing the process to register prosumers at the distribution company], it has been very helpful to have you for these proceedings” (...)* *“You helped us to reflect on issues like repartition of share energy and strategic questions”* [Stakeholder]

Living Lab Bristol Energy Company (United Kingdom): *“The interventions provided a means of viewing the challenges from a different perspective and brought together some of the country’s leading thinkers on these issues. However, alone these types of interventions were not able to solve structural issues within the business”* [Focal Point]

Living Lab Aardehuizen (Netherlands): *"I would have liked to have gotten along more on the content. This has to do with the deepening of knowledge and asking specific questions to the right people [...] I would have liked to get more out of it, [...] extract more knowledge out of it"* [Focal Point]

### 4.3.2 PROSEU teams

Table 9 Outcomes achieved (PROSEU teams)

<b>Good practices (things that worked well)</b>	Creation of new visions and narratives, for instance, concerning the end-use of wood chips (from LCMW) or the heating transition ("heating commons")
	Opening the discussions on how RES can contribute to the local goals of providing many public and private buildings with sustainable energy from the region
	Promotion of networking opportunities with local actors, enlarging the visibility of the initiatives at the local or regional levels
	In-depth knowledge of under-analysed solutions for collective prosumerism (e.g., wood chips from LCMW for heating)
	Raising awareness of energy issues in remote communities where solutions might be available and present at their location, also promoting a willingness to actively work for sustainable solutions in the future
	Increase water and energy independency by implementing green technologies and innovative solutions that will bring the status of sustainable community by using locally available sources
	Production of tailor-made solutions that incorporated (and will continue incorporating) end-users' feedback to provide specific tools for prosumers: these solutions replied to the specific needs of the stakeholders involved and will have a real impact
	Serve as a booster to support the development and implementation of new projects: the PROSEU Living Labs help to push further already ongoing projects by providing the necessary input
	Promotion of more structure and innovative ways of involving potential participants of the prosumer community
	Learning of preferences and priorities, but also the "no go's" of the Living Lab participants involved
	The interventions moved from general to precise content
	By looking at local initiatives' examples in very similar contexts but in other countries, the Living Lab participants felt inspired and realized that "the others" are very similar to them, which can aim at following their example and replicating what others have been implementing
	Living Lab participants are now more aware of the legislation at national and EU level which also shows how much the EU is working towards the energy transition
	Creation of momentum for new collective push and direction to local energy transition processes and actions (e.g., participatory budget to promote prosumerism at local level)
	Understanding institutional barriers

Living Lab Silba island (Croatia): *"(this Living Lab) has brought a different way of thinking to smaller communities – instead of being passive consumers of water and energy, they can become active prosumers in which they can simultaneously consume their own produced goods and export them where they are needed. (...) Silba can act as the originator of changes for other island communities facing the same or similar issues in every-day life"* [PROSEU team]



## 4.4 Internal dynamics and external factors

This theme refers to the internal and external conditions that affected the successful implementation of the PROSEU Living Labs or the development of the RES projects carried out by the collective prosumer initiatives involved in Living Labs activities. Living Lab participants framed within this theme challenges and difficulties associated with the internal dynamics of their organisations (e.g., **volunteer work**), internal dynamics occurred within the development of the Living Labs (e.g., limited time to discuss and decide), or external factors (affecting the initiatives and/or the Living Labs), such as problems derived from the COVID-19 pandemic (lockdown and economic downturn). The different teams of PROSEU partners involved in the Living Labs manifested that while the diversity of participants is a plus for inclusion, it also raises problems, particularly as regards the **heterogeneity of knowledge** within the participants' group. Addressing the needs of people with almost no knowledge and of people with deep knowledge on a topic, while keeping sessions interesting for all, was found to be very challenging.

The impact of the **COVID-19 pandemic** is undeniable, leading not only to restrictions in meeting and advancing with the Living Lab activities, but also in the participants availability and their commitment to the local transition projects, which in some cases contributed to the closing of some of the initiatives (e.g., Bristol Energy). Other less foreseeable external factors that created barriers for advancing with the Living Lab's activities, include land ownership conflicts and lack of political will and engagement in the local projects. Nevertheless, the pandemic also resulted in increased participation in the final Living Lab (online meetings), as participants' numbers overall increased when meetings went online. This equally offered the opportunity to develop online methods and facilitation tools that can be used in other projects, thus combining online and in-person participation to reduce emissions (i.e., from travel to the workshop locations), but also, in the case of citizens with average online literacy, to increase citizens' participation.

### 4.4.1 PROSEU Living Lab participants

Table 10 Internal dynamics and external factors (Living Lab participants)

	Internal dynamics (Focal Points)	External factors (Focal Points)
Challenges and difficulties experienced	Limited time to discuss and decide which aspects of the process were the most interesting to focus on	Lack of political will and engagement with the project (or prosumerism in general)
	Different "speeds" of the partners involved (PROSEU researchers and Living Lab focal points) did not always ensure perfect alignment of the interventions with what the project was already doing	Limited support to renewables, prosumerism and alternative forms of financing by public administrations (e.g., municipalities)
	Motivation to carry out the project was there but not enough, in some cases additional problems hindered the development of the project and of the Living Lab (Belgium)	COVID-19 pandemic and its restrictions have slowed down or stopped citizens' participation in prosumerism projects/initiatives, as well as activities within some Living Labs
	Limited budget or no money at all to develop the project	Economic downturn resulting from the COVID-19 pandemic and lockdown had a huge impact on some initiatives (e.g., furloughed many staff, or stopped all their activities)



		Limitations in carrying out some of the planned interventions due to the COVID-19 restrictions (e.g., from in-person to online interaction)
		Lack of long-term thinking regarding collective prosumerism
		Land ownership conflicts
		Lack of external financial support (e.g., from municipalities)
	<b>Internal dynamics (Stakeholders)</b>	<b>External factors (Stakeholders)</b>
	Difficulty to develop community projects mainly because work in many cases is done by volunteer-based and/or led by informal groups without well-defined organisational responsibilities	The COVID-19 pandemic and economic downturn that followed the lockdown had a negative effect on the activities of some of the initiatives involved, making them more challenging and its long-term future less certain. These also affected the Living Lab process, reducing opportunities to engage with the Living Lab members and making the relationship more challenging
		The current energy system regulation and wider institutional norms are presenting challenges in moving beyond the trial stage of one of the initiatives involved in the Living Labs (UK) so it is forced to emulate the practices of conventional energy suppliers despite its social value objectives.

Living Lab Bristol Energy Cooperative (United Kingdom): *(COVID-19 pandemic and lockdown) "It was difficult to engage with PROSEU, given all the challenges we are now facing and stretched demand on our time"* [Stakeholder]

Living Lab Bristol Energy Company (United Kingdom): *"In time it is hoped that concepts such as energy service models can begin to challenge the dominance of the market paradigm. However, UK municipalities face significant structural challenges in developing prosumer business models against an ongoing backdrop of austerity and privatisation"* [Stakeholder]

#### 4.4.2 PROSEU teams

Table 11 Internal dynamics and external factors (PROSEU teams)

	Internal factors	External Factors
<b>Good practices (things that worked well)</b>	Workshops offered new and useful opportunities to grow the initiatives' networks and reach more stakeholders (e.g., government and researchers)	The COVID-19 pandemic offered some opportunities: resilience and resources (provided by PROSEU researchers) to keep the projects active also during the lockdown: a quick reaction to turn the interventions into online workshops

		<p>allowed projects to keep an ongoing contact and collaboration; it also offered better access than a regular face-to-face format (i.e., more participants in the online sessions than in the in-person sessions)</p>
<p><b>Challenges and difficulties experienced</b></p>	<p>The voluntary basis of the people involved in the prosumer initiatives was a challenge for the development of the Living Labs: time and resource constraints slowed down the process in some of the countries</p>	<p>Take advantage of current changes in regulatory frameworks on self-consumption, re-municipalization of the energy grid, and local decentralized energy production: this openness in the political context of some countries facilitated the involvement of local municipalities</p>
	<p>Highly complex processes, with many and diverse stakeholders involved who have different (and often) competitive interests and priorities, it is easy to lose sight of the overall goal (e.g., providing citizens with sustainable heat, in a cost-effective manner)</p>	<p>Lack of adequate policies and legal uncertainty hindered the willingness to participate in developing prosumerism activities</p>
	<p>Internal conflicts, changes in goals and visions or in the internal structure led to new needs, objectives, and requirements, making more difficult to identify the right interventions</p>	<p>The COVID-19 pandemic affected the development of the Living Labs but also the activity of the participant initiatives: in some cases, difficulties to keep the relations with Living Lab participants (lack of engagement) which had more urgent priorities or problems, e.g., face the economic downturn represented a big issue in the development of the Living Lab; in other cases, the lack of basic computer skills (when the workshops were moved online) also made more difficult the interactions</p>
	<p>Heterogeneity of knowledge within and between the Living Lab participants: addressing the needs of people with almost no knowledge and people with deep knowledge on the topic at the same time is challenging</p>	
	<p>Difficulty to stay connected with focal point and participants due to different pace and dynamics of professional lives</p>	
<p>Limited time to support the Living Lab</p>		

Living Lab Getesnippers (Belgium): *“Stepping in from the outside into an existing project can be complicated since some time was required to properly familiarize ourselves with the subject matter and the status quo of the Getesnippers project. At the same time, the project was getting its bearings so arriving at a common understanding of where the Living Lab should go, was a bit tricky”* [PROSEU team]

Living Labs (United Kingdom): *“Although the capital cost of renewable energy has come down significantly since the FITs were introduced, long payback periods combined with uncertainties surrounding the level of*

*self-consumption has rendered many projects un-economic. The economic downturn that has followed the lockdown has also led to fewer proposed projects, and issues with existing ones due to social distancing requirements" [PROSEU team]*

## 4.5 The role and background of the PROSEU teams

No difficulties were encountered by Living Lab participants in relation to the PROSEU research teams involved. The PROSEU teams involved were **interdisciplinary**, covering a wide range of disciplines from the social sciences and humanities to biology and ecology, engineering, and mathematics. This was an asset for the Living Labs' research which required different knowledges and approaches to meet the different and context-specific challenges of the prosumers and stakeholder communities involved. Most Living Labs would like to keep their connection with the PROSEU teams, and the collaboration helped accelerating their activities towards reaching their desired energy system futures.

### 4.5.1 PROSEU Living Lab participants

Table 12 Role and background of PROSEU teams involved (Living Lab participants)

Good practices (things that worked well)	Living Lab Focal Points
	Cooperation with the university (PROSEU partners) was very useful to gain competence and respectability by different stakeholders
	Cooperation with the university (PROSEU partners) helped to engage other actors (e.g., municipalities) to get interested in the project and to follow a scheme/action plan (e.g., what needs to be done, next steps, important inputs needed, etc.)
	Cooperation with the university (PROSEU partners) helped on communication towards stakeholders as they took the project more seriously when the collaboration with the university was mentioned
	Good to have an external partner helping us evaluate/reflect on their way of working, and carrying out the activities co-designed
	PROSEU partners were attributed a different level of professionalism and trust compared to other local actors
	Living Lab partners would like to stay connected to the PROSEU team (e.g., through workshops, or the Prosumer Community of Interest)
	The involvement of PROSEU members helped the community advance forward with their shared visions, they appreciated that the PROSEU team was able to understand their visions and goals, as well as limitations, needs and resources available
	Living Lab partners found they felt equals throughout the whole process, meaning that by constantly being involved at the different stages of the work developed (i.e., including in co-designing the interventions, etc.), they felt they were working truly together with the PROSEU research team, rather than being led by the team
	Collaborating with the PROSEU project and team helped forwarding with their shared visions and motivations for a more sustainable production (e.g., wine sector)
	Living Lab Focal Stakeholders
	The PROSEU interventions provided a good basis for advancing and take more concrete actions in the project's development

In one case, the PROSEU partners involved were not recognised as a credible and legitimate partner that could bring added value to the local reality of the initiatives involved (this was the case of a PROSEU partner working with prosumer initiatives based in a different country - Spain/France)

### 4.5.2 PROSEU teams

Table 13 Role and background of PROSEU teams involved (PROSEU teams)

PROSEU teams	
Challenges and difficulties experienced	While co-creation implies that Living Lab participants use much of their own knowledge to innovate, they used to see the PROSEU team as experts/consultants not as equal actors
	Management of expectations, commitments and responsibilities of all players involved in the Living Lab
	Find a good balance between Living Lab participants' needs and the expertise / added value offered by the PROSEU team

Living Lab Buurtwarmte (Netherlands): *“Managing to find an intervention that is useful for both DRIFT and the Living Lab and lies within the expertise of DRIFT (was challenging). Many of the LL focal point needs were very practical or business oriented (e.g., finding a first municipality that wants to use their services) which lies outside of the capacities of DRIFT within the Living Lab”* [PROSEU team]

## 4.6 Opportunities and challenges for collective prosumerism in Europe: prosumers and stakeholders’ perspectives

Some main challenges experienced (and ways to overcoming them) identified specifically by the Living Lab participants who also participated in the 4<sup>th</sup> international PIA workshop (c.f. section 3.1.2) were the following:

Living Lab Santorso (Italy): Their awareness programme started with a bigger group that then dwindled down; municipality is supporting them financially, now have a technician supporting technical aspects, but they struggle to work as/with volunteers due to lack of technical knowledge, their ‘clients’ - the town people - ask technical questions, need technical support. Then again, they have trouble finding enough volunteers; energy is linked to housing and young people (potential volunteers) rarely have their own house. For the Santorso Living Lab, it is important to show feasibility and advantages of RES.

Living Lab São Luís (Portugal): They designed a plan to become a solar village, creating a partnership (“symbiosis”) with PROSEU. The project studied the village but São Luís wanted practical information, which they feel they got. The Living Lab started with a bigger group but then dwindled down. They managed two collective acquisitions, but it was very hard and took a lot of energy from the group. The process was very difficult but also successful: the São Luís community learned about new scenarios, strategies and used this with the municipality: budget has been approved for a participatory financed PV installation (120kW plant), it will be voted soon at the municipality’s assembly.

São Luís Living Lab stakeholder (energy cooperative): Coopérnico has an energy poverty programme through energy communities with people who suffer from energy poverty. Municipalities are interested and might offer the rooftops for PV installations, which in the weekends can be channelled to people in energy poverty. People in energy poverty often have poor living / building conditions, so improving their housing is also key. Coopérnico recruits volunteers from universities and can obtain building materials from the municipality/companies in the area. Municipality acts as a go-between. Work power comes from the volunteers. This project has motivated people with more means in the community to donate other necessities to people in energy poverty.

Additionally, external stakeholders, together with Living Lab participants, who were also involved in the workshop, identified different opportunities and challenges related to the development of business and financial models, technological solutions, legal challenges, and community building aspects. These results are summarised in tables 14 to 17.

Overall, key opportunities for developing **new business and financial models** include a better communication of pricing to consumers, as well as the involvement of municipalities as participants in new energy communities, and who can provide local incentives to join prosumer projects. Prosumers are not working in isolation and are rather depending on their local ecosystems and actor networks. To acknowledge this can bring benefits and support the development of new projects. The **complexity of regulatory frameworks** was pointed out as challenge for new business and financial models, the lack of professionalisation and the need to build the capacity of prosumer projects (largely run by volunteers) is also relevant. On the other hand, consumers may not be interested in being involved, nor in dealing with the complexity of new business and regulatory frameworks, and in some countries, technologies are still expensive and not viable for citizen-led projects. Here the lack of subsidies is an important handicap, especially for small projects, which can be more expensive than larger installations financed through utility companies.

Regarding **technological solutions**, participants found there is a wide scope for implementing simple solutions and that the lack of regulation sometimes can be an incentive to thinking out of the box and developing new technical solutions that bypass legal barriers. Smart meters will need to be rolled out for an effective implementation of collective self-consumption and renewable energy communities. They will also facilitate a more immediate understanding of the consumers' own energy behaviours, which could result in new behaviour changes with positive environmental effects (e.g., reduced consumption or improved efficiency). **Diversity and flexibility** are key words, and the more diversity exists in the types of buildings participating in a collective self-consumption project or renewable energy community, the better flexibility services can be provided to balance the grid and flatten the load curve. This is a response to a key challenge, particularly for small towns which might require equipment upgrades to cope with considerable share of PV. Data access, data security and real-time visibility are also key challenges which will require innovative solutions. The risk that governments impose heavier tariffs on prosumers, may be a barrier to the future growth of prosumerism.

Opportunities for **overcoming legal challenges** are largely related to the (ongoing) transposition of the Winter Package policies, including the REDII (articles 21 and 22) and the Internal Electricity Market Directive (articles 15 and 16) which present a range of new definitions and provisions on prosumers, collective self-consumption, renewable energy communities and citizen energy communities that once transposed to national legislations are likely to help prosumers move past various legal challenges. Some examples have been provided by Dutch participants, namely the opportunities posed by Dutch

regulation on energy heating communities and community involvement in energy policy development in the Netherlands (e.g., through direct lobbying activities). In this sense, the organisation of stakeholders and communities in networks that directly lobby for the effective transposition of the Winter Package directives can open new opportunities for regulatory frameworks that support prosumers. This **transposition process** has already kickstarted in some countries (e.g., Spain, Portugal), but it is far from complete. Key issues to be addressed include: economic viability of prosumer projects; higher awareness of the urgency to meet climate-related goals (in some countries); lack of transparency of grid conditions; the complexity of legal and administrative requirements; slowdown of RES projects, namely wind energy installations, due to local resistance networks (i.e. in the Netherlands); the tendency in most countries for reducing direct or indirect subsidies, such as net metering; grid tariffs pose higher costs for collective self-consumption projects and are not sufficiently addressed in new regulations; and issues with definitions, for instance what does proximity mean (in Portugal) and other clarifications of legal terms in practice.

As regards opportunities for **community building**, Living Lab stakeholders and participants found there is a window of opportunity for energy communities, especially as the EU Directives being transposed to national legislation include provisions specifically focused on community action. While the COVID-19 pandemic prevented the usual opportunities for networking and connecting to others in our communities, it also enabled a wave of online events, gathering people together, supporting the engagement of people in their communities (i.e., stakeholders representing energy cooperatives claimed that their online general assembly meetings had more people participating than in-person meetings) as well as the easy access to documentation and information, previously not accessible online. **Municipalities** have been considered to have an important role in connecting different communities and pushing forward the replication and upscaling of energy communities, which could also include municipalities as members. Among the challenges identified, the lack of interest and knowledge about energy issues has been highly stressed. There is also a perception that crowdfunded projects (which are the majority in the case of renewable energy cooperatives) carry financial risks and uncertainties which prevent a higher number of participants to join. In some countries there is a distrust in the cooperative model and in the benefits of setting up renewable energy communities, particularly from older people (e.g., Croatia). There is little focus on ensuring community building and participation can include more **vulnerable and disenfranchised communities**, and little research or practice in developing inclusive approaches. This is contradictory with a speech around energy justice and the EU’s goal of ‘leaving no-one behind’. This aspect also contributes to a higher distrust from citizens and a feeling that indeed many may be left behind. However, participants found that the pandemic could be an opportunity to strengthen community trust. Some participants also referred a lack of will and even blockage of public institutions to promote community building and self-consumption at the local level (e.g., in Hungary and Croatia). Overall, participants found that the opportunities for community building can help overcome the major challenges identified, but the effective transposition of EC Directives will be a critical milestone to achieve a wider citizen involvement in prosumer projects.

### 4.6.1 Developing Business and Financial Models

Table 14 Developing Business and Financial Models

Developing Business and Financial models	
Opportunities	Unpacking the pricing: making pricing more understandable for consumers (to try to facilitate the establishment of new business models)



	<p>Helping municipalities, planning actions at the local level (e.g., informing citizens about energy efficiency, incentives, maps local providers like construction and PV companies)</p> <p>“One stop shop” projects where municipalities and cooperatives can play a role with renovation projects</p>
<b>Challenges and difficulties experienced</b>	<p>Systems are based on the assumption that retailers are providing power, which makes it more difficult to implement P2P systems</p>
	<p>Cost (e.g., network costs) and difficulty to create a value itself on the consumer</p>
	<p>Excess (and complexity) of regulatory frameworks, e.g., network charging is heavily regulated, making harder to build business models around them</p>
	<p>In some countries (Hungary), cooperatives are not viable, and technology is still very expensive</p>
	<p>Capacity building for members of the cooperative</p>
	<p>Not all consumers want to deal with the complexity of new business models</p>
	<p>Lack of subsidies for district heating (managed by local groups)</p>
	<p>Sustainable heating is more expensive than natural gas in the Netherlands (which makes it more difficult to shift)</p>
	<p>Lack of incentives for collective prosumerism</p>
<p>Small projects are often more risky than big projects such as solar parks: local initiatives cannot compete with big players</p>	

### 4.6.2 Developing Technological Solutions

Table 15 Developing Technical Solutions

<b>Developing Technological Solutions</b>	
<b>Opportunities</b>	<p>Before legislation update in 2019 (in Portugal) there was no legal framework regulating energy sharing (nor collective self-consumption): legal void led to brainstorming about possibilities such as the possibility of creating private-owned grid to bypass legal barriers</p>
	<p>Law enables PV sharing inside the same building</p>
	<p>There is lots of room for the implementation of simple solutions</p>
	<p>Smart meters at homes to promote knowledge on own energy behaviour and engage on behavioural changes</p>
	<p>Business models can benefit from merging different load profiles, enabling possibility for the provision of grid support services</p>
	<p>Combining several types of buildings (residential, commercial, etc.) to offer flexibility services to the grid as a parallel service to prosumerism</p>
<b>Challenges and difficulties experienced</b>	<p>Current grid has some capacity room to accept energy sharing, but small towns might require equipment upgrade to cope with considerable share of PV</p>
	<p>Complexity of the regulatory frameworks (for collective self-consumption)</p>
	<p>Data access and real-time visibility are big technical challenges: different sources, not so in-demand data (e.g., rooftop mapping); other data which traditionally are very “unshareable” (e.g., electricity consumption or power grid characteristics)</p>
	<p>Innovative technical solutions (e.g., PV-enabled desalination) experienced some difficulties to engage with local stakeholders, in particular, with those with “business-as-usual” mindset</p>

Complex social issues that need to be addressed in parallel to data and technical issues
Demystifying the technical and financial side of PV and prosumerism
Bigger prosumers have difficulties in connecting to the grid (Croatia)
Prosumerism might not be successful in the long term, as governments might impose heavier tariffs once prosumerism really starts growing (to tackle growing grid costs)
Most smart meters being installed in Europe are passive, in a sense that they don't enable technical controllability of load/generation, which may block the perspective for flexibility (e.g., virtual power plants)

### 4.6.3 Overcoming Legal Challenges

Table 16 Overcoming Legal Challenges

Overcoming Legal Challenges	
<b>Opportunities</b>	Dutch regulation on energy participation has inspired prosumer heating
	Dutch approach to see the "community" as a third market actor/model - in addition to the free Market and the State/public sector
	Build a common narrative, for example, in the Netherlands they "translated" energy heating community into a Dutch word
	Community involvement in Energy (policy support) in the Netherlands
	Countries have a requirement to carry out assessments of renewable communities, and this should also be done for citizen energy communities
	The Netherlands had a system set up to experiment (energy communities) without limitations
	Energy communities can impact regulation as it's still early in the process
<b>Challenges and difficulties experienced</b>	In some EU countries (e.g., Spain) the transposition of the Clean Energy Package is still needed and can improve current legislation
	Economic viability is seen as the main issue to be addressed
	In some countries, climate awareness is not a driver for change
	Lack of transparency of the grid conditions, use, costs, etc: without access to the information about the system it cannot be transformed
	Having several steps to follow adds more complexity for prosumers
	Complete slowdown of wind energy projects due to resistance from the citizens (in the Netherlands)
	Excess of paperwork (administrative permits)
	The implementation of the two directives REDII and IEMD are not sufficiently coordinated
	Lack of prosumer projects in some EU countries (Hungary), cooperatives aiming at promoting PV production outside of their own rooftops experience too high costs, so it can only be done with public support
	The concept of net metering (where you can roll back meter when producing) is a great incentive, but now it's being rolled back
	"Storage fee" being used by the grid makes the business models less attractive
	Grid fees are problematic for flexibility
	In many countries (e.g., Spain) there are some issues with "definitions" and a clarification on what the terms mean in practice would be necessary



Renewable energy on the local level highly relies on the small-scale level. The net-metering supports it, but that will stop to be functional in 2023 (in Hungary), and therefore a new system will be needed

New energy market models are not regulated (yet)

### 4.6.4 Community Building

Table 17 Community Building

Community Building	
Opportunities	Window of opportunity for energy cooperatives at this moment
	COVID-19 pandemic: online events allowed gathering more people together, the engagement from the members (e.g., cooperatives) also increased
	COVID-19 pandemic: availability of a larger number of online documents, putting more information accessible
	Active (proactive) communities pushing forward to promote energy sharing and self-consumption
	Municipalities are seen as key players having a prominent role in building energy communities, being a hub to connect everyone
	Interlinked projects (e.g., climate adaptation and water management) to take advantage of methodologies developed in one project for the other
Challenges and difficulties experienced	Lack of interest, information and/or knowledge about energy issues
	COVID-19 pandemic: difficulty to 'bump into' new people, more selection and/or exclusivity (e.g., personal invitations to join meetings) rather than open events
	Financial risks and insecurity due to the crowdfunding nature of many projects
	Distrust from citizens
	Lack of will (even blockage) of public institutions (e.g., some municipalities) to promote community building or self-consumption at the local level
	Lack of clear legislation and regulation, e.g., energy communities
Building trust requires a lot of effort but the COVID-19 pandemic might be an opportunity for more community feeling	

## 5. Lessons learned from the PROSEU Living Labs

The PROSEU Living Labs created spaces for mutual learning and co-creation of innovative solutions that involved a diverse group of people interested in mainstreaming RES prosumerism at their local, regional or national levels. From the participatory activities carried out, participants' interactions and engagement, or the tools and services developed, some key lessons learned were extracted by Living Lab participants and the PROSEU teams involved in the process. The following subsections present the main lessons learned from the PROSEU Living Labs in relation to the five main themes identified.

### 5.1 Participatory approach and co-creation dynamics

In general terms, PROSEU Living Lab participants acknowledged the advantages of implementing a participatory and co-creative approach not only to guide the Living Lab activities conducted (e.g., allowing them to **think about the 'big picture' regarding a specific challenge**), but also to improve some ways of doing in their initiatives, such as framing a 'long-term dream' that lead their objectives (e.g., through 'visionary' exercises that helped them to focus on their future visions). Then, for many of the initiatives involved, especially for those not familiar with this participatory method, the main lesson learned extracted is the potential of including co-creation approaches and participation in their own activities. A negative point identified, and something to learn about, was the lack of iteration, in particular, in the needs assessment and evaluation conducted. One of the Living Lab participants expressed the need for having **periodic revisions** (also carried out in a more structural manner) of the

needs addressed by the Living Lab, which could have helped them to make choices throughout the Living Lab process. For PROSEU researchers and partitioners in charge of the Living Labs, the main lesson learned identified was the usefulness of this methodology to boost and support existing citizen-led projects. Also, applying a holistic approach was found useful to potentiate projects' development and reach.

Some quotations that exemplify and contextualize these findings are the following:

Living Lab "São Luís" (Portugal): *"the value of hearing more and speaking less" (...) "trust the collective creativity of the group" and allow that "new solutions emerge from this collective co-creation process, even if it takes more time" (...) "Avoid top-down approaches" and "deliver on promises made"* [Focal Point]

Living Lab Silba island (Croatia): *"A key lesson learned from participating (in this Living Lab) is that a holistic approach including technical expertise, economically and environmentally acceptable solutions with the contribution of social component can potentiate all relevant stakeholders to start seeking for other, more acceptable and secure solutions"* [Stakeholder]

## 5.2 Stakeholder engagement

Engagement with multiple and diverse stakeholders throughout the development of the PROSEU Living Labs was key to ensure their success as they were aimed at gathering together different voiced and interests of actors involved in RES prosumerism from different sectors and regions. This **inclusiveness** was recognized and valued by the Living Lab participants, who stated that bringing together people with different interests, visions, and know-hows to focus on a specific topic helped them to build new alliances and synergies, and then, to advance with the energy transition by finding creative and effective solutions. Moreover, engaging diverse actors was acknowledged as a key aspect of promoting more inclusive development of RES prosumerism in Europe. For the PROSEU teams, the involvement of diverse stakeholders from the initial phases of the Living Lab development was proven to be an important milestone that defined the direction in which the projects could develop. Another lesson learned by the PROSEU teams was the need to **support projects to identify and contact the most relevant stakeholders**, since some projects were in too early stages to state which stakeholders could have been the most relevant for them, others did not have the right contacts. All in all, having all the stakeholders on the same page was seen as fundamental to assess different points of view and take informed decisions.

Some quotations that exemplify and contextualize these findings are the following:

Living Lab São Luís (Portugal): *"The main lesson learned is that by just bringing different people, with different interests and visions in the same room, to focus on a specific topic (i.e. increasing local decentralised energy production and developing a new energy community), we can build new alliances, new synergies, that help advance further with the transition. So, moving beyond the local community work, it is important to join different types of communities, with different experiences (e.g. the local transition town, a local eco-villa, a national renewable energy cooperative, the local municipality); different interests (e.g. energy autonomy; producing renewable energy; meeting local decarbonisation goals); different know-hows (e.g. community building, financing renewables; administrative and legal knowledge); different visions for the transition (e.g. off-grid 'island' systems; grid-connected energy systems; decentralised*

*municipal-drive production), to find creative and effective solutions, but also a new flow and push for the transition, building on the collective motivations of these different players” [Stakeholder]*

Living Lab Silba island (Croatia): *“The main lesson is that inhabitants and local community are the ones who should be included, informed and a part of every big and important project such as this one. If the local community is not aware and educated, there is no interest from the authorities to make their lives easier” [Focal Point]*

Living Lab Santorso (Italy): *“It was inclusive having sit around the table not only representatives of the municipalities but also technicians and some volunteers of the local group of citizens. Giving the nature of the LL (very informative) the LL participants pointed out that the activities could have been opened to all the citizens” [PROSEU team]*

### 5.3 Outcomes achieved

In connection with the outcomes achieved, some lessons learned were also extracted by Living Lab participants. For instance, the importance of **communication and engagement** with relevant local actors (i.e., citizens, governments, industry, etc.), networking and partnership building, and setting up clear goals, were identified as some key lessons learned to reach the planned objectives and develop successful RES projects within the framework of the Living Labs. Specifically, in relation with communication issues, Living Lab participants realised that it is important that results generated in the Living Labs are shared with relevant stakeholders (e.g., municipalities, schools, church, etc), although conversations with some of them will need to be rekindled to ensure their cooperation after the end of the Living Lab. **Working together and establishing partnerships** with other actors were also acknowledged as crucial to reaching the established goals, for instance, developing new energy communities or increase the RES installed. Connected with this aspect, the lack of clear objectives can lead to certain insecurity on what Living Labs can and aim to achieve. It is therefore important to define focused (and achievable) objectives at the start of a Living Lab, as well as ensure the follow-up after the interventions. Knowledge (local and technical/expert knowledge) as well as governance structures were also associated with the outcomes achieved. In particular, Living Lab participants realised that the competences, local knowledge, and governance structure to be able to become a prosumer community are already there, which opens up the door to look for additional and specific knowledge (e.g., at the municipal level) to accelerate the energy transition.

Some quotations that exemplify and contextualize these findings are the following:

Living Lab One Stop Shop (Croatia): *“The main lesson learned is that the market is well aware of the benefits of the prosumer solutions, but that there is still a missing link from that awareness to the realization and larger scale up of the projects being implemented” (...) “I learned that sustainable way of life and investments in green energy are the future” (...) “The main lesson learned is that PV panels have high potential to be integrated with households in Croatia and that banks support such initiatives” (...) “I learned that solar era is coming very fast and everybody should think about it” [Focal Point]*

Getesnippers Living Lab (Belgium): *“While we have collectively worked in this direction (to create a business plan for the valorisation of LCMW for sustainable heat), it appeared that the management and logistic aspects related to setting up a valorisation chain (especially the collection and management of wood assets / biomass feedstock) already takes up a lot of resources, time and effort before thought can*

*be given to the end-use of the woodchips (e.g., in a boiler). Having set up a step-by-step guideline was very useful as it enabled us to structure our actions in a clear manner” [Stakeholder]*

Living Lab Santorso (Italy): *“We can benefit from the ideas taken from other Living Labs, but we also gained confidence in ourselves. Looking at other experiences we realised that have the competences, local knowledge and governance structure to be able to become a better prosumer community” [Stakeholder]*

Living Lab Aardehuizen (Netherlands): *“The workshop on prosumers opened my eyes about the multiple ways to prosume. This taught me that policy of the municipality has to be flexible, so that there is space for diversity” [Stakeholder]*

## 5.4 Internal dynamics and external factors

Only a few lessons learned were extracted from the internal dynamics and external factors identified by the Living Lab participants. The main ones were related with two topics: time and resources. For instance, to be able to support RES projects in developing business plans, it is necessary to **invest time and resources**. Although it seems to be an obvious statement, it is important to acknowledge that time and energy should be taken beforehand to understand the technical and financial challenges faced by prosumers’ projects, as well as the opportunities that energy markets, new regulations, and novel technological solutions can bring to the RES initiatives to further develop their projects, in particular, in changes times like the ones we are living now.

One quotation that relates to these findings is the following:

Living Labs (United Kingdom): *“Plummeting costs of solar PV panels and batteries are making projects increasingly viable, in spite of the challenging regulatory environment and removal of subsidies. Further, the rollout of smart meters, EVs and internet of things enabled devices is likely to open up new sources of revenue which community groups such as BEC can base their business models. Further, governments are looking to stimulate their economies in the wake of the COVID-19 induced economic downturn. Proposals for stimulus packages, increasingly call for the energy retrofit of homes. The UK government has recently announced a Green Homes Grant which will cover energy efficiency and low carbon heat measures. It is hoped that this initiative will help to catalyse the prosumer market, as a share of the funding is available for solar PV installations on non-domestic buildings” [PROSEU team]*

## 5.5 The role and background of the PROSEU teams

An interesting lesson learned was identified by one of the PROSEU teams involved in Living Labs activities: representing an EU project can put some distance between researchers/practitioners and the stakeholders involved in the Living Labs. A way of overcoming this initial resistance or disconnection when establishing collaborative process is **to connect the initiatives and projects with other stakeholders and experts closer to their reality** (e.g., local governments, local organisations, other local/regional initiatives, etc.)

This finding was expressed by a PROSEU team member as follows:

Living Lab Santorso (Italy): *“Especially at the beginning, the fact that we were representing an EU project put some distance in between us and the LL participants which were more into a “listen and learn” mood. This has been overcome by inviting as contributors experts who are more and more close to their reality”*

## 6. Final recommendations from the PROSEU Living Labs

The final recommendations presented in this section gather the inputs from Living Lab participants (focal points and stakeholders) and from PROSEU teams, for both starting/developing RES projects and for implementing Living Lab processes, also applicable to other topics.

Recommendations for the PROSEU Living Labs highlight the **need to establish new partnerships** with other stakeholders from the policy, market and civil society spheres, and the importance of **strengthening ties with potential investors and local administrations** to accelerate the development of prosumer projects. Communicating well the key ideas of the initiative/s being developed through the Living Lab is critical to gain public support, buy-in and acceptance. The development of **new synergies between energy community and other types of initiatives** (e.g., energy efficiency, energy literacy) is also highlighted, as means to accelerate, and strengthen the impact of prosumer projects.

Recommendations for the specific implementation of Living Labs highlight that **showing examples of best practices from other countries** is an added value, as inspiring others should be a central aspect of the Living Labs' activities. However, it is important to choose the presented good practices with enough care so that local stakeholders can best relate to them and do not feel that the presented cases are too "removed" from their own context. It is important to keep an open mind to the possibility that the Living Lab's goals and strategies may change halfway and embrace any changes through a collaborative and collective problem-solving approach. It is also critical to **manage expectations** of the different participants and their responsibilities, ensuring these are well understood and accepted by the Living Lab participants. Research teams should also balance their interest, especially in the case of transdisciplinary teams, as research interests may clash with more operational and practice-based approaches. Bilateral meetings with Living Lab members are important to **strengthen cooperation and maintain a good level of engagement** throughout the process. Also, it is relevant to integrate Living Lab partners (i.e., Focal Points) in the process from the early stages, if possible, even in project writing and grant development activities, allocating a **budget to ensure tangible outcomes** and guarantee their availability to participate. Producing tangible and measurable results is also a central aspect, and at the end of the Living Lab engagement participants should feel they have co-produced specific tools, products or services that help move forward with implementing their projects.

The following tables summarize all these findings.

### 6.1 For collective prosumers willing to start a RES project

Key concepts	Specific recommendations identified
Identify good practices/examples	Provide examples from other contexts in which similar actions have been done
	Show examples of international good practices but also invite local and regional best practice examples, keep a good balance both to inspire and promote mutual learning opportunities

	Explore if similar tools, products, or services are already available (e.g., banking/financial products for prosumers) before start developing yours
<b>Partnerships &amp; collaborations</b>	Establish new partnerships with other stakeholders (e.g., energy cooperatives, local governments, regional administration, etc.)
	Persist and collaborate with other projects such as PROSEU
	Strengthen ties with potential investors and local administrators to accelerate the process
<b>Communication (external)</b>	Gain more attention for your project because people might be sceptical but there are very interested!
	Try to be more persuasive to get participants for your events and maybe find better incentives
<b>Goals and approach</b>	Bring together energy efficiency and energy community/self-consumption efforts
	Design and implement integrated approaches that address more than only one major shortcoming
	Diversity your strategies
	Take time to reflect on what you are doing
	Size (and location) does not matter, not only big cities with a lot of resources can afford to implement bold actions
	Make use of the current opportunities that markets and technological development offer
	Before advancing with new RES installations, it is critical to optimise consumption and ensure both energy efficiency and energy production are well integrated
	Follow a step-by-step approach: complex processes/projects that involve multiple stakeholders and/or face multiples external/internal issues might need to sort out several problems (e.g., managerial steps of the parts involved) before reaching their final objective
<b>Persistence</b>	Do not give up even though it is very hard at times
<b>Funding</b>	Apply for local participatory budgets

Some of the quotations that exemplify these findings are the following:



Living Lab Northeast Lower-Saxony (Germany): *"To go through with such projects like solar initiatives you need "strong" people, who really work for the project and do not let themselves stop by little obstacles"* [Focal Point]

Living Lab Silba island (Croatia): *"Future actions regarding water supply solutions in Silba (and other islands facing similar shortcomings) should focus on the actual implementation of the proposed concept, bearing in mind that an integrated approach should address more than only one major shortcoming identified"* [Stakeholder]

Living Lab Silba island (Croatia): *"Future research with the Silba Living Lab should be focused on exploring business models/frameworks in which stakeholders can actively participate in the funding of the project by getting the most out of that action"* [PROSEU team]

Living Lab Santorso (Italy): *"At this point it will be interesting to support them in the planning and set up of an energy community. The LL will need to dedicate some resources to invest, to keep update with the development at the policy level and to "translate" it and present it to the community in order to gain their support"* [PROSEU team]

Living Lab Bristol Energy Cooperative (United Kingdom): *"Continue the large solar sites with PPAs and community share offer as core business model. Build more partnerships on new business models including microgrids and local energy markets. Work with city council to investigate the Community Municipal Investment (CMI) structure, to reduce the cost of capital on projects"* [PROSEU team]

Living Lab São Luís (Portugal): *"Creating synergies and new collaborations is central to accelerate the transition. Local community action is important but to reach a new level it is important to bring together different stakeholders and different communities, even if they have opposing views regarding the energy transition and how it should move forward, to unleash a creative collective power and create a new momentum for the transition. Although regulatory and policy aspects are crucial, community ingenuity is more important, since solutions can often be found even when regulatory frameworks are not the most advantageous"* [PROSEU team]

## 6.1 For other researchers and practitioners willing to implement a Living Lab

Key concepts	Specific recommendations identified
<b>Identify good practices/examples</b>	Showing examples of best practices from other EU countries (or abroad) is useful to get inspired but it is more effective to select such best practices based on the analysis of the needs/interests of the Living Lab
	Show similar examples that inspire the process
<b>Goals and approach</b>	Follow a step-a-step approach to structure the actions to be taken
	Design intuitive and easy to use solutions.
<b>Flexibility and open mind</b>	Be prepare to shift goals and strategies / be flexible with the goals and outcomes expected: rigid target setting can stifle innovation and genuine collaboration
	Be very open with the methods to engage people
	Be aware that Living Lab participants, projects or initiatives involved are likely to go through a steep learning curve or develop over time with shifting goals and strategies
<b>Managing expectations and duties</b>	Manage commitments and responsibilities from both sides (organisers and participants), and check in regularly (do not leave that up to chance)
	Understand participants' priorities, needs and expectations: ensure that all participants involved have the same expectations of the cooperation
	Consider the constraints of all people involved in the Living Lab, e.g., time, resources, etc
	Work closely with your Living Lab members in setting up the goals, establish the commitments and dedication of all parts involved, and help them to map who should be invited to participate in the process
	Try to balance the possible different interests of the research team: academic research vs. more operational approaches
	Don't overpromise, be aware of the limitations of the Living Lab approach followed, a limited number of interventions could be not enough to address the goals set
	Bilateral meetings with some of the key Living Lab members are useful to strengthen the cooperation between the parts involved in the process

<p><b>Communication and engagement with participants</b></p>	<p>If possible, lock in Living Lab members into the process from the very beginning by engaging them in the project writing/grant development and/or allocating some budget to them to ensure tangible outcomes and guarantee their participation and personal investment in the project or, alternatively, ensure a strong voluntary commitment during the whole life of the project</p> <p>Listen to bottom-up initiatives and leverage them, be extremely careful in supporting them, making sure that their ownership is fully maintained</p> <p>Participatory workshops are a very effective tool for engagement: working on concrete tasks and facilitating networking opportunities are highly valued</p>
<p><b>Local context</b></p>	<p>Create a closer connection with the local context with specific analysis of the problem to be tackled</p>
<p><b>Outcomes</b></p>	<p>Produce tangible results (e.g., tools, products, services, models, etc.)</p>
<p><b>Internal management</b></p>	<p>An operational plan (internal guideline) to design a joint methodology to work with Living Lab participants may be useful but allow some flexibility in the methods to be used depending on the own dynamics of the initiative/project in your Living Lab</p>

Some of the quotations that exemplify these findings are the following:

Living Lab Getesnippers (Belgium): *"If Living Labs are formed on the basis / together with already ongoing projects, it is important to consider that the timing of the interventions, does not automatically align with the schedule of the project. Time also needs to be planned for to allow the researchers to properly get up to speed with the current status of the project, so that it can serve as a proper basis for a Living Lab. This means likely extra time needs to be planned in to ensure that the needs-assessment is as thorough and useful as possible"* [PROSEU team]

Living Lab One Stop Shop (Croatia): *"The main strength of a Living Labs is a potential of really making an impact on the market and solving a designated market issue or starting up the procedure of solving a designated market issue which would otherwise be left unattended. In other words, through investment of time and know how in a specific documentation needed for a decision to start a project it has the potential to enable project realization for projects which would otherwise be lacking the initial initiative and high-risk capital. The main weakness is that, after the Living Lab is done, there are few instruments to further continue the projects, so it is up to the Living Lab to create enough interest for further steps amongst potential investors and developers"* [Focal Point]

Living Lab Northeast Lower-Saxony (Germany): *"It is important to establish full commitment from all LL Partners. To do so, suggestions based on our experience are to really think and discuss with the partner (before LL start) which benefits they can have from the LL. This is often already done. Nevertheless, the focus on the identification of the benefits can be strengthened. Furthermore, we would not recommend any forms of contracts, since most of the partners are working on voluntary basis and a contract puts a lot*

*much pressure on them. Most of them would probably take not part in the LL under a contract. Rather it could help if it were possible to pay them compensations for their efforts" [PROSEU team]*

*Living Lab SWW (Germany): "People are interested in ecological transitions and want to be involved, but it is important to know their other priorities to shape the form of the transition. Especially in small towns it might help if someone from the outside facilitates the process and brings in new ideas" [PROSEU team]*

*Living Lab Santorso (Italy): "It is really important to find similarities with other experiences that shows that what preached is actually possible. Best practices and example are fundamental in order to motivate the participants. A Focal point which is really engaged in the initiative is key as he/she is the person that somehow represent the entire project under the eyes of the LL participants" [PROSEU team]*

*Living Lab Buurtwarmte (Netherlands): "Discuss how and how often to have contact during the cooperation period; in hindsight a fixed check-in every few weeks would have been useful, also for evaluation and reflection purposes. This could also be an intervention, using your outside position as a researcher to help the Living Lab in reflecting on what they are doing" [PROSEU team]*

*Living Lab Wines of Alentejo (Portugal): "Taking more time in the initial planning and preparation stages is critical. Map the stakeholders to involve, by interviewing those that are already involved and already engaged in the transition. This step was missing and would probably highlight the need to involve stakeholders representing local community associations and local administrations. Increasing the interactions between the different interventions would also potentially improve the impact of the Living Lab. Although we did maintain ongoing communications with our key stakeholders, we could have benefited from having set up a Facebook page or another social media channel, specifically for the Living Lab, that enabled a closer ongoing contact. This would have strongly benefited the Living Lab process and possibly increase participation" [PROSEU team]*

*Living Lab São Luís (Portugal): "A key suggestion is to take more time in defining who to involve in the LL. Once a first connection is established with a 'focal point' or the key action-group, it is important to map in the detail who should be involved, by for instance interviewing the members of the 'focal group'. Even before a first intervention, a careful and detailed stakeholder mapping is very important, and that step was missing from our methodology. I think maintaining an ongoing communication with all stakeholders is also critical. We did this and I think this benefited all interventions. Developing together the agendas, goals and moments of each intervention, collecting feedback (and integrating the feedback received) on an ongoing basis, is also important. As one participant pointed out, delivering on the promises made is critical. We were careful to be very clear on what we could or could not do for the community and made sure we delivered on our promises. I think this openness and clarity when communicating with all stakeholders is very important" [PROSEU team]*

## 7. Discussion

The PROSEU Living Labs bottom-up approach was guided by the overall aim of understanding how collective prosumer initiatives and their stakeholders are advancing towards the mainstreaming of RES prosumerism, and in this way actively contributing to co-constructing a transition pathway towards a low-carbon and more sustainable energy system. Together, prosumer initiatives and their stakeholders make up the social fabric of RES prosumerism – i.e., a socio-technical innovation that exists in the form of ideas, objects, and actions (D6.1) and a social movement (Campos & Marín-González, 2020). Thus,

the Living Labs' research offered an opportunity to strengthen the capacity of citizens and stakeholders actively involved in the energy transition to exchange their knowledge, skills, ideas around prosumerism and to co-produce new knowledge and new solutions, while advancing with their projects.

The adoption in PROSEU of this co-creation and transdisciplinary methodology (Hinsch et al., 2020; Renn, 2018) has shown to be effective in enabling and fostering the co-production of knowledge. Across the different Living Labs, participants recognised they gained new knowledge on new regulatory frameworks (for prosumers, renewable energy communities and citizens energy communities), on new business models (e.g., peer-to-peer) involving different financial alternatives (e.g., crowdfunding, crowdlending), and learning about the application of new technologies, including new modelling approaches to support renewable energy communities (i.e., learning about the local energy needs, systems' dimensioning, costs, etc.). This co-learning process results from the exchanges and interactions within the Living Lab. Thus, learning was not a one-sided process, as different stakeholders' involved gained insights on different aspects of prosumerism, while also contributing with their expertise to the co-creation of new ideas and solutions that responded to the different challenges collectively identified. This knowledge exchange and co-production of knowledge is empowering to those participating and whose voices are included, reinforcing the relevance of adopting real world laboratories' approaches in transition research (Engels & Walz, 2018).

Overall participants and teams found that the Living Lab's process has been inclusive, as it enabled responding to needs collectively identified, and integrating the perspectives, ideas and solutions brought forward by all those participating. However, the evaluation also tells us the process should have been more inclusive, in the sense that more stakeholder groups, including from the financial sector, civil society and community spheres, should have been involved in the Living Lab's work. This aspect largely relates to the research design of the Living Labs, which was grounded on the identification of participating stakeholders through the work developed (in the context of PROSEU's WP2) on characterising prosumers. Indeed, the Living Labs do reflect to a large extent the different types of actors and stakeholder typologies identified early in the project (e.g., from the policy, market, community and third sector spheres, see also Wittmayer et al., 2019)). However, two factors may have contributed to the assessment that some stakeholders were missing. First, the characterisation of collective prosumer initiatives and stakeholders that preceded the Living Lab's research was done before the recast of two European Union's Directives (Renewable Energy Directive and the Internal Electricity Market Directive), which have put forward new definitions of prosumers, collective self-consumption, renewable energy communities and citizen energy communities. These new definitions also implied the emergence of new actors relevant for prosumerism, such as aggregators, and strengthened the relevance of other actors, such as financial and market agents and ICT-related initiatives developing new demand-side management, among others. Second, the engagement of some stakeholder groups, such as companies and financial agencies in the Living Lab process, has proven to be quite challenging, particularly when the goals of the prosumer initiatives involved in the Living Labs were not necessarily profit-driven, but rather to develop new solutions that create local social and environmental benefits for communities (in line with, for instance the REDII definition of renewable energy communities) (Campos et al., 2020).

While Living Labs no doubt offered a forum for sharing new ideas and solutions (e.g., the new desalination process in Silba Island, the new business models for tackling energy poverty in Bristol Energy; the new pathways for developing renewable energy communities in Southern Portugal, a new inter-municipal plan for the valorisation of waste wood for sustainable heat in Getesnipper etc.), a wider

and continued stakeholder involvement would be necessary for not only improving the effectiveness of the new solutions, but also to put them into practice.

Nevertheless, the Living Lab process is not meant to be a static one, and is rather a moving target, as it is meant to continue developing even after PROSEU ends, if not in all cases, at least for some. For those that can continue leading forward their prosumer initiatives and projects, it is relevant to include stakeholder groups that have not yet been properly involved and that can have a critical role in implementing the new ideas and solutions developed.

The ability to build new as well as expand on pre-existing innovation networks is another key strength of the Living Lab's approach highlighted through the evaluation of PROSEU's Living Labs, which is relevant for transition research. As transitions require the active involvement of a multitude of social actors, including 'regime' actors as well as frontrunners (i.e., prosumers, alternative finance system) (Loorbach et al., 2020), Living Labs have shown to be an excellent approach to ensure a wide involvement of different social actors, across different spheres (i.e., market, public, community and third sector) (Avelino & Wittmayer, 2016) in a co-creation process.

Across the different Living Labs, the networking aspect was highly valued in the evaluation. Local prosumer initiatives found they increased their stakeholder connections, established new relations with other market, public, community and civil society actors, and have reported this aspect as an important benefit of their participation. However, participants and teams also found it difficult to keep stakeholders engaged throughout the Living Lab process. This difficulty equally related to a lack of financial compensation for participation. This is key lesson learned for future projects – Living Labs' research will benefit from some financial compensation for those who participate.

Interestingly, an unforeseen impact of the stakeholder dialogue and network building activities promoted through the Living Lab was that the activities reinforced a sense of togetherness and of a collective European Union effort in most cases. This was mainly due to the extensive conversations and Living Lab interventions specifically focussed on regulatory aspects (i.e., to exchange information on the recast of EU Directives and their provisions on renewable energy communities, collective self-consumption, and citizen energy communities). Participants gained a higher awareness that advancements in their country went hand in hand with advancements in other EU countries, and that collective prosumer initiative models were very much grounded on a collective EU project. Even in the case of the United Kingdom's Living Labs, there was an ongoing comparison between EU advancements and expectations for prosumers in this country. Thus, another key lesson learned for Living Labs in the context of transition research, is the value of establishing Living Labs in different countries and not only ensuring they implement a similar methodology, but also that an ongoing dialogue is actively encouraged through regular online meetings and even 'blind date' events between the different countries' Living Labs. At the same time, care needs to be taken to ensure that European examples are as relevant to the local initiatives as possible to allow for proper knowledge transfer which can contribute to direct implementation in the Living Lab.

Critical external and internal factors affecting the Living Labs process, emerged mainly throughout the last year of their implementation (2020) and are intrinsically related to the COVID-19 pandemic. The impacts included initiatives who were key participants in the Living Lab and whose activities terminated (such as the Bristol Energy Company). Participants also reported lack of time and lack of availability for meetings. With few exceptions, the final Living Lab interventions were all done online, which did not



affect the number of participants (and in most cases resulted in a higher number of participants), but also resulted in usually shorter and more condensed events. Thus, another key lesson learned is that Living Labs research takes time, often implying moments of pause between different interventions, but requiring the availability of extra time to accommodate additional meetings, for clarification, including individual meetings with some key participants, throughout the implementation process.

Another key lesson learned from the evaluation is the need to harmonise the expertise of the research teams and the needs of the Living Labs. This is not always easily done, especially since research teams tend to be set up before the Living Labs' needs are known, since the latter result from the first Living Labs' interventions. However, to address this issue, two aspects can be considered in future Living Labs' research. First, the team can be complemented with new expertise once the Living Lab's needs and aspirations are understood. In PROSEU, this cross-pollination of Living Labs was ensured, also, through researchers attending the interventions of other Living Labs. The Living Labs process should thus start with a small team that will be completed once the first needs assessment is completed. This implies equally, that researchers spend considerable time understanding participants' priorities, needs and aspirations, and that all participants have a shared understanding of their expectations for the collaboration and co-creation process. Second, external stakeholder experts can be invited to participate in meetings and provide their specific input and a budget should equally be reserved to pay these experts for this participation.

PROSEU's transdisciplinary Living Labs research was also informed by a Participatory Integrated Assessment (PIA) of the incentive structures for prosumerism, and its resulting pathways towards mainstreaming prosumerism in the energy transition. Against this background, Living Lab participants found there is a window of opportunity for energy communities, which can largely benefit from the active involvement of local governments, of new business and financial agents and of proactive communities pushing to implement new energy communities. In this context, Living Labs can function as a transition arena (Loorbach & Rotmans, 2010) for the collective engagement and of these actors, thus accelerating the implementation of new energy communities.

Throughout the Living Labs' process, participants highlighted numerous challenges collective prosumer initiatives still face, such as capacity building, professionalisation versus volunteering, the complexity of new business models and of new regulatory frameworks, complex administrative requirements, grid balance and grid tariffs, and the need to build community trust, to name a few. While these and other challenges exist for prosumers and are acting as lock-ins in a transition process (Frantzeskaki & Loorbach, 2010) Living Labs can provide a means to collectively identify such challenges and difficulties and develop new strategies and ideas on how best to overcome them.

## 8. Conclusion and further research

Overall, PROSEU's Living Labs enabled a robust approach to understand the multi-stakeholder dynamics of prosumerism, as a bundle of different socio-technical innovations – i.e., individual and collective prosumers, renewable energy communities, renewable energy cooperatives – and their stakeholders, bringing to the foreground new knowledge on how they deviate, challenge and transform the rules and incentives of the dominant socio-technical energy system, and how these processes can promote the mainstreaming of prosumerism in the energy transition.



Further research drawing on a Living Labs' approach in the context of energy transition studies, should strive to depart from a thorough stakeholder mapping before advancing with the Living Lab process, taking stock of expert interviews to identify in detail who should be involved from the beginning. This a critical step to ensure a highly inclusive process. Some funding to compensate participants for their time is also critical, as Living Lab participants are often volunteering, already stretched to their limit in allocating time for the transition projects where they participate, and therefore should be compensated in some form for their participation. Even considering that action-research projects do aim to provide direct benefits for communities, such benefits should not obscure the need for compensating people for their individual time and the expertise they provide to accomplish goals for the common good. Involving Living Lab participants from the early stages of project development (including grant application writing) is also an important step to ensure commitment and a successful collaborative partnership.

Further research is needed on experimenting with regional and even nation-wide Living Labs, integrating stakeholders from the policy, civil society, academia, and market spheres. Although all PROSEU Living Labs were mainly local, considering the need to match policymaking with actions taking place in the ground, it is fundamental to widen the range of Living Labs' experimentation. Again, this requires funding, and specific project calls for implementing Living Labs would be very beneficial to accomplish this goal. The energy transition is a moving target and therefore requires flexible and dynamic research and innovation approaches that involve practitioners on the ground, connect policymakers and decision makers at multiple levels of governance, as well as innovators, working across technology, financial, business, and social innovation aspects.

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## 10. Annex

*Annex 1. Programme of the 4th International Online Workshop: Prosumerism in Europe: Barriers today - Pathways ahead, celebrated on the 29th of October 2020*

<b>Morning session: Co-creating solutions to real prosumer challenges</b>	
10:00 - 10:05	<b>Welcome and introduction of the day</b> <i>Opening and welcome: Tessa de Geus (DRIFT)</i>
10:05 - 10:15	<b>Overview of PROSEU RES Living Labs</b> <i>Short presentation: Arthur Hinsch (ICLEI Europe)</i>
10:15 - 10:25	<b>Speed dating (2 rounds)</b>
10:25 - 10:55	<b>Breakout sessions (round 1):</b> Topics: <ul style="list-style-type: none"> <li>• Group 1: Developing Business and Finance Models</li> <li>• Group 2: Developing Technological Solutions</li> <li>• Group 3: Overcoming Legal Challenges</li> <li>• Group 4: Community Building</li> </ul> <u>Guiding question to open the discussion:</u> <i>What were the main challenges of the PROSEU Living Labs and to what extent have their members overcome them together? What have the Living Labs learned? Do you think that similar solutions/approaches would work in your context?</i>
10:55 - 11:05	<b>Break</b>
11:05 - 11:35	<b>Breakout sessions (round 2)</b> Topics: <ul style="list-style-type: none"> <li>• Group 1: Developing Business and Finance Models</li> <li>• Group 2: Developing Technological Solutions</li> <li>• Group 3: Overcoming Legal Challenges</li> <li>• Group 4: Community Building</li> </ul>
11:35 - 12:05	<b>Plenary</b> Each group reports back and connections between sub-topics will be jointly identified to discuss the benefit of holistic solutions for prosumer initiatives. <i>Discussion moderated by: Arthur Hinsch (ICLEI Europe)</i>
12:05 - 12:15	<b>Wrap-up</b> There are different Futures to mainstreaming prosumerism... which we will explore in the afternoon! <i>Closing morning session: Arthur Hinsch (ICLEI Europe)</i>
12:15 - 13:05	<b>Lunch</b>

<b>Afternoon session: Critical choices and recommendations for mainstreaming prosumerism in Europe</b>	
13:05 - 13:30	<p><b>Critical choices for mainstreaming prosumerism</b></p> <p>During this introduction we will share the results from the previous roadmapping workshops, and present what '<a href="#">critical choices</a>' and recommendations emerged from those discussions. You can already access the results from the workshops here: <a href="#">1: 'business models'</a>, <a href="#">2: 'inclusiveness'</a>, and <a href="#">3: 'system configuration'</a>.</p> <p><i>Opening and welcome: Tessa de Geus (DRIFT)</i></p>
13:30 - 14:00	<p><b>Round 1: Break-out groups (30min)</b></p> <p>Each participant chooses one of the seven 'critical choices' to focus on, and joins the break-out group that discusses that issue. The group discusses the recommendation that has emerged from previous discussions, whether they agree with the proposition, and what problems they identify for realising the recommendation.</p>
14:00 - 14:15	<p><b>Short recap of highlights</b></p> <p>Facilitators will be asked to report back on the highlights and main insights of their break-out group. Participants can choose to stay in the same group or switch to a new group for Round 2 of the break-out groups.</p>
14:15 - 14:30	<p><b>Break</b></p>
14:30 - 15:15 (15:00)	<p><b>Round 2: Break-out groups (30min)</b></p> <p>The second round of break-out groups will focus on looking forward. Participants will discuss how the problems to realise the recommendations might be overcome, what actors should be involved in this, and what windows of opportunity they identify in the coming 10 and 30 years.</p>
15:15 - 15:30	<p><b>Short recap of highlights</b></p> <p>Facilitators will be asked to report back on the highlights and main insights of their break-out group.</p>
15:30 - 15:55	<p><b>Call to action: Steps to be taken</b></p> <p>During the closing panel, PROSEU researchers Kristian Petrick (Eco-Union), Swantje Gähns (IÖW) and Mark Davis (University of Leeds) discuss what call to action they see following the emerging recommendations.</p>
15:55 - 16:00	<p><b>Conclusion, synthesis and next steps</b></p>



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