MASTERPIECE - Multidisciplinary Approaches and Software Technologies for Engagement, Recruitment and Participation in Innovative Energy Communities in Europe

Deliverable 2.6

ASSESSMENT OF ENERGY COMMUNITIES' MATURITY AND ASPIRATIONS IN THE PILOT CASES UPDATE

Title	Assessment of energy communities' maturity and aspirations in the pilot cases – update
Document description	This report is an update of D2.5, which also describes the results of T2.3 and T2.4, including data provision, pilot mapping, use case requirements and performance evaluation planning.
Nature	Type and dissemination level: R - PU
Task	T2.2
Status	Final
WP	WP2
Lead Partner	EXP
Partners Involved	UMU, CERTH, TROYA, UEDAS, SUST, AMU, ALEC, BERC, SEIN
Date	18/12/2024

Revision history	Author	Delivery date	Summary of changes and comments
Version 1	EXP	10/11/2024	ToC
Version 2a	EXP	20/11/2024	Initial content of the EC journey
Version 3	EXP	16/12/2024	Final Draft
Version 3a	EXP	17/12/2024	Final Draft Revision
Version 4	UMU	17/12/2024	Revision
Version 5	EXP	18/12/2024	Final version
Version 6	UMU	20/12/2024	Last revision

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1 EXECUTIVE SUMMARY

This report presents an updated assessment of Energy Communities (ECs) within the framework of the Masterpiece project, building upon the foundations established in previous deliverables, particularly Deliverable 2.1 and Deliverable 3.5. It provides insights into the maturity, readiness, and aspirations of ECs, integrating data from workshops, pilot visits, and stakeholder engagement conducted throughout the project. The findings aim to inform the next phase of development, including the design and implementation of the Recomme profiling and recommendation tool under WP3.

The workshops conducted with pilot projects form a central component of this report. These workshops were carefully designed to explore user needs, behavioural patterns, values, goals, drivers, and barriers faced by ECs. The report outlines the rationale behind the workshops, analyses the results, and connects these findings to the EC journey framework introduced in D3.5. This framework, which includes a readiness and maturity scale, provides a structured approach to understanding the development stages of ECs and serves as a foundation for assessing the progress of the pilots.

Key performance indicators (KPIs) from each pilot project have been evaluated and mapped to different stages of the EC journey. This analysis establishes a clear linkage between the practical outcomes of the pilots and the theoretical framework, offering valuable insights into how ECs can progress towards greater maturity and effectiveness.

One of the report's key contributions is its development of user profiles and behavioural models based on an in-depth investigation of pilot participants. These profiles capture critical insights into the behavioural and experiential drivers, challenges, and aspirations of EC members, creating a robust basis for future work. These findings are instrumental in shaping Recomme, which aims to provide tailored recommendations and support tools for energy communities.

In summary, this report provides a comprehensive and updated understanding of energy communities in the Masterpiece project. It outlines their current state of maturity as resulting from the investigation and activities reported in this deliverable, identifies key barriers and enablers, and offers actionable insights for supporting their growth. This work lays the groundwork for the continued development and deployment of tools and strategies that will empower energy communities to achieve their goals and contribute meaningfully to the energy transition.

2 INTRODUCTION

This report is an updated version of the previous deliverable, *Deliverable 2.1*, and provides an in-depth assessment of energy communities (ECs) in the context of the Masterpiece project. It builds on the foundation laid in earlier reports, particularly *Deliverable 3.5*, to offer a detailed analysis of the current state of energy community maturity and readiness. The assessment integrates insights gathered through workshops, site visits, and extensive stakeholder engagement throughout the Masterpiece project.

The analysis begins with a detailed overview of the workshop methodology and objectives, followed by a comprehensive examination of the workshop outcomes. These results are analysed in relation to the Energy Community (EC) journey framework previously established in Deliverable D3.5, which detailed the EC maturity model and readiness scale for community members.

These workshops with the pilots were designed to explore the evolving dynamics of ECs, including their needs, challenges, and aspirations. By carefully analysing the workshop results, the report aims to provide a clear understanding of how the pilot projects align with the EC journey, a conceptual framework that charts the stages of maturity and readiness of energy communities and their members.

The analysis begins with a detailed overview of the workshop methodology and objectives, followed by a comprehensive examination of the workshop outcomes. These results are analysed in relation to the Energy Community (REC) journey framework previously established in Deliverable D3.5, which detailed the EC maturity model and readiness scale for community members.

Building on this framework, we evaluate the correlation between pilot-specific Key Performance Indicators (KPIs) for designated use cases and their corresponding stages in the EC journey. This analysis lays the groundwork for ongoing developments in Work Package 3 (WP3), specifically the Recomme EC profiling and recommendations tool.

Finally, this report provides a broader assessment of energy communities' maturity and aspirations across the pilot sites, examining user needs, behavioural patterns, values, goals, drivers, and barriers within Energy Communities. The findings inform the development of user profiles and behavioural models, which will guide the development and implementation phases of Recomme in WP3.

2.1 Relation to other tasks

The primary objective of this document is to outline the updates achieved through Task 2.2 and establish a foundation for the work conducted in WP3. Task 2.2 serves as the cornerstone for the activities in WP3, particularly in Tasks 3.3, 3.4, and 3.5.

The results presented in this deliverable form the basis for both the experimental plan (T3.5) and the design of the Recomme recommendation tool (T3.3), including its content and methodology. Furthermore, the assessment of Renewable Energy Communities (REC) based on pilot studies provides framework for the experiments and activities to be conducted during the pilots, ultimately setting the groundwork for future pilot experiments and the necessary tools for implementation strategies.

2.2 Overview of Key Findings and Objectives

This report provides a comprehensive assessment and analysis of Renewable Energy Communities (RECs) within the framework of the Masterpiece project, emphasising their current maturity, readiness, and future aspirations. It synthesises insights gathered through workshops, pilot visits, and stakeholder engagement, aligning them with the Energy Community Journey Framework.

The assessment of energy communities (ECs) reveals several critical findings and objectives that shape the future of community-based energy initiatives. Primary findings indicate that successful ECs demonstrate a characteristic participation pattern, with approximately 10% of members forming an actively engaged core whilst 90% maintain passive involvement. Financial incentives emerge as the dominant motivator for participation, though environmental consciousness and community cohesion play increasingly important roles. The analysis identifies four distinct evolutionary stages of EC development, from inception to full integration, with each stage marked by increasing technological sophistication and self-sufficiency levels ranging from less than 10% to up to 80%. Key objectives focus on addressing identified challenges, including limited awareness of EC benefits, legal constraints on energy sharing, leadership succession concerns, and varying levels of technical literacy amongst participants. The study aims to develop targeted strategies for enhancing community engagement, improving governance structures, and creating sustainable growth pathways. Through the implementation of the RECOMME tool across pilot sites, the project seeks to validate these findings and provide practical solutions for EC development. Furthermore, the research emphasises the importance of understanding and leveraging different member archetypes to create more effective engagement strategies and support mechanisms, ultimately contributing to the broader goal of advancing sustainable energy transitions through community-based initiatives.

The objectives of the report are to assess these dynamics, identify actionable pathways for EC advancement, and support the development and implementation of the RECOMME profiling and recommendation tool. By mapping user profiles, behavioural insights, and readiness metrics, the report aims to provide a structured approach to fostering community engagement, scaling EC initiatives, and driving the transition to sustainable energy systems.

2.3 Structure of the document

D2.6 report begins with an Executive Summary that provides a comprehensive overview of the assessment of energy communities within the Masterpiece project framework, followed by an Introduction that establishes the context and relationship to previous deliverables. The Methodology section then details the approach through workshop designs and pilot visit insights, establishing the foundation for data collection and analysis. Moving into the core analysis, the Pilots Assessment section examines the Energy Community journey and maturity models, leading to detailed Pilot Site Analyses covering the Swedish, French, and Turkish implementations, each exploring unique community dynamics, challenges, and outcomes. The document then transitions to the practical implementation through the RECOMME tool, detailing how it's applied across different pilot sites with specific use cases and KPIs. A thorough Energy Community Archetypes Analysis follows, breaking down the dimensions of values, knowledge, and resources that shape community participation and development. The report culminates in an examination of the Evolutionary Stages of Renewable Energy Communities, presenting a detailed framework of four developmental stages from inception to full integration. Throughout these sections, the document maintains a cohesive flow from theoretical frameworks to practical implementations, concluding with a synthesis of findings and implications for future energy community development. Each major section builds upon previous insights, creating a comprehensive understanding of energy community development, challenges, and success factors.

3 METHODOLOGY

3.1 Workshop Design and Objectives

The methodology centred on a "Deep Discovery Workshop" approach, designed to facilitate an interactive and participatory exploration of EC development. The primary objective was to gather comprehensive insights into the establishment, growth, and strategic planning of Energy Communities while validating the previously developed EC Journey framework.

3.1.1 Workshops Methodology

The Deep Discovery Workshop was conceptualised as an interactive and participatory session aimed at enhancing the understanding and strategic planning of Energy Communities (ECs). It sought to provide a platform for participants to explore their unique journeys in establishing and advancing energy communities or cooperatives.

The workshop methodology employed a mixed-method approach to data collection:

- Facilitated group discussions
- Interactive mapping exercises
- Stakeholder interviews
- Documentation review
- Observational analysis

3.1.2 Workshops: Design and Objectives

The workshop methodology was structured around two key frameworks:

- Energy Community Maturity Journey
- User Journey of Energy Community (including member readiness assessment)

These frameworks served as foundational tools for facilitating discussions and mapping participant experiences against established theoretical models.

3.1.2.1 Workshops: Objectives

The workshop objectives included:

- Providing a structured framework to analyse and reflect upon the Energy Community Journey, focusing on key dimensions:
    - The Maturity Journey of Energy Communities: Evaluating the stages of community development and progress.
    - The User Journey of Energy Communities: Understanding the readiness, engagement, and involvement of EC members.
- Facilitating discussions on how the Energy Community Journey framework aligns with the participants' own experiences and challenges.
- Offering actionable insights to support participants in their strategic roadmap, spanning initial planning, participant onboarding, and advanced community development.

3.1.2.1 Workshops: Design

The workshops emphasized several critical areas integral to the successful establishment and evolution of energy communities:

- ***Community Energy Membership:***
    - Investigating the driving forces behind citizens' decisions to join or abstain from joining community energy groups.
    - Identifying barriers and motivators that influence membership engagement.
- ***User Profiling:***
    - Exploring the process of categorizing and understanding different user profiles.
    - Providing tailored solutions that address specific user preferences and behavioural patterns.
- ***Consumption Patterns:***
    - Assessing energy consumption habits and the hierarchy of needs influencing usage.
    - Evaluating how these patterns impact both energy consumption and production dynamics.

- ***Thermal Comfort Dimensions:***
    - Analysing various aspects of thermal comfort to design solutions prioritising user experience and satisfaction.
- ***Assessment of Enrolment and Onboarding Needs:***
    - Identifying the key integration requirements for seamless entry into energy communities.
    - Highlighting strategies to improve the enrolment and onboarding processes for new members.
- ***User Types and Groups:***
    - Mapping and categorising the diverse user types and groups within energy communities.

- Understanding the unique needs and expectations of each group to enhance inclusivity and effectiveness.

- ***Stakeholder Identification:***
  - Conducting a detailed analysis of the stakeholder network within the energy community.
  - Identifying factors that impact community functionality and stakeholder collaboration.

Figure 1 : Intro Pages from the deep discovery workshop

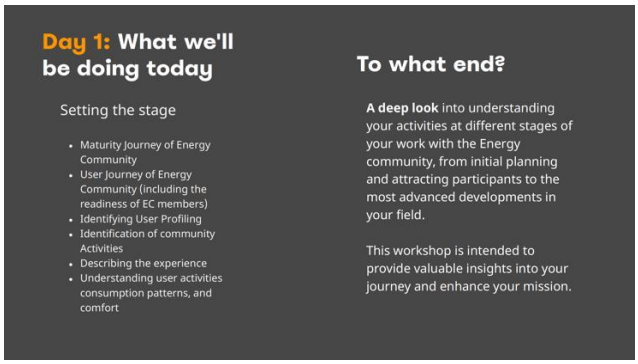

Figure 2: Framework from the deep discovery workshop

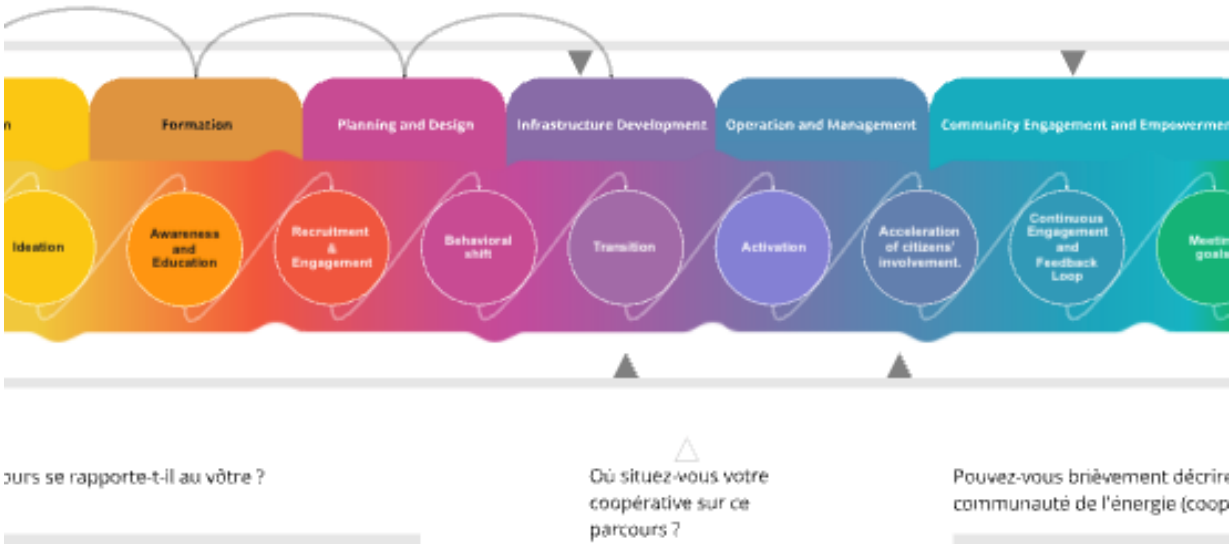

Figure 3: Collaborative work on an exercise from the deep discovery workshop

3.1.3 Implementation Across Pilot Sites

The Deep Discovery Workshop was designed adopting a collaboratively approach to ensure participant-centric outcomes. The workshop activities included:

- Presentations on the Energy Community Journey Framework to establish a common understanding.
- Group discussions and brainstorming sessions to contextualize the framework within participants' experiences.
- Hands-on exercises to identify and analyse critical factors such as user profiling, thermal comfort dimensions, and stakeholder dynamics.

By focusing on these areas, the workshop aimed to provide participants with the tools and insights necessary to advance their energy community initiatives effectively.

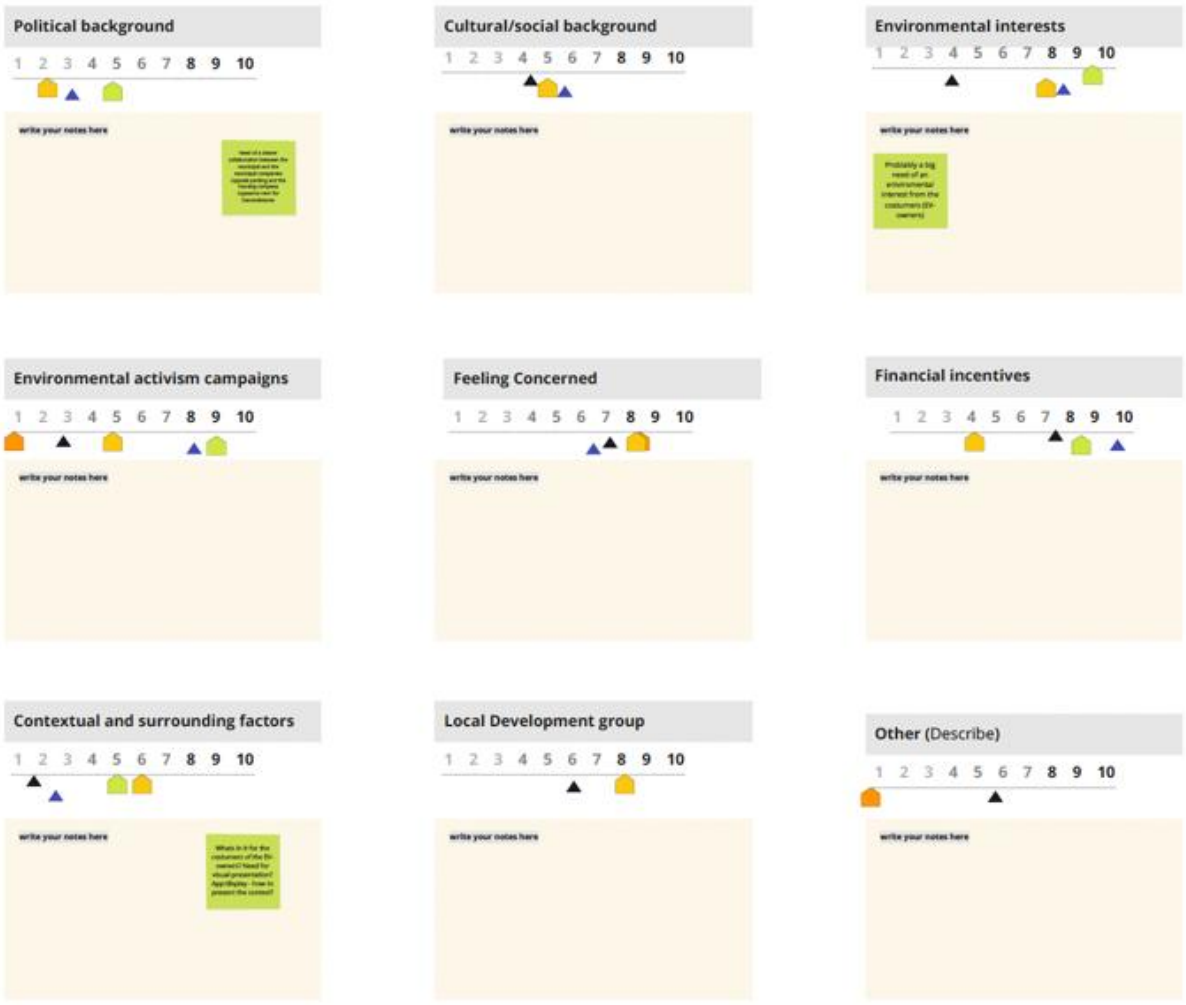

Figure 4: Exercise extract from the deep discovery workshop

3.1.4 Documentation and Outcomes

The workshop content and outcomes were documented to inform the broader assessment presented in this report. These findings directly contribute to the profiling and recommendations tool (Recomme) under development in WP3, aligning with the overall objectives of the Masterpiece project.

3.2 Insights from Pilot Visits

In addition to the structured workshop methodology, significant insights and knowledge were gathered through comprehensive pilot site visits conducted during General Assembly meetings. These visits provided invaluable contextual information and supplementary data through various observations and interactions with stakeholders in their local contexts, enabling a deeper understanding of the unique dynamics and challenges faced by each pilot.

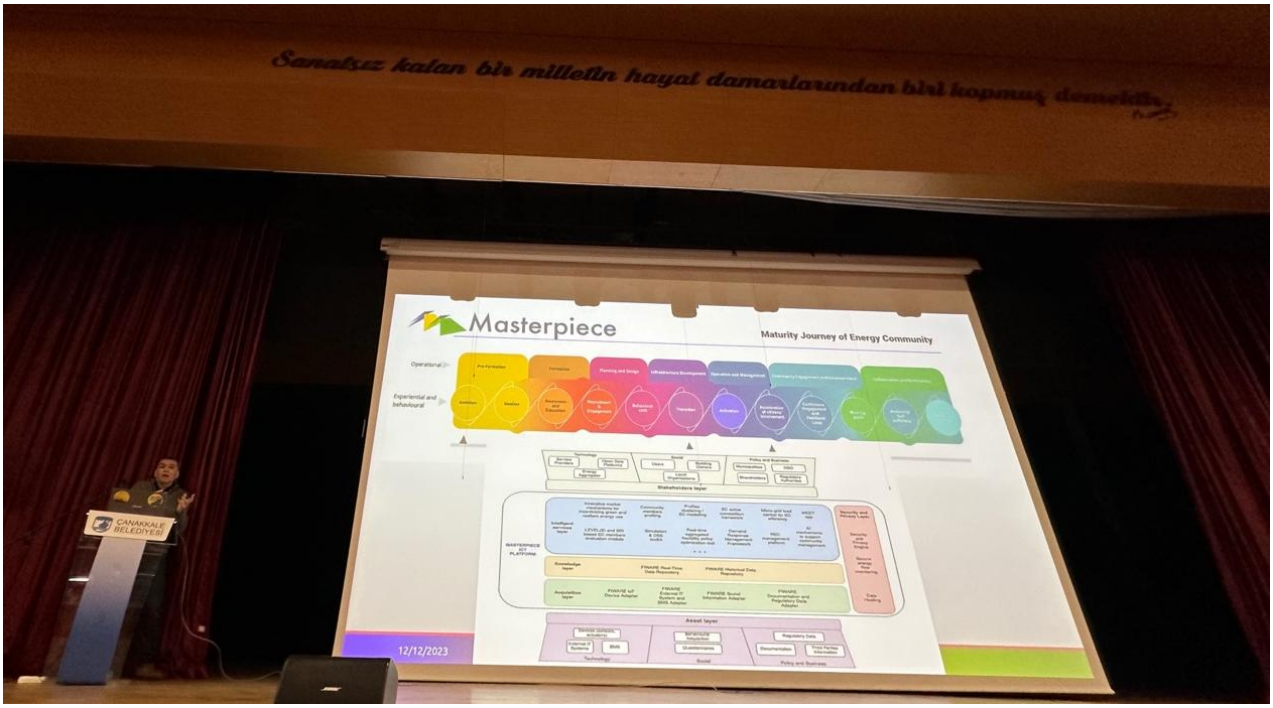

Figure 5: The experiential EC journey presented at the Municipality of Çannakale as part of the pilot visit during a GA.

The pilot visits involved on-site data collection, participatory workshops, informal conversations, and side discussions with community members, stakeholders, and practitioners. These visits provided invaluable contextual information and supplementary data through various informal and formal channels:

On-Site Observations:

- Direct observation of EC operations and infrastructure
- Documentation of physical implementation challenges
- Assessment of local context and environmental factors
- Real-time evaluation of community engagement

Informal Knowledge Exchange

- Spontaneous conversations with EC members
- Side discussions during site tours
- Impromptu feedback sessions
- Casual interactions with stakeholders

Supplementary Data Collection

- Visual documentation of implementations
- Technical infrastructure assessment
- Local resource availability evaluation
- Cultural and social context documentation
- Regulatory and administrative framework understanding

Integration of Field Data

- Validation of workshop insights
- Identification of gaps between theory and practice
- Recognition of unique local challenges and solutions
- Understanding of implementation variations across different contexts
- Documentation of best practices and lessons learned

Moreover, these engagements offered a wealth of qualitative insights, allowing Experientia to:

- Gain firsthand exposure to the operational realities of energy communities, including their infrastructures, workflows, and participant dynamics.
- Understand context-specific drivers and barriers that influence community development and participation.
- Collect nuanced perspectives on community energy strategies, including member recruitment, onboarding practices, and stakeholder collaboration.
- Observe behavioural patterns and values in action, complementing the insights gathered through workshops and literature.

Figure 6: On-site workshop with local citizens and stakeholders in Berchidda pilot during a GA

The knowledge acquired through the combination of structured workshops, literature review, and on-site observations provided a comprehensive foundation for our assessment, ensuring that both formal and informal aspects of EC development were adequately captured and analysed.

These insights also helped to refine the Energy Community Journey and the readiness and maturity scales, ensuring that they align more closely with the real-world experiences of the pilots.

These collective insights lay the foundation for actionable recommendations and further development of Recomme in WP3, tailored to the unique needs of the energy communities based on pilots' feedback.

4 PILOTS ASSESSMENT AND ANALYSIS

4.1 Key Insights and Takeaways

The main objectives:

- Gain a deep understanding of energy community activities across various stages.
- Identify stages of maturity and readiness within energy communities.
- Define user profiles and assess enrolment and onboarding needs.
- Analyse user activities, consumption patterns, and comfort levels.

4.2 Energy Community Journey Assessment

In order to set the stage for the pilot assessment we present the following brief description of the EC journey

4.2.1 Overview of EC Maturity Model

4.2.1.1 Stages of Maturity Journey of Energy Community:

- Operational Stages:
  - Pre-Formation
  - Formation
  - Planning and Design
  - Infrastructure Development
  - Operation and Management
  - Community Engagement and Empowerment
  - Collaboration and Networking
- Experiential and Behavioural Stages:
  - Ambition
  - Ideation
  - Awareness and Education
  - Recruitment & Engagement
  - Behavioural shift
  - Transition
  - Activation
  - Acceleration of citizens' involvement
  - Continuous Engagement and Feedback Loop
  - Meeting goals
  - Achieving Self-sufficiency
  - Exporting Energy

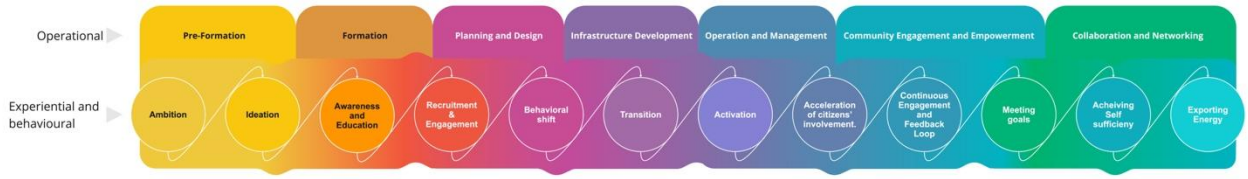

Figure 7: The operational - Experiential and Behavioural EC Journey

We identified the relational Operational/Experiential through these Key Stages:

- **Pre-Formation**
  - Initial ambition and ideation.
  - Awareness and education initiatives.
- **Formation**
  - Recruitment and engagement.
  - Early collaboration and behaviour shift.
- **Planning and Design**
  - Strategy development and infrastructure considerations.
- **Infrastructure Development**
  - Setting up physical and digital infrastructure.
- **Operation and Management**
  - Day-to-day management and operational optimization.
- **Community Engagement and Empowerment**
  - Continuous feedback, collaboration, and engagement.
- **Collaboration and Networking**
  - Broader connections within and outside the EC.

Key Metrics:

- Maturity: Promising → Favourable → Advanced.
- Readiness: 1 (Low) to 10 (High).

4.2.2 User Journey of Energy Community

4.2.2.1 Readiness Levels Assessment

Roles:

- Citizen: Awareness and consideration stages.
- Consumer: Enrolment and onboarding.
- Prosumer: Engagement and active participation.
- Active Member: Advocacy and commitment.
- Influencer/Activist: Leading change within the community.

Notable Observations:

- Initial engagement often driven by a board or small group of pioneers.
- Challenges in scaling participation beyond initial advocates.

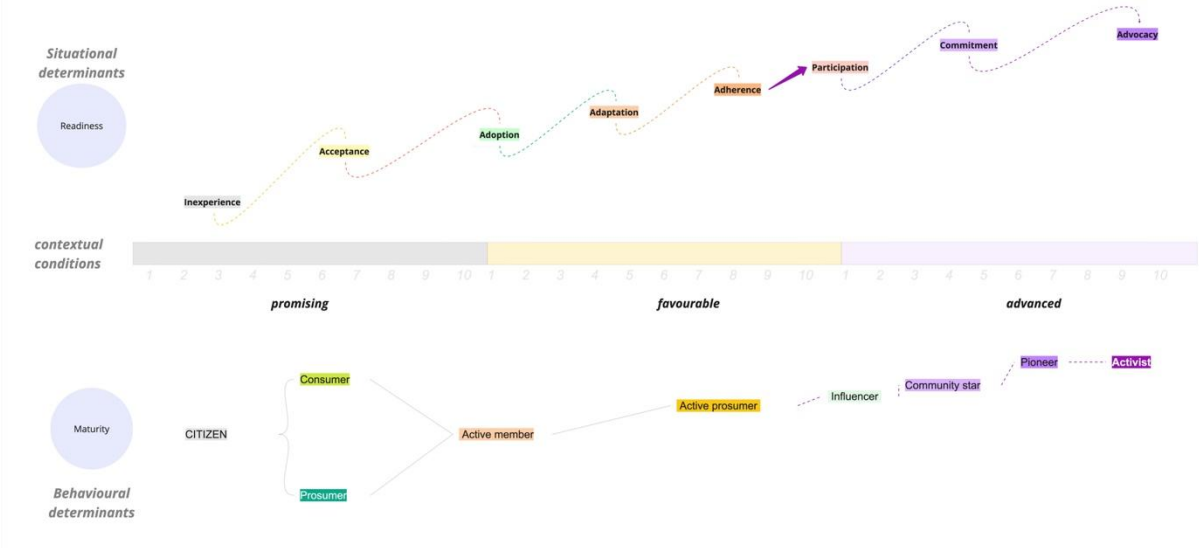

Figure 8: EC Member Maturity

Key Phases:

- Awareness:
  - Initial introduction to the concept of EC through outreach efforts such as campaigns and public information sessions.
- Consideration:
  - Citizens actively evaluate the potential benefits of joining an Energy Community.
  - Contemplation often influenced by financial incentives, environmental awareness, and peer influence.
- Enrolment:
  - Decision-making phase where participants formally join the Energy Community.
  - Processes include signing agreements, confirming eligibility, and onboarding readiness.
- Onboarding:
  - Comprehensive support provided to integrate new members into the EC.
  - Educational materials and tools are distributed to align expectations.
- Engagement:
  - Members take an active role in participating in community activities, contributing feedback, and collaborating on shared initiatives.
- Consolidation:
  - Strengthening the EC's internal structure and processes to ensure long-term sustainability.
  - Focuses on retaining members and addressing any barriers to satisfaction.
- Proactivity:
  - Encouraging members to take initiative in contributing ideas, leading projects, or advocating for the EC.
  - Marks a transition from passive participation to active ownership.
- Innovation:
  - Adoption of new technologies and methods to enhance EC efficiency and appeal.
  - Includes implementing renewable energy systems, IoT integrations, and novel community initiatives.

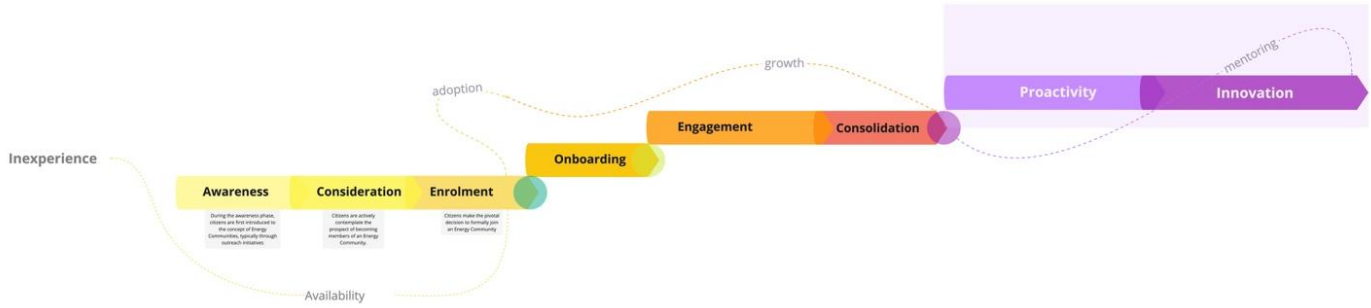

Figure 9: EC Member Journey

5 PILOT SITE ANALYSIS AND FINDINGS

5.1 Swedish Pilot: Overview Analysis

Member Types and Demographics:

Residential members:

- Primary Residents: Mix of house owners and families forming the core community
- Seasonal Pattern: Notable split between year-round (1/3) and summer residents (2/3)
- Student Housing: Dedicated segment in Dansmästaren apartments
- Age Distribution: Predominantly 35+ with distinct subgroups:
    - Young families (comprising 20% during summer)
    - Retired residents (significant board participation)
    - Working adults

Commercial/community members:

- Local Businesses: ~5 established enterprises
- Mix of trades: Carpentry, farming, restaurants
- Varying energy consumption patterns
- Community Institutions: Local church participation
- Winter occupancy: 50-70 regular participants
- Special Interest Groups: Car owners (particularly EV owners)

- **Board Composition:**
    - Predominantly retired members (due to time availability)
    - 1-2 energy-focused and engaged in energy related matters
    - Working groups for specific initiatives (e.g., EV charging)
- **Participation Patterns:**
    - 90/10 Engagement Split:
    - Majority (90%): Passive tenants with minimal involvement
    - Active Minority (10%): Board and committee participants
- **Decision Making:**
    - Board-driven initiatives (especially for PV projects)
    - EV initiatives often user-driven based on charging needs

Communication Channels:

- **Digital Communication:**
  - Email newsletter system
  - Frequency evolution: From bi-monthly to thrice monthly
  - App-based solutions for utilities and amenities
- **Engagement Methods:**
  - Technology Integration:
  - Energy usage tracking applications
  - Facility management systems (e.g., laundry booking)
  - Mixed reception to digital tools
- **Payment Systems:**
  - Traditional billing remains primary interface for many
  - Need for better integration of modern payment solutions
  - Challenge of transitioning from passive to active engagement
  - Motivation and Incentive Framework

Hierarchical Priorities:

- **Economic Benefits:**
  - Cost savings as primary driver
  - Return on investment considerations
  - Energy cost stability
- **Infrastructure Resilience:**
  - Energy independence
  - Supply security
  - Grid stability
- **Broader Impact:**
  - Environmental benefits
  - Community development
  - Climate action

Key Discussion Points with Participants

Assessment of Community Readiness:

- Maturity levels across user types (e.g., Consumer, Prosumer).
- Behavioural and situational determinants influencing readiness.

Participant Profiling:

- Demographics: Retired individuals, young families, EV owners.
- Common motivations: Financial savings, environmental impact.

Campaign Effectiveness:

- Strategies used to engage participants.
- Responses and outcomes of past campaigns.

Challenges in Collaboration:

- Bridging gaps between municipalities, private actors, and residents.
- Managing diverse expectations and priorities.

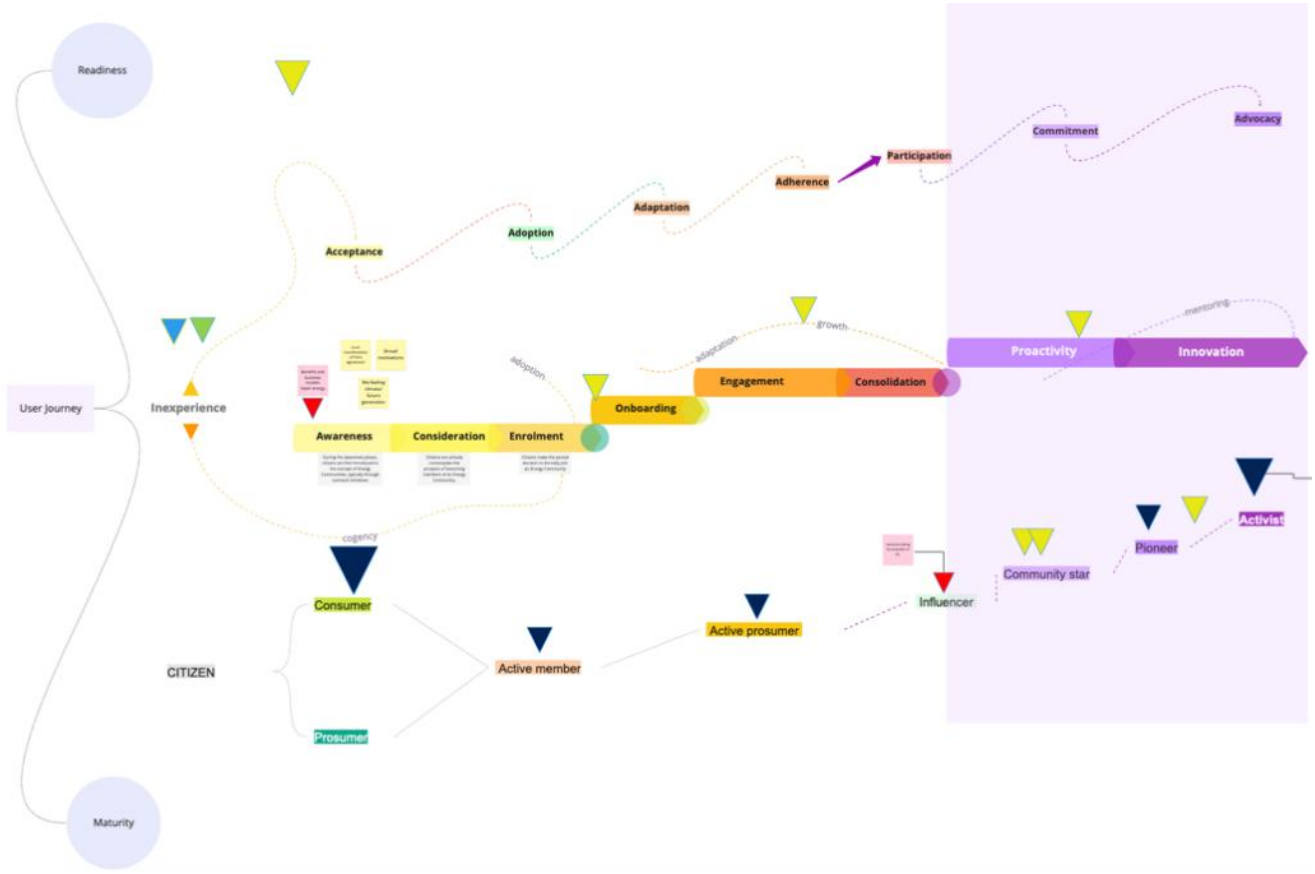

Figure 10: Working on Maturity and Journey - from a Participatory Session with the Swedish Pilot

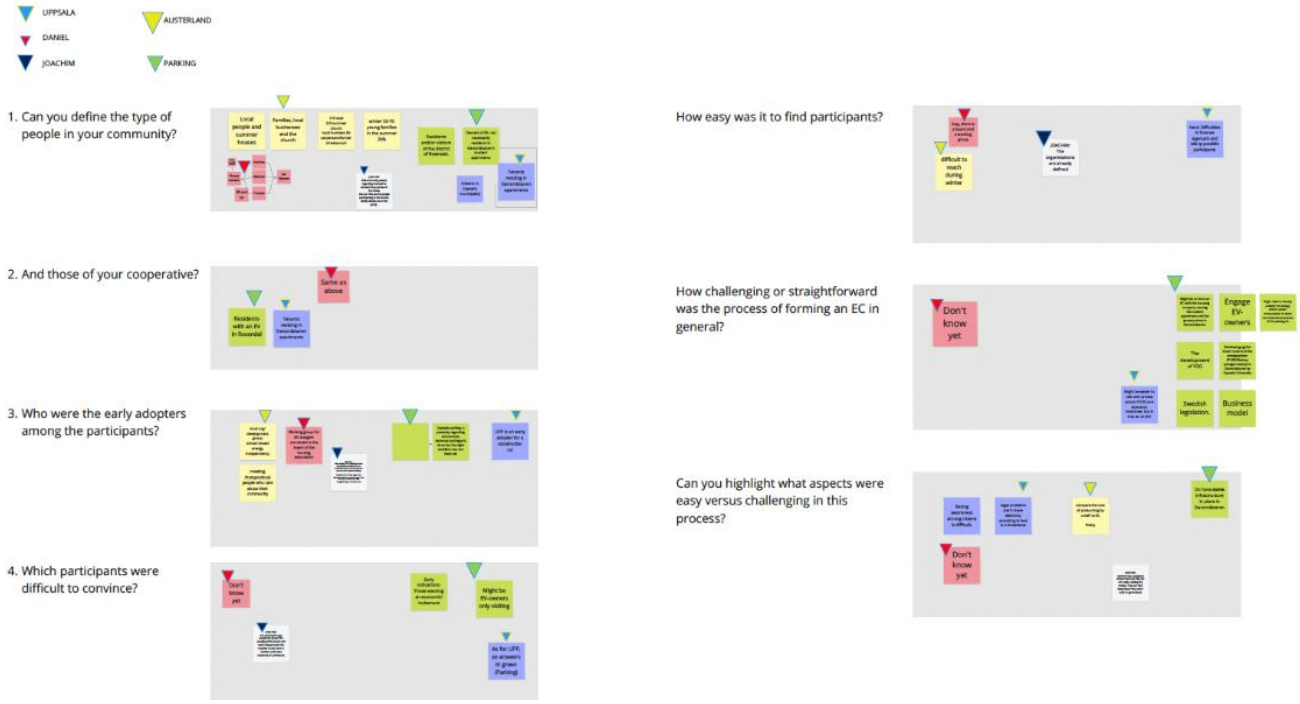

Figure 11: From a Participatory Session with the Swedish Pilot

Challenges Identified:

Formation and Engagement

- Difficulty in reaching and convincing participants. ("Just living here" mentality)
- Limited awareness of EC benefits in Sweden/Uppsala municipality.
- Lack of visible leadership or influencers to mobilize communities.
- Limited advertising and promotion within regions like Uppsala.
- Information overload

Community Readiness:

- Generally promising, but gaps exist in leadership and infrastructure.
- Many members are not familiar with EC goals, requiring educational initiatives.

Adoption Barriers

- Legal issues (e.g., restrictions on energy sharing).
- Technical and financial uncertainties.
- Reluctance to engage deeply beyond initial participation.

Operational Gaps

- Misaligned incentives (e.g., economic vs. societal gains).
- Swedish laws limiting energy sharing between residents.
- Difficulty convincing tenants to engage beyond paying utility bills.
- Inadequate communication strategies.
- Challenges in unifying diverse participant demographics.

Engagement Strategies

Awareness and Education

- Focus on economic incentives and simplified messaging.
- Campaigns showcasing community benefits (e.g., testimonials, success stories).
- Educational workshops targeting various age groups.

Community Building

- Create events to foster dialogue and connection.
- Leverage local influencers and existing boards for leadership.
- Encourage participation through clear economic benefits and shared goals.

Feedback and Improvement

- Utilize surveys to gather insights and improve communication.
- Ensure transparency in processes and decision-making.
- Offer consistent updates via email and apps.

Recommendations

Short-Term Actions

- Develop clear communication materials tailored to different demographics.

- Organize local events and workshops to generate interest.
- Strengthen partnerships with municipalities and housing boards.

Long-Term Goals

- Establish scalable business models for EC growth.
- Build digital tools for energy monitoring and feedback.
- Address legal and infrastructural challenges to enable broader adoption.

Insights

The Swedish Pilot Workshop served as a comprehensive platform for exploring the dynamics of energy communities, focusing on user journeys, engagement strategies, and maturity assessment.

Positive Indicators:

- Many are eager to invest in PVs or EV infrastructure.
- Some show high acceptance of sustainable goals with monetary incentives.

Challenges:

- Elderly members dominate leadership; younger members are less engaged due to societal transitions.
- EV owners primarily focus on individual charging rather than collective energy goals.

5.2 French Pilot: Overview Analysis

Key Discussion Points with Participants

Community Readiness Assessment:

Evaluate maturity levels and readiness indicators among members.

User Profiling:

Identify key demographic groups, motivations, and challenges.

Campaign and Initiative Effectiveness:

Analyse strategies used to attract and retain participants.

Collaboration Challenges:

Address gaps in collaboration between stakeholders.

Participation Metrics:

- Newsletter engagement
- Project value adoption
- Production mode adaptation
- Participation rate: ~10%
- Core commitment level: ~6%

Engagement Activities:

- Graphic tools development
- Educational workshops
- Project development

- Seasonal events (e.g. Christmas market)
- Newsletter distribution

Primary Goals:

- Local energy production
- Energy reappropriation
- Collective action without sector expertise
- Cooperative operational model
- Development of "community spirit"

Development Focus:

- Fixed pricing by government
- Community-based decision making
- Progressive skill development
- Sustainable growth model

Challenges Identified

Formation and Engagement

- Difficulty in recruiting and retaining participants.
- Limited advertising and visibility of energy community initiatives.
- Absence of prominent leaders or influencers.

Recruitment Difficulties

- Initial engagement is hindered by a lack of awareness.
- Economic incentives remain a key motivator.
- Resistance to change from inactive members.

Adoption Barriers

- Legal restrictions (e.g., constraints on energy sharing).
- Financial and technical uncertainties.
- Resistance to deeper engagement beyond initial phases.

Readiness Gaps

- Many communities lack influential leaders.
- Participants' maturity levels vary, ranging from promising to advanced.

Communication Challenges

- Tailoring communication for diverse demographics.
- Striking a balance between economic, social, and environmental motivations.

Operational Gaps

- Misaligned incentives (e.g., economic benefits vs. community goals).
- Insufficient communication strategies.
- Challenges in addressing diverse demographic needs.
- Challenges with legal frameworks (e.g., sharing electricity in cooperatives).
- Difficulties in aligning individual and collective interests.

Engagement Strategies

Awareness and Education

- Leverage economic incentives and simplified messaging.
- Develop campaigns highlighting tangible community benefits.
- Conduct educational sessions tailored to different audience groups.

Community Building

- Organize interactive events fostering connections among members.
- Utilize local influencers to enhance participation.
- Promote shared goals emphasizing collective benefits.

Feedback and Improvement

- Regularly collect feedback through surveys and discussions.
- Enhance transparency in community processes.
- Communicate updates effectively via digital tools.

Insights

Positive Engagement:

- Some participants actively contribute (e.g., attending workshops, joining projects).
- High acceptance among participants who see direct benefits.

Barriers to Participation:

- Older members dominate leadership roles.
- Younger participants show limited engagement due to external priorities.

Early Adopters:

- Individuals with prior exposure to renewable energy systems (e.g., PV owners).

5.3 Turkish Pilot

Community Profile

Demographics:

- Foresters form the majority.
- Participants are low-educated, mid-aged energy users, with most women managing energy-related decisions at home.
- Open to the concept of producing energy but concerned about practical issues like PV panel challenges.

Engagement Levels:

- Limited leadership: Boards typically have only 1–2 active members promoting energy transitions.
- General readiness is low to moderate, with participants requiring substantial motivation and guidance.

Outreach and Participation

Attendance:

Out of 19 invited, 13 attended outreach meetings, and 11 provided feedback.

Insights on Participation:

- Most attendees of outreach meetings were men, but it was noted that women at home play a critical role in energy-related decisions and practices.
- Financial incentives and tribal drivers play a significant role in motivating participation, while social incentives and political influence remain low.

Approaches and Strategies for Engagement

Techniques Used:

- Provided a clear introduction to the Masterpiece project, explaining the goals and potential benefits.
- Offered support materials and education on renewable energy topics.
- Directly invited participants with the question: “Would you like to join?”
- Emphasized practical benefits and incentives tied to local development.

Response:

- Participants were generally happy to join, with added motivation stemming from exchange opportunities (e.g., a member visiting another country pilot).
- There was high interest in learning about EU energy initiatives and incorporating best practices.

Motivational Drivers

Strong Drivers:

- Financial incentives: Savings and cost-cutting appeal heavily to the participants.
- Tribal drivers: Sense of belonging and collective action resonates with the community.
- Interest in Local Development Groups: Localized benefits and development opportunities are appealing.

Weak Drivers:

- Social incentives: Low awareness of the environmental and societal benefits of energy communities.
- Political influence: Minimal impact on engagement decisions.
- Feeling concerned: Low urgency or concern regarding energy or environmental issues.

Challenges

Leadership Gaps:

- A lack of higher-level users capable of driving energy transition efforts.
- Boards have minimal engagement, typically with just 1–2 active members.

Barriers to Engagement:

- PV panel challenges and technical questions dominate discussions.
- Low awareness of broader EC benefits (e.g., societal or environmental impacts).

Recommendations

Short-Term Actions:

- Expand outreach to women, emphasizing their critical role in energy decisions.
- Address PV panel-related concerns through detailed demonstrations and success stories.
- Use financial incentives as the primary hook during recruitment efforts.

Long-Term Strategies:

- Build local leadership by identifying and training active members to act as EC advocates.
- Strengthen collaboration with Local Development Groups to enhance engagement.
- Increase awareness of the tribal and communal benefits of ECs, leveraging their strong sense of belonging.

5.4 A Broad Assessment and Analysis of Energy Community (EC) Based on Pilot's Feedback

We present a comprehensive evaluation of Renewable Energy Communities (RECs) derived from pilot feedback. It highlights member demographics, including residential and commercial participants, and explores organizational structures, leadership dynamics, and engagement strategies. Key insights highlight challenges such as low awareness, limited leadership, and adoption barriers, alongside opportunities like strong financial motivators and tribal drivers. By addressing these factors, the analysis offers actionable recommendations to enhance readiness, streamline communication, and foster greater participation in sustainable energy initiatives.

5.4.1 Core Characteristics and Dynamics

Demographic Composition

Energy communities typically exhibit a multi-layered membership structure with distinct participation patterns:

- A core group of highly engaged members (typically 10% or less)
- A majority of passive participants (around 90%)
- Significant generational divide in engagement levels
- Mixed residential patterns (permanent vs. seasonal residents)
- Diverse stakeholder groups including residential, commercial, and institutional members

Member Types and Demographics:

Residential Members:

- Core participants include homeowners, families, and seasonal residents.
- Predominantly older age groups (35+), with young families and retirees playing significant roles.
- Women make critical energy-related decisions in their households.

Commercial and Institutional Members:

- Participation from local businesses and institutions adds diversity to the energy mix.
- Trades and services (e.g., carpentry, farming) bring varying energy consumption needs and patterns.

Organizational Architecture

The governance structure reveals several consistent patterns:

- Leadership concentrated among retired members with available time
- Board-driven decision-making processes
- Working groups for specific initiatives
- Hybrid communication systems combining traditional and digital methods
- Challenge of balancing diverse stakeholder interests

5.4.2 Drivers and Barriers

Key Success Enablers

Economic Incentives: Financial benefits, such as cost savings and return on investment, are the most compelling drivers**.**

- Cost savings serve as primary motivation
- Return on investment considerations
- Long-term energy cost stability potential

Infrastructure Development: Independence from external grids and energy supply security are growing priorities.

- Focus on energy independence
- Grid stability improvements
- Technical infrastructure modernization

Community and Tribal Drivers: The sense of belonging and collective action resonates strongly in communities with established social bonds.

- Shared environmental goals
- Local development opportunities
- Collective decision-making processes

Other Drivers:

- **Social Incentives:** Many participants lack awareness of the societal benefits of ECs, such as environmental impact.
- **Political Influence:** Minimal political advocacy or influence impacts member engagement.
- **Urgency/Concern:** Low levels of concern for environmental or energy issues reduce engagement urgency.

Significant Barriers

Formation and Engagement:

- Many participants adopt a "just living here" mentality, contributing to passive involvement.
- ECs often struggle to recruit and retain members due to limited awareness and visibility of benefits.
- A lack of visible leaders or influencers hampers momentum

Community Readiness:

- Readiness levels vary significantly, with many communities lacking foundational knowledge or leadership.
- Education gaps persist, particularly regarding technical and infrastructural aspects.

Operational Barriers:

- Legal constraints, such as restrictions on energy sharing, hinder progress.
- Mismatched incentives between economic, social, and environmental goals create friction.
- Participants often prioritize individual benefits (e.g., personal EV charging) over collective goals.

Communication and Awareness:

- Tailoring messages for diverse demographics remains a challenge.
- Digital tools (e.g., apps for energy usage) see mixed adoption, with many relying on traditional billing systems.

Engagement Challenges

- Limited awareness of EC benefits
- Passive participation mindset
- Information overload
- Difficulty in sustained engagement

Structural Impediments

- Legal restrictions on energy sharing
- Technical uncertainties
- Financial barriers

- Leadership gaps

Demographic Constraints

- Aging leadership
- Limited youth engagement
- Varying levels of technical literacy

6 RECOMME IMPLEMENTATION IN PILOTS: USE CASES AND KPI ANALYSIS

6.1 Introduction to Recomme and Pilot Implementation

RECOMME serves as a central tool across all pilots, adapting to diverse use cases while maintaining consistent profiling and assessment capabilities. The implementation varies by pilot location, addressing specific local needs while contributing to overarching goals of community engagement, governance, and energy awareness. The tool's flexibility allows it to qualitative assessments, making it valuable for various aspects of energy community development and management.

RECOMME is designed to assess user profiles across multiple dimensions, including knowledge levels, values, resource capacity, and energy consumption patterns. By analysing these profiles, RECOMME has been conceived to provide personalised recommendations and to evaluate key metrics such as environmental commitment, financial interest, community engagement, and readiness to participate in Renewable Energy Communities (RECs).

The tool will be deployed across several pilot sites to address specific use cases and measure progress through designated Key Performance Indicators (KPIs). These use cases and KPIs are positioned along the Renewable Energy Community Journey maturity scale, which consists of five primary stages: Awareness, Consideration, Enrolment, Engagement, and Adaptation. Each stage consists of phases tailored to the specific needs of the use cases and KPIs, allowing for a gradual and effective progression of user readiness and involvement.

The RECOMME tool is instrumental in addressing specific objectives across diverse pilot sites, enabling:

- User profiling and readiness assessment to identify engagement potential.
- Target-driven implementation through quantitative KPIs (e.g., number of informed citizens) and qualitative feedback.
- Inclusive governance and participation to ensure fair representation in energy communities.

By aligning RECOMME with the unique goals of each pilot, the tool effectively supports the development of sustainable, engaged, and collaborative energy communities.

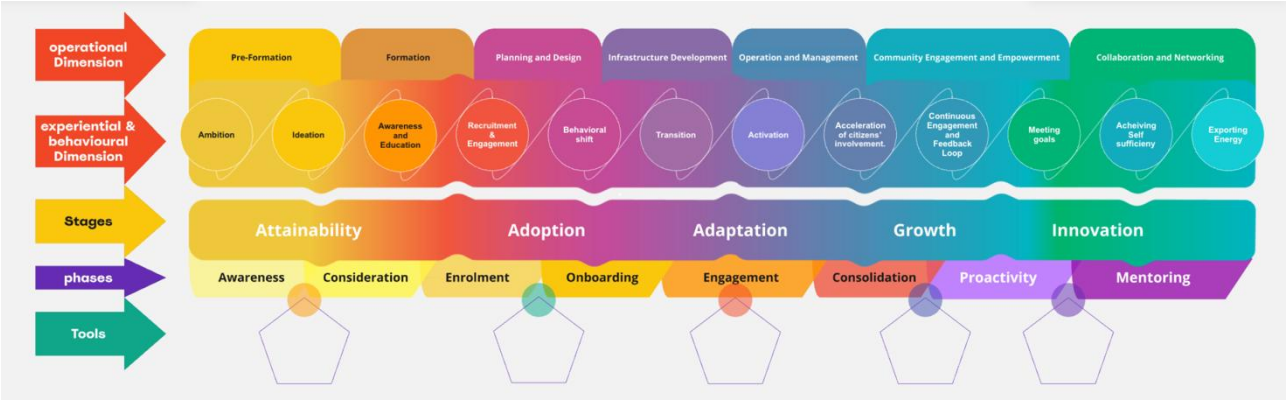

Figure 12: The REC Journey Framework

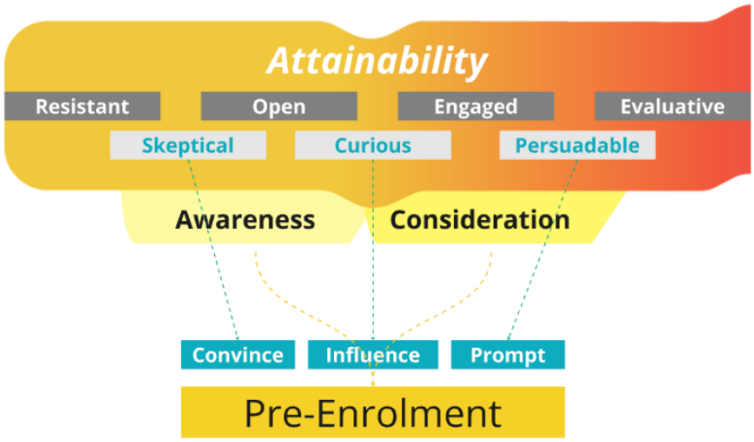

Figure 13: Assigning EC phases with strategic actions related to KPIs

6.2 Energy Community Journey Phases

Awareness Phase:

This phase targets sceptical or uninformed citizens, aiming to familiarise them with the concept of energy communities.

KPIs in this phase measure initial exposure, understanding, and basic engagement (e.g., number of interactions or citizens informed).

Use Cases: Informational sessions, workshops, or tools like RECOMME introduce the EC concept to potential participants.

Consideration Phase:

Citizens become curious and open to exploring the benefits and feasibility of joining an energy community.

KPIs measure engagement depth, interest levels, and readiness to proceed (e.g., profiling individuals' willingness or tracking their understanding).

Use Cases: Interactive tools like RECOMME provide personalised recommendations and detailed insights tailored to individual needs.

Enrolment Phase:

Focuses on onboarding participants who are persuadable and ready to engage actively.

KPIs track enrolment rates, qualitative feedback, and successful participant onboarding.

Use Cases: Tools facilitate participant profiling, group alignment, and integration into the EC framework.

Engagement Phase:

Participants are actively involved in community activities and decision-making processes.

KPIs measure sustained participation, governance balance, and energy usage shifts (e.g., solar consumption alignment).

Use Cases: Tools like RECOMME enable active participation by providing real-time data and governance feedback.

Adaptation Phase:

The community begins to consolidate and adapt to optimised energy usage, governance, and collaboration.

KPIs focus on behavioural changes, energy consumption patterns, and collective decision-making outcomes.

Use Cases: Participants engage in advanced activities, such as shifting energy consumption based on solar generation periods.

Each stage of the journey contains phases that align with the user's evolving readiness. For example:

- Awareness is initiated with sceptical individuals and progresses to those who are curious, ensuring they are provided with foundational knowledge.
- Consideration influences participants who are open and persuadable, offering tailored information to advance them to enrolment.
- Enrolment targets participants who have been convinced and guided towards active participation.
- Engagement and Adaptation are supported by continuous involvement through governance feedback, behaviour shifts, and alignment with sustainable practices.

RECOMME tool adapts to the specific phases within each stage, aligning with KPIs and use case objectives to maximise community development outcomes.

6.1 - Pilot Implementation: Mapping The EC journey with UCs and KPIs

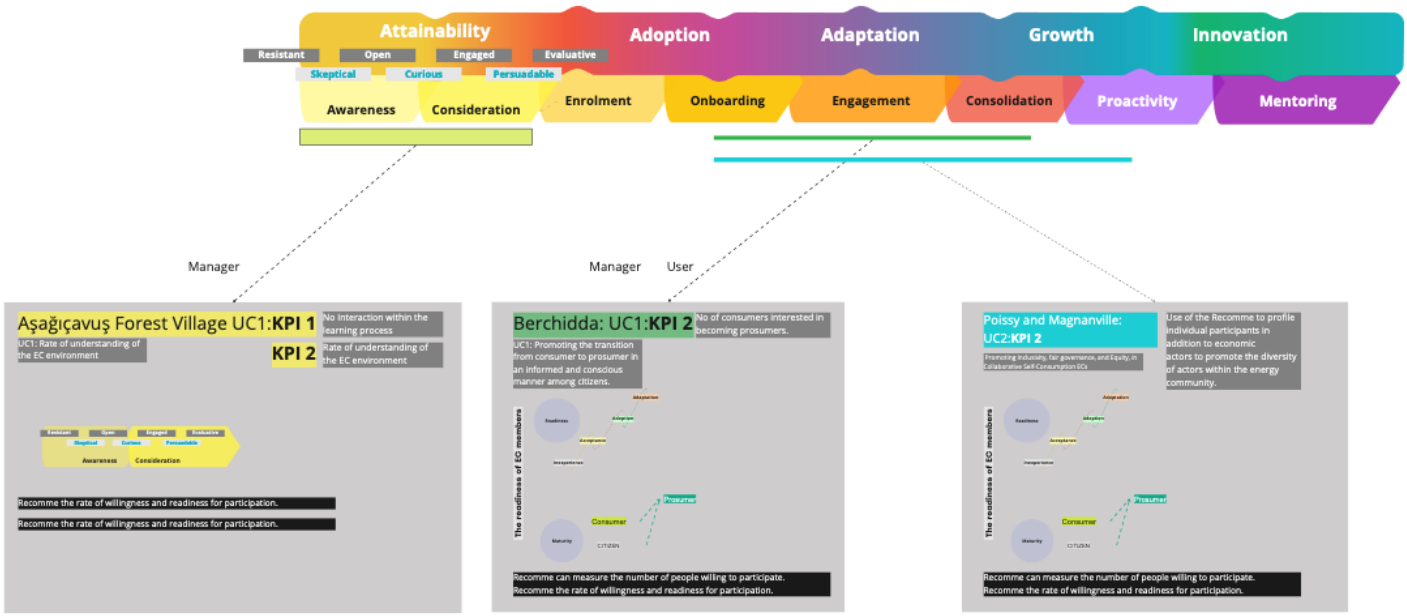

Figure 14: Mapping EC Journey with relevant UCs and KPIs of each pilot

6.1.1 Turkey - UEDAS (Aşağıçavuş Forest Village)

Use Case 1: Understanding ECs and Engagement of Citizens

KPI 1: Number of interactions within the learning process

Position on the Maturity Scale: Awareness and Consideration

Description: Citizens are encouraged to familiarise themselves with the concept of ECs using tools, guided by the EC Manager.

Implementation:

- The EC Manager uses RECOMME to profile individuals and support engagement.
- Data is collected through workshops, meetings, and phone calls.
- Feedback on the tool's usability, interface, and availability is also gathered.
- Implementation Strategy: EC Manager serves as intermediary between citizens and tools
- Data Collection: Combination of physical workshops and tool-based feedback
- Target Metric: Minimum 10 complete data entries

Use Case 2: Achieving Active Participation and Sensibilisation in Sustainable Energy Usage

KPI 1: Energy shifted to solar generation periods (kWh) – Community Perspective

Position on the Maturity Scale: Adaptation

Description: Users receive recommendations to align energy consumption with community solar production.

Implementation:

RECOMME provides behavioural recommendations for adjusting energy consumption during solar production periods

6.1.2 France - SEIN (Poissy and Magnanville)

Use Case 2: Promoting Inclusivity, Fair Governance, and Equity in Collaborative Self-Consumption ECs

KPI 1: Actor Profile Representation

Position on the Maturity Scale: Enrolment and Engagement

Description: Promote representativeness by engaging public/private economic actors, academic actors, and households.

- Target: Minimum 3 distinct actor profiles
- Scope: Public actors, private economic actors, academic actors, households
- Implementation: RECOMME tool used for behavioural profile identification
- Purpose: Ensure diverse stakeholder representation

Implementation: Stakeholder profiles are identified and assessed using RECOMME.

KPI 2: Balanced governance

Position on the Maturity Scale: Engagement and Adaptation

Description: Facilitate fair governance and collective decision-making.

Position on the Maturity Scale: Engagement and Adaptation

- Target: Minimum 3 votes per stakeholder category
- Implementation: Utilizes profile data from RECOMME
- Focus: Promoting long-term engagement and fair decision-making
- Measurement: Vote tracking by stakeholder category

Implementation: Data on stakeholder profiles (from KPI 1) is used to monitor votes by category.

6.1.3 France - ALEC: Solévent

Use Case 2: Enrolment and Onboarding in the EC

Position on the Maturity Scale: Enrolment and Onboarding

KPI 2: Qualitative feedback on RECOMME (online questionnaire)

Description: Collect qualitative insights on the tool's effectiveness from EC Managers and selected users.

- Scope: EC manager feedback on tool usage
- Measurement: Rating scale integrated within RECOMME
- Purpose: Tool effectiveness evaluation

Implementation: RECOMME's built-in rating scale gathers feedback on usability and user experience.

6.1.4 Sweden - UPP: Dansmästaren

Use Case 1: Understanding ECs and Engagement of Citizens

Position on the Maturity Scale: Awareness and Consideration

KPI 1: Citizen Information Reach

Description: Inform residents about energy communities and assess their interest in forming one.

Implementation:

- Target: Minimum 10 citizens informed about EC participation
- Implementation: Combined use of RECOMME and MEET APP
- Measurement: User registration tracking and engagement assessment

6.1.5 Sweden - NGENIC: BRF Väppeby Backe & BRF Venus

Use Case 1: Strengthening Social Bonds and Energy Literacy

Position on the Maturity Scale: Awareness and Consideration

KPI 1: Resident Information Reach

- NGENIC conducts interviews and manages tool usage.

Description: Promote energy literacy and awareness of energy community opportunities.

Implementation:

- Target: Minimum 5 residents informed about REC participation
- Implementation: Integrated approach using RECOMME
- Focus: Education and community development
- RECOMME will be used to profile and inform residents.

The RECOMME tool is instrumental in addressing specific objectives across diverse pilot sites, enabling:

- User profiling and readiness assessment to identify engagement potential.
- Target-driven implementation through quantitative KPIs (e.g., number of informed citizens) and qualitative feedback.
- Alignment with the Renewable Energy Community Journey maturity scale, ensuring activities such as Awareness, Consideration, Enrolment, Engagement, and Adaptation are systematically addressed through structured phases.
- Inclusive governance and participation to ensure fair representation in energy communities.
- By aligning RECOMME with the unique goals of each pilot and the maturity scale, the tool effectively supports the development of sustainable, engaged, and collaborative energy communities.

7 RENEWABLE ENERGY COMMUNITY ARCHETYPES ANALYSIS

As part of the assessment of Renewable Energy Communities (RECs), we conducted a study to identify key archetypes that represent the profiles of existing members and potential participants. These archetypes serve as a foundation for understanding the diverse motivations, knowledge levels, and available resources of individuals engaged in ECs. By leveraging these archetypes, we aim to provide personalized recommendations tailored to the unique needs and characteristics of participants at various maturity stages of the EC journey. This approach ensures targeted support, facilitating the growth, engagement, and long-term sustainability of energy communities.

7.1 Dimensions and Aspects Overview

This analysis examines the framework used to categorize Energy Community archetypes across three primary dimensions: Values, Knowledge/Experience, and Resources. The framework provides a comprehensive understanding of different stakeholder profiles within energy communities, helping to identify and address their specific needs, motivations, and capabilities.

The categorization system is built on three foundational dimensions, each containing multiple aspects that shape participant behaviour and engagement within energy communities:

7.1.1 Values Dimension

Values are categorized into four key aspects that drive participant motivation and commitment:

Environmental Values

- Climate change mitigation through emission reduction
- Environmental preservation and pollution reduction

Financial Values

- Entrepreneurial drive for business development and control
- Cost reduction and savings optimization

Socio-political Values

- Collaborative change through cooperation
- Future-oriented vision
- Individual responsibility awareness

Personal Values

- Community belonging and group identity
- Environmental risk awareness
- Financial risk awareness
- Socio-political risk awareness
- Achievement recognition and reputational benefits

7.1.2 Knowledge/Experience Dimension

This dimension encompasses the skills and understanding required for effective participation:

Environmental Knowledge

- Understanding of sustainable behaviours
- Comprehension of energy systems
- Awareness of environmental stakeholders

Financial Knowledge

- Energy business operations understanding
- Incentive program familiarity
- Resource conservation practices

Socio-political Knowledge

- Renewable Energy Community operational understanding
- Association and volunteering expertise

Personal Knowledge

- Digital competency
- Interpersonal communication
- Leadership capabilities

7.1.3 RESOURCES DIMENSION

This dimension covers the tangible and intangible assets available to participants:

Environmental Resources

- Solar infrastructure
- Grid connectivity
- IoT technology access

Financial Resources

- Available capital

Socio-political Resources

- EC accessibility
- Social influence
- Decision-making authority

7.2 Archetype Formation Analysis

The intersection of these dimensions creates distinct archetypal profiles within energy communities:

7.2.1 Value-Based Differentiation

- Environmental priorities shape conservation-focused archetypes
- Financial motivations create entrepreneurial archetypes
- Socio-political values form community-oriented archetypes
- Personal values influence individual engagement patterns

7.2.2 Knowledge Impact

- Technical expertise levels determine operational involvement
- Financial literacy affects investment and participation decisions
- Social awareness influences community engagement roles
- Personal skills shape leadership positions

7.2.3 Resource Influence

- Asset availability defines participation capacity
- Social capital affects community influence
- Authority levels determine decision-making roles

The archetypes were developed by combining primary and secondary aspects across the three dimensions, providing profiles of EC members and participants. These archetypes allow for better profiling and targeted recommendations.

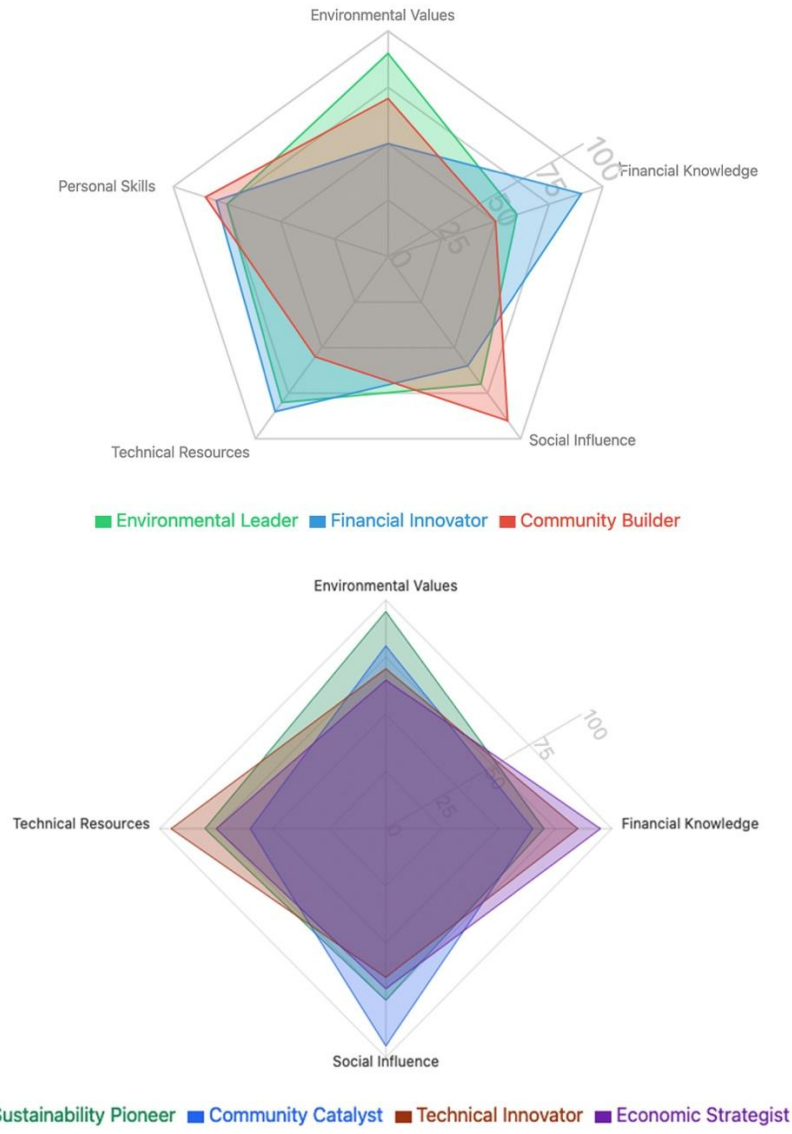

Figure 15: A Set of Radar Chart Comparing Example of archetypes across key dimensions

Table 1: Archetypes Aspects and Description

Archetype	Primary Aspect	Secondary Aspect	Description
The Innovator	Environmental	Financial	Early adopters of new technologies and solutions
The Environmental Advocate	Environmental	Social	Strong commitment to environmental causes through cooperation
The Visionary	Environmental	Personal	Driven by a clear vision with strong personal pride
The Investor	Financial	Environmental	Focuses on financial returns with environmental awareness
The Supporter	Social	Financial	Contributes to ECs through active participation
The Educator	Social	Personal	Raises awareness and educates within the community
The Tech Enthusiast	Personal	Environmental	Personally motivated by technology and innovation
The Community Leader	Personal	Social	Takes on leadership roles to build and support ECs
The Skeptic	Personal	Financial	Requires convincing; cautious with strong personal concerns

7.3 Implications and Applications

7.3.1 Next Analysis Steps for Energy Community Archetypes

To build on the current findings and further enhance the understanding of Renewable Energy Community (REC) participants, the following will be implemented:

7.3.1.1 Refinement of Archetypes

- **Validate Existing Archetypes:** Conduct surveys, interviews, or contextual enquires to ensure that the identified archetypes reflect real-life EC participants and their motivations, knowledge, and resources.
- **Quantitative Analysis:** Use data collected from EC members to analyse the distribution of archetypes across different communities.
- **Refine Profiles:** Identify overlaps, nuances, or missing archetypes and adjust definitions as needed.

7.3.1.2 Maturity Stage Mapping

- **Define REC Maturity Stages:** Categorize RECs into stages (e.g., Emerging, Developing, Mature) based on their organizational structure, membership, resources, and activities.
- **Align Archetypes to Maturity Stages:** Map each archetype to specific maturity stages, identifying which profiles are most active or influential at each phase.
- **Identify Gaps:** Analyse which archetypes are underrepresented at each stage and why, to highlight areas for intervention.

7.3.1.3 Personalized Recommendation Development

- **Needs Assessment:** Evaluate the needs and barriers of each archetype, such as lack of knowledge, financial constraints, or resource limitations.
- **Tailored Recommendations:** Develop specific actions or incentives for each archetype based on their values, knowledge, and resources. Examples include:
    - **Innovators:** Provide access to emerging technologies or pilot programs.
    - **Supporters:** Offer community-building activities or volunteering opportunities.
    - **Sceptics:** Share educational resources and success stories to build trust.
    - **Dynamic Strategies:** Adapt recommendations to different maturity stages of the EC journey.

7.3.1.4 Comparative Analysis

- **Cross-Community Analysis:** Compare archetype distribution and engagement strategies across different pilot regions, energy types, or community sizes.
- **Best Practices Identification:** Identify successful strategies implemented by mature ECs and document best practices for other communities.

7.3.1.5 Integration into WP3 Deliverables

- **Profiling Tools:** Feed Recomme for EC managers to assess archetypes within their communities.

- **Strategic Recommendations:** Integrate findings into WP3 deliverables, providing clear, actionable strategies tailored to archetypes and EC maturity stages.
- **Policy and Stakeholder Support:** Use insights to inform policymakers, stakeholders, and facilitators on how to support ECs effectively.

8 Evolutionary Stages of Renewable Energy Communities for the Experimental Plan

8.1 Macro-Parameters and determinants

The following parameters provide a state-of-the-art and concrete, although simplified, way to assess where a particular renewable energy community might be in its evolutionary journey. The parameters reflect the current state of knowledge in the scientific literature. They also highlight the interconnected nature of these determinants - for example, how technological advancements enable larger community sizes and greater self-sufficiency.

1. Technological Readiness: We've included metrics like solar PV efficiency, and energy storage capacity. These improve as we move through the stages, reflecting technological advancements including the digitalization maturity levels.

2. Policymaking: This is quantified by the types of policies in place. We see a progression from basic incentives to comprehensive frameworks and integration into broader energy strategies.

3. Sustainability Readiness: This is measured by public awareness and engagement, as well as CO2 reduction goals. Both increase significantly as communities mature

4. Growth capability: This is represented by community size and energy self-sufficiency. We see a dramatic increase in both as we progress through the stages.

5. The socio-behavioural readiness can be used to measure the success of energy communities by evaluating the progression and outcomes at each stage of the journey. This approach allows for a comprehensive assessment of both the tangible and intangible aspects of community energy initiatives.

6. Governance sophistication framework: This is considered across the evolutionary stages, incorporating energy democracy and participatory governance models

These parameters provide a concrete way to assess where a particular renewable energy community might be in its evolutionary journey. They also highlight the interconnected nature of these determinants - for example, how technological advancements enable larger community sizes and greater self-sufficiency.

See in the following a comprehensive framework that integrates all five dimensions: Technological Readiness, Policymaking, Sustainability Readiness, Growth Capability, and Socio-Behavioural Journey.

Table 2: STAGES OF RENEWABLE ENERGY COMMUNITIES

Dimension	Stage 1 : Inception and Awarness	Stage 2: Early Adoption and Experimentation	Stage 3: Growth and Recognition	Stage 4: Scaling and Integration	Stage 5: Maturity and Transformation
Technological Readiness	- Basic solar PV efficiency: 15-18% - No dedicated energy storage - Manual data collection and basic monitoring - Simple billing systems - Basic website/communication platforms - Minimal automation: <10% of processes	- Solar PV efficiency: 18-20% - Basic energy storage: 1-5 kWh per household - Semi-automated data collection - Basic energy management software - Digital payment systems - Basic forecasting capabilities - Process automation: 10-30%	- Solar PV efficiency: 20-23% - Energy storage: 5-10 kWh per household - Basic energy management systems implemented - IoT sensors deployment (30-50% coverage) - Cloud-based management platforms - Mobile apps for community engagement - Basic predictive analytics and community profiling - Process automation: 30-60% - Cybersecurity frameworks implemented	- Solar PV efficiency: 23-25% - Energy storage: 10-20 kWh per household - Smart grid technologies with 70-80% penetration - Grid flexibility metrics (e.g., demand response capability partially automated i.e up to 60% e.g. Loss of Load Expectation (LOLE): Indicates the expected number of hours per year when the grid might not meet the load demand. Energy Payback: Assesses the energy required to return to normal operation after a demand response event - Multiple technology integration index (solar + wind + biomass) - Digital twin adoption rates (tbd) for predictive maintenance - Full IoT integration (>70% coverage) - AI/ML for community engagement and for demand prediction - Digital twins for asset management - Blockchain for energy trading - Process automation: 60-80% - Advanced cybersecurity with real-time monitoring	- Solar PV efficiency: > 25% - Energy storage: > 20 kWh per household - AI-driven energy management (includes Recommender systems) with >50%+ penetration - Vehicle-to-grid integration: >30%+ of EVs - Grid flexibility metrics (e.g., demand response capability fully automated i.e. close to 100%) - Energy Management System sophistication levels - Multiple technology integration index (solar + wind + biomass) - Digital twin adoption (tbd) rates for predictive maintenance - Full IoT ecosystem (>90% coverage) - Advanced AI for system optimization - Predictive maintenance - Automated trading algorithms - Process automation: >80% - Edge computing implementation
Policymaking	- Limited financial incentives (e.g., feed-in tariffs) - Mention of regulatory sandboxes for experimentation	- Introduction of tax incentives and grants - Local government participation	- Standardized grid integration policies - Peer-to-peer trading frameworks	- EU-wide frameworks for cross-border energy community cooperation - Community benefit sharing mechanisms	- Energy communities integrated into national and EU energy strategies - Grid service compensation structures
Sustainability Readiness:	- < 10% of local population aware of energy communities - CO2 reduction goals: 0-5% compared to traditional energy use	- 10-30% of local population aware of energy communities	- >30% of local population aware and supportive - CO2 reduction goals: 15-30% - Circular economy indicators implemented	- EU-wide frameworks for cross-border energy community cooperation - Community benefit sharing mechanisms	- > 80% of local population actively engaged - CO2 reduction goals: > 50% compared to traditional energy use - Local job creation metrics available - Circular economy indicators monitored and fully adopted to be part of the strategy - Environmental impact beyond CO2 (e.g., lifecycle assessment implemented as practice)
Growth capability:	- Community size: 5-20 households - Energy self-sufficiency: < 10% - Investment capacity limited to few acquaintances - Simple feed-in tariff arrangements - Fixed price contracts only - No demand response capability	- Community size: 20-100 households - Energy self-sufficiency: 10-25% - Investment capacity limited to proximal contacts - Time-of-use pricing adoption - Basic demand response programs - Multiple supplier relationships - Simple energy trading within community	- Community size: 100-500 households - Energy self-sufficiency: 25-50% - Investment capacity goes beyond proximal contacts - Dynamic pricing adoption - Demand response aggregation - Participation in local flexibility markets - Basic ancillary services provision (e.g. one-stop shop for services) - P2P energy trading within community	- > 60% of proximal population actively engaged - CO2 reduction goals: 30-50% - Social justice and energy poverty metrics available - Circular economy indicators implemented and monitored	- Community size: > 2000 households or equivalent, including industrial participants - Energy self-sufficiency: > 80%, with regular surplus generation - Investment capacity fully integrated in the market - High resilience indicated by the ability to operate independently - Capability to negotiate market price at regional level - Multi-market participation - Advanced trading algorithms - Full flexibility service provision - Cross-sector integration (e.g., heating, transport) - Market maker capability - Innovation in new energy services
Socio-Behavioural Journey:	- Ambition and Ideation stage - Initial awareness and education efforts - Preliminary community goal setting - Emerging understanding of collective energy concepts - Early-stage recruitment and engagement - Limited community energy literacy	- CO2 reduction goals: 5-15% - Active recruitment and engagement - Initial behavioural shift attempts - Developing planning and design capabilities - Growing understanding of renewable energy potential - First collective decision-making experiences - Increasing community interest to building on behavioural & experiential drivers	- Significant behavioural shifts in energy consumption (i.e. saving capabilities increase) - Structured infrastructure development - Active citizen involvement acceleration - Establishing robust engagement mechanisms - Developing continuous feedback loops - Increasing community empowerment	- Community size: >500 <2000 households or equivalent - Energy self-sufficiency: 50-80% - Investment capacity open to market - Initial capability to negotiate and influence market price - Real-time pricing integration - Virtual power plant functionality - Multiple revenue streams - Cross-regional trading capability - Advanced ancillary services provision	- Achieved substantial self-sufficiency - Advanced goal achievement across environmental, economic, social dimensions - Capability to export energy - Transformative community empowerment - Adaptive and resilient community governance - Systemic social innovation
Governance sophistication	Organizational Form: - Simple volunteer-based structure - Informal leadership - Basic decision-making processes Participation Mechanisms: - Ad-hoc meetings - Basic information sharing - Limited stakeholder engagement Rules & Procedures: - Minimal formal documentation - Basic membership criteria - Simple conflict resolution process	Organizational Form: - Legal entity established - Defined roles and responsibilities Participation Mechanisms: - Regular general meetings - Basic consultation processes - Digital communication platforms Rules & Procedures: - Written bylaws - Membership agreements - Basic financial governance Decision-Making: - Majority voting system - Basic transparency measures	Organizational Form: - Professional management team - Working groups/committees - Clear accountability structures Participation Mechanisms: - Regular stakeholder forums - Online voting systems - Diverse engagement channels Rules & Procedures: - Comprehensive governance documents - Risk management framework - Performance monitoring systems Decision-Making: - Participatory decision-making models - Structured consultation processes - Transparency reporting	Organizational Form: - Multi-stakeholder governance model - Expert advisory boards - Professional secretariat Participation Mechanisms: - Digital democracy tools - Continuous engagement platforms - Co-creation frameworks Rules & Procedures: - Advanced risk management - Impact assessment frameworks - External audit processes Decision-Making: - Consensus-building mechanisms - Evidence-based decision frameworks - Stakeholder weighted voting rights	- Organizational Form: - Dynamic governance structures - Innovation hubs - Knowledge transfer systems - Participation Mechanisms: - AI-supported engagement tools - Real-time feedback systems - Multi-level participation frameworks - Rules & Procedures: - Adaptive governance frameworks - Automated compliance systems - Advanced impact measurement - Decision-Making: - Distributed decision-making - Predictive governance models - Cross-community collaboration

Key Integration Insights:

1. Each dimension evolves synergistically
2. Technological advancement can be used to enable social transformation and behavioural changes
3. Policy support could accelerate community development (e.g., through incentives mechanisms)
4. Social engagement drives sustainable growth
5. Success measured by holistic, multi-dimensional progress

8.1.1 Interactions and co-evolution of the dimensions across the five stages:

Interdimensional Interactions in REC Progression

Technological Readiness and Policy Dynamics:

- Early Stages (1-2): Policies primarily create incentives for basic technological adoption
- Mid Stages (3-4): Policies become more sophisticated, actively supporting technological innovation
- Mature Stage (5): Policies fully integrate advanced technologies into broader energy strategies
- Key Observation: Technological capabilities drive policy evolution, while supportive policies accelerate technological development

Socio-Behavioural Journey and Sustainability Readiness:

- Stage 1: Minimal awareness, low engagement
- Stage 2: Initial behavioural shifts, growing environmental consciousness
- Stage 3: Active community involvement, significant sustainability understanding
- Stage 4: Comprehensive engagement, systematic sustainability approaches
- Stage 5: Transformative social innovation, deeply embedded sustainability culture

Growth Capability and Technological Readiness:

- Technological advancements are used to enable community growth
- Energy storage improvements correlate with increased self-sufficiency
- Smart grid technologies expand community scaling potential
- Progression shows exponential growth potential as technological capabilities improve

Policy and Socio-Behavioural Co-Evolution:

- Initial stages: Top-down policy approaches
- Mid stages: Increasing citizen participation in policy formation
- Mature stage: Co-created, adaptive policy frameworks
- Community becomes increasingly active in shaping policy landscape

Sustainability Readiness and Growth Dynamics:

- Early stages: Limited CO2 reduction, small community size
- Progressive stages: Increasing correlation between community size and sustainability impact
- Mature stage: Significant CO2 reduction, large-scale community involvement
- Sustainability becomes a key driver of community growth and attraction

Insights related to Crosscutting Interactions:

1. Technological improvements unlock policy opportunities
2. Engaged communities drive policy innovation
3. Policy support accelerates technological adoption
4. Increased sustainability awareness expands community growth
5. Technological capabilities enable deeper social engagement

Key Evolutionary Principles:

- Mutual Reinforcement: Dimensions continuously enhance each other
- Non-Linear Progress: Development is not uniform across dimensions
- Adaptive Complexity: Increasing interconnectedness and sophistication
- Emergent Capabilities: New possibilities emerge from dimensional interactions

Challenges and Opportunities:

- Managing technological complexity
- Maintaining social cohesion during rapid changes
- Aligning policy frameworks with community needs
- Balancing technological innovation with human-centric approaches

9 SUMMARY OF FINDINGS

D2.6 report provides a comprehensive assessment of Renewable Energy Communities (RECs) within the Masterpiece project, integrating insights from pilot site visits, workshops, and stakeholder engagement. Key findings include:

Renewable **Energy Community Maturity and Readiness:**

- RECs are assessed across various maturity stages: pre-formation, planning, operation, and growth.
- Readiness levels vary widely, with many communities still in early phases, requiring education, incentives, and leadership development.

Key Drivers and Barriers:

- Drivers: Financial incentives, energy independence, and collective action are primary motivators.
- Barriers: Limited leadership, legal constraints, technical challenges, and passive community engagement hinder growth.

User Profiling and Behavioural Insights:

- EC members exhibit diverse archetypes, including Innovators, Financial Investors, and Environmental Advocates.
- Profiles reflect varying values, resource availability, and readiness, influencing engagement strategies.

Workshop Outcomes:

- Workshops highlighted the importance of tailored communication, stakeholder inclusivity, and strategies for onboarding new members.
- Practical challenges such as energy literacy gaps, PV technical issues, and governance inefficiencies were identified.

Pilot Site Insights:

Swedish, French, Italian and Turkish pilots revealed localized dynamics. Financial incentives and tribal drivers emerged as strong motivators, while regulatory challenges and information overload persisted as key barriers.

RECOMME Tool Implementation:

- The tool enables user profiling, maturity assessment, and tailored recommendations to support EC development at each stage of their journey.

10 CONCLUSION

The comprehensive analysis of renewable energy communities reveals their significant potential in advancing sustainable energy transitions while highlighting the complex interplay between technical, social, and organizational factors. The findings demonstrate that successful RECs require a balanced approach that addresses both infrastructure development and social cohesion, supported by clear governance structures and engagement strategies.

The report also highlights the complex yet promising landscape of Renewable Energy Communities based on the findings from Masterpiece project. These findings suggest that while economic incentives remain crucial, long-term sustainability depends equally on building strong community connections, developing inclusive governance models, and creating clear pathways for leadership succession. This understanding will be instrumental in shaping future EC development strategies and policy frameworks to support their growth and effectiveness in contributing to broader energy transition goals. While significant barriers such as regulatory constraints and passive participation remain, the RECOMME tool will offer in WP3 actionable pathways to address these challenges. By fostering inclusivity, enhancing energy literacy, and promoting localized solutions, ECs are well-positioned to accelerate their journey towards self-sufficiency and broader societal impact, contributing meaningfully to the energy transition.

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