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Developing a tool to assess the maturity and growth of energy communities

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I INTRODUCTION

Currently there is a need of leaders and representatives of local energy communities for tools supporting the understanding of the development, strength and shortcomings of (their) local communities. The COMPILE project contributes to this need by developing such a tool called the “maturity framework”. The tool comprises an indicator set that helps to assess the current maturity of an initiative, thereby providing insights and deeper understanding of the level of development, the core strengths and key weaknesses of a certain community group dealing with energy related issues. The tool remains to be validated and refined in close interaction with the COMPILE pilot sites and the broader research and practice community in Europe.

The maturity framework consists of a set of stable key performance indicators (KPI) that will provide insights in the level of readiness, the stability and the socio-economic environment of an energy community, indicating its perspectives for growth and development. It mainly focuses on local energy communities – those are communities embedded in an existing local network - although it can easily be transferred to any other energy community. The set of tools and techniques of the maturity framework can be tailored to the local needs and deployed by groups to identify starting points for organizational development.

2 METHOD AND PROCESS

The maturity framework was developed under COMPILE Task 4.2 led by REScoop.eu, who provided the rationale and concept of the tool, based on the work performed through the INTERREG ECCO project. Specification of the structure and design of indicators was made by Joanneum Research based on a literature review with the support of REScoop.eu, and expert knowledge stemming from community creation projects realised by both partners. The maturity framework was validated with COMPILE project partners and pilots, as well as community leaders from across Europe through qualitative workshops. Furthermore, the framework was basis for discussion within the BRIDGE working group Consumer and Citizen Engagement Working Group, subgroup “Assessment of engagement” that was led by JR (D’Herbemont et al., 2020). The tool will be further tested and consolidated in a series of workshops to be organized within COMPILE project during the year 2022.

3 LITERATURE REVIEW

There is a range of literature addressing elements of energy community establishment, operation and growth. There is a range of literature that aims to

- Understand the multitude of factors impacting energy communities developments
- Assess the role of niche management and social and external networks
- Investigate the role of governance structures

3.1 ASSESSING THE MULTITUDE OF FACTORS IMPACTING ENERGY COMMUNITIES DEVELOPMENTS

Blumer et al. (2013) assess non-technical factors that play a decisive role in the successful implementation of bioenergy projects including project characteristics, policy frameworks, regional integration, public perception and stakeholder engagement. Seyfang et al. (2013) focus on the community formation process, distinguishing between 1) group factors such as commitment of key

individuals, skills among groups and shared group vision; 2) project factors including competent project management, specific/technical aspects, community engagement, sufficient (and long-lasting) funding; 3) community factors such as engagement with and support by local community; 4) networking and partnership factors such as links with external organisations and other energy communities; 5) policy factors such as grant funding structure. Horstink et al. (2020) take a broad stock-taking approach by assessing the demographic, technological, organizational, financial, motivational factors and their hindering or facilitating effects that characterize energy initiatives. They conclude that consistent across countries as well as legal forms (with the exception of France and recent prosumer countries such as Portugal and Spain, which were more concerned with the ability to use RES technology), initiatives listed as their top four facilitating factors the knowledge of renewable energy technologies, access to finance/subsidies/grants, collaborating and networking with others, and the availability of renewable energy technology options. Wirling et al. (2018) investigate among others financial factors concluding that the historic development of the number of energy cooperatives coincides with the development of supportive schemes in the different countries. As a reaction to the removal or tightening up of the incentives schemes, energy cooperatives responded with diversifying their portfolio or increasing the numbers of shares and members, as an alternative to completely terminating all activities, that also happened in many cases. All these indicators, identified prior as important for the emergence and persistence of energy initiatives are taken up and ordered by the maturity framework, leading to a concise set of indicators helping community leaders and representatives to assess the sustainability and resilience of the own community.

3.2 THE ROLE OF NETWORKS AND GOVERNANCE

Susur et al (2019) and Seyfang and Longhurst (2016) assess the factors related to strategic niche management. These include learning approaches but also the access to internal and external networks. The authors find strong evidence that wider regime and sociopolitical contexts are significant in determining diffusion success. Favourable policy contexts and regime destabilisations are linked to wider diffusion. Ceschin (2013) analyses the societal embedding, learning process as well as embedment into actors networks such as involvement of actors that can influence dominant culture (e.g. ministries, agencies that develop standards and protocols, policy makers). Also Ruggiero et al. (2019) assess, next to socio-cultural and policy factors, actors characteristics such as knowledge of leadership, entrepreneurial mind-set of leaders and their commitment. The authors conclude that collective decision-making is a common characteristic to community energy projects. Collective decisions are taken when important choices are to be made, e.g. decisions regarding a bank loan or a specific technical design. However, the project stage at which a collective decision is taken necessary varies across adopted legal entity models and countries. Collective decision-making ensures that project proposals get enough support to be executed and to overcome resistance (see Ruggiero et al., 2019). Roby and Dibb (2019) advance the understanding of the role of actors and their interrelationship proposing a more network-oriented approach instead of isolated community establishment. Under this hybrid approach, local authorities, businesses and third sector organisations can act as intermediaries that offer technical advice, give access to information, policy advocacy/support, business partnerships and professional services; provide access to buildings, loans, staff time or expertise, to help setting up community energy businesses.

Aim of the proposed maturity framework is to build on existing literature and creating a consistent tool to assess and monitor the resilience and robustness of a community against unexpected changes in the energy system.

4 BASIC PRINCIPLES AND STRUCTURE OF THE MATURITY FRAMEWORK

4.1 DEFINITION OF MATURITY

Maturity describes an ideal a community may strive to. Here, maturity is understood as the resilience and robustness of a community against unexpected changes in the energy system. A mature community is capable of coping with external influences of the energy system “by responding or reorganizing in ways that maintain its essential function and structure while also maintaining the capacity for adaptation, learning and transformation” (pursuant to the IPCC definition of resilience).

Thus, maturity encompasses a community’s ability to respond to a favorable environment (by recognizing and leveraging its opportunities) as well as to respond to an unfavorable environment (by surviving crises, cushioning adverse impacts, and bouncing back to a stable state). A community scoring high on the maturity indicators proposed here is better prepared to withstand or even ride the ups and downs in the energy system.

The concept of maturity also refers back to components of the “organisational maturity” concept developed in the framework of the socio-dynamic methodologies (Fauvet, 1996) for driving change in organisations. The maturity in this concept refers back to the capability of an organisation to perform in a changing environment at large, including components of social and environmental change.

Maturity may result in longevity of a community and in the community maintaining a stable position in the energy system over a long period of time.

4.2 STRUCTURE OF THE MATURITY FRAMEWORK

The maturity framework is assessing and optimizing three main criteria:

- Democratic representativeness: the capacity of an energy community to represent and execute the will of the local citizens living in the community.
- Market impact: the capacity of an energy community to take on an active role in the energy system.
- Supportive environment: the extent to which an environment in which the energy community operates is supportive or not.

Maturity arises from many different community characteristics. We organize the indicators pertaining to these characteristics in six factors. These factors are understood as capacities, resources or assets a community accumulates, spends and balances against each other through its actions or when developing its activities. Different factors may substitute for or complement each other.

We assess the following factors:



Figure 1: Factors included in the Maturity Framework:

- **Social factors** (Members and Key personal): criteria that are directly linked to capacity of the community to collect social capital, align and communicate expectations and actions of members and the group and build trust in the local citizens groups. Here, we differentiate between members and key personnel involved in the community.
- **Financial factors:** criteria based on the typical market values and business indicators linked with the entity built by the community.
- **Political factors:** criteria manifesting how the community is embedded in external networks in order to leverage and positively shape policies in its environment and the amount of support the community can expect from political and administrative decision makers.
- **Technical factors:** those criteria are related to the knowledge and technical capabilities of the community entity.
- **Learning factors:** criteria that verifies how experiences made by the community are managed, distributed and incorporated in the community's actions.

We differentiate threshold indicators from continuous indicators:

- Threshold indicators refer to tipping points; when passing the threshold, the community undergoes profound change in its organizational structure.
- Continuous indicators capture the spectrum in the design and outlook of communities. A community's performance on a specific indicator is scored on a continuous framework with endpoints indicated by verbal anchors.

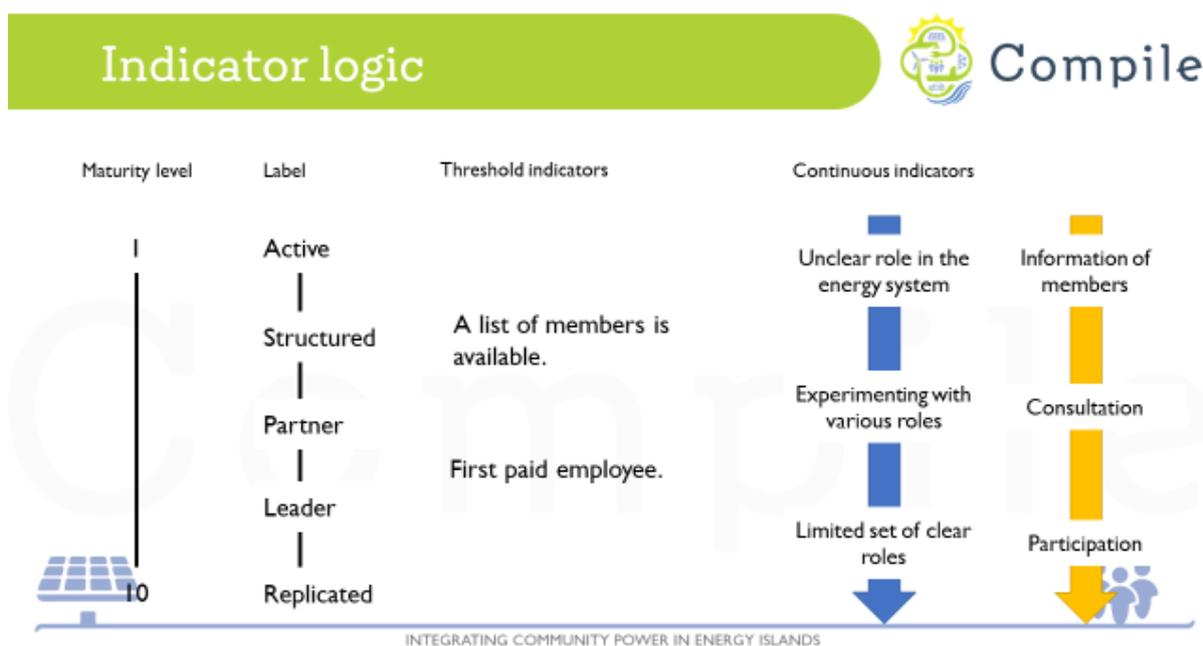


Figure 2: Logic of threshold and continuous indicators

4.3 STAGES OF CHANGE

Based on the research carried by in the field of behaviour change for individual (Bamberg, 2013), we extracted four stages of maturity of communities in developing a specific activity type. Those stages of maturity were confronted to the ECCO stage of development developed in the INTERREG ECCO project (ECCO, 2020). Those four stages are summarized in the community canvas.

	Contemplation	Preparation	Implementation	Maintenance
	<i>Start a group and develop a vision</i>	<i>Develop a project and create a plan</i>	<i>Collect resources and structure an organisation</i>	<i>Maintain and grow the community</i>
Community Factors				
Staff & Organisation Factors				
Financial factors				
Political and Network factors				
Technical factors				

4.4 OPPORTUNITIES AND LIMITATIONS OF THE FRAMEWORK

The maturity framework is primarily intended for self-assessment and monitoring of communities who wish to understand their current development stage and who wish to identify aspects they might address in order to improve their position in the energy system. We expect each individual community to feature a unique pattern of indicator grades, thereby pointing out its specific strengths and weaknesses.

Furthermore, the maturity framework allows comparison between more mature and less mature communities, or allows prioritisation between different approaches how communities achieve and maintain access to the energy system. Thereby, the maturity framework may be applied to connect scores in factors or specific indicators to examples of best practice or failure in previous/existing communities or to different strategies for providing services to community members.

However, the logic of scoring various indicators should not be mistaken for quantifying performance measurements. This is why we suggest to use grading on abstract indicators instead of numerical scaling suggesting quantitative metrics. Aggregating the respective indicator grades to a single number



on a composite maturity index would necessitate metric prioritizing and weighting of how strongly each indicator contributes to such an overall index. In the light of the exceptional diversity of communities present in Europe, we argue against any attempt of deriving uniform weights applicable across multiple contexts.

5 CONCLUSIONS

This Working paper represents a first attempt to create a tool for a consistent (self-)assessment and monitoring of citizen-led energy communities. The relevance of indicators will depend of the type of community and their aims. Collective actions operating outside the stricter framework of EU provisions for energy communities may have less focus on social factors while economic factors such as profitability may play a bigger role. Currently the indicators developed within the above named factors are tested in a variety of different energy initiatives and by collecting feedback from initiative representatives and experts. This will also provide insight which indicators are more or less important for the maturity development of a community according to the current stage of the community.

6 ANNEX: THE MATURITY FRAMEWORK INDICATOR SET

Category	Indicator	Threshold indicator	Continuous indicator			Rationale and impact mechanism	References
			lower end	mid	higher end		
Social factors: members	Number of members	A list of members is available.	high fluctuation; erratic recruitment of new members		low fluctuation; strategic recruitment of new members	A collective of named, committed members ensures the persistence of the EnC. Retention of original members ensures knowledge management and a shared organizational identity. Rotation of members ensures that new ideas enter the EnC and that the EnC continuously adapts to a changing energy system. New members need to be integrated into decision making procedures and division of responsibilities.	(Blumer et al., 2013)(Susur et al. 2019) (Seyfang und Longhurst 2016)(Ceschin 2013))
	Number of customers/users who are not members (if relevant)	A list of customers/non-member users is available	high fluctuation; erratic recruitment of new customers/users		low fluctuation; strategic recruitment of new customers/users		
	Diversity of members		low diversity among members		high diversity among members	Broad membership by gender, age, and other characteristics of social background reduces risk of political protest from socially excluded groups, and ensures support of the EnC by representatives of various social groups. However, high diversity may complicate the development of a shared vision, and may reduce efficiency in EnC operations.	(see also Hatzel et al., 2016; Ruggiero et al., 2019)
	Quality of interaction		Information: decisions are explained and made transparent to members	Consultation: Members may comment and discuss upcoming decisions	Participation: Members may cast a vote for or against decisions	Inspired by Arnstein's Participation Ladder. Deeper participation leads to stronger commitment of members. Participatory decisions tend to be better, because they have been scrutinised and refined from multiple perspectives. Close interaction ensures transparency and that all members carry decisions.	(see also: Goedkoop und Devine-Wright 2016; Hatzel et al., 2016; (Susur et al. 2019) (Seyfang und Longhurst 2016, Ceschin 2013)))
	Specific decision rules	Rules for decision making are defined.	rules never changed since the EnC's origin		rules are regularly revisited, and if necessary revised	Clear decision making procedures lead to transparency and therefore trust in a EnC. As new members join the EnC and the EnC's activities evolve, the procedures currently in place should be re-checked whether they are deemed democratic and inclusive by all members, and whether they fit to the current set	(QUEST, 2016)
	Inclusivity of the decision making	Decision making institutions are accessible to all members	Decision making institutions are accessible to all members	Decision making institutions include specific corrective rules for	Decision making institutions include specific reporting and	Inclusivity and community representativity is crucial for the development of EnCs. In order to implement an inclusive governance, the EnC need to include specific inclusivity rules to correct the existing imbalances in the market.	
	Transparency in the decision process	Rules for decision making are transparent for all participants				The process of reaching a decision and the democratic dialogue needs to be documented in order to allow for all participants to participate fully in the EnC.	
	Commitment of members		a minority of members participates in annual general assembly		the majority of members participates in annual general assembly	After initial excitement and interest, mature EnCs find it increasingly harder to engage their members in regular decision-making. Continued involvement of members typically manifests in the attendance at general meetings.	
	Efficacy of interaction		drawn-out debates using technical/legal terminology		streamlined decision-making using easily accessible	Ensures that volunteer workforce drives the EnCs mission forward and is not squandered in internal squabble. Allows rapid reaction to changes in the energy system.	
	Shared vision	The EnC's mission is declared in written form.	unclear role	experimenting with various roles	limited set of clearly defined roles	An jointly agreed mission ensures cohesion among members. After an orientation phase, areas of business activity are narrowed and specified to roles in the energy system the EnC can fulfill regularly.	(Seyfang et al., 2013; Ceschin 2013; QUEST, 2016)

Social factors: key personnel	Number of key personnel	Rules for selecting leaders are defined.	No clearly responsible leadership	Single-leadership structure, where one person is responsible for everything	Core leadership team with clear leading tasks and specific roles (finances, legal aspects, marketing, etc.)	EnCs with a single-leadership structure are at high risk of failure, if the single spokesperson drops out for any reason and other members are not prepared to step up. Unclear leadership may incur diffusion of responsibility and lack of ownership for failures. A leadership team puts more diverse expertise (e.g. legal, technical, communication specialists) to use for the EnC; this requires clear assignment of responsibilities and strong cohesion among the team members though.	(Blumer et al., 2013; Ruggiero et al., 2019; QUEST, 2016)
	Diversity of key personnel		low diversity among key personnel		high diversity among key personnel	High diversity provides a differentiated skillset, multiple perspectives and access to networks for the EnC.	(see also Hatzel et al., 2016; Ruggiero et al., 2019)
	Commitment of key personnel		low workforce availability, sporadic presence at meetings		high workforce availability, all key personnel are present at all meetings	Highly committed people are more willing to invest time and resources in order to promote the EnC. Key personnel act as ambassadors and frontrunners, spreading their commitment to members.	(Blumer et al., 2013; Seyfang et al., 2013; Ruggiero et al., 2019)
	Skills of key personnel		key personnel command a limited skillset		key personnel command a skillset coherent with the EnC activities	Internal availability of skills necessary for the management of the EnC reduced dependency on external help and ensures that skills are applied specifically to the EnC's demand. Skills may include negotiation, communication, accounting, engineering, planning, lobbying, legal knowledge, etc.	(Seyfang et al., 2013; Ruggiero et al., 2019; QUEST, 2016)
	Communication of key personnel		infrequent or informal communication		regular and institutionalized communication	Regular coordination of targets, actions and problems ensures a smooth functioning of the EnC. Informal and unstructured exchange impedes transparency and causes friction loss if information and decisions are distributed in a partial manner.	(Susur et al., 2019; Seyfang & Longhurst, 2016; QUEST, 2016)

Financial factors	Available capital and assets	The EnC is clear of debt.	few, one-sided assets	many, diversified assets	Assets provide financial security for taking out loans or receiving external funding. In a consolidated business model, upfront investment costs amortize over time.	
	Return on investment for members of the initiative		underperforms other (green) investment schemes on the market	overperforms other (green) investment schemes on the market	Provides an incentive for continued membership. When interpreting this indicator, consider payback flows (e.g., reduced energy prices, interest rates) and re-investment of profits.	
	Economic stability		resources almost exhausted	resource buffer available	Similar to landing strip for startup companies, i.e. the timeframe within which sustained revenues must be achieved unless the EnC is at risk of collapse. Resources include monetary capital, but also volunteer workforce.	(Seyfang et al., 2013; QUEST, 2016)
	Credit status		Debt level >80%, majority of credit is provided by banks or non-members	Debt level <30%, majority of credit is provided by members	Financial ratio that allows to estimate the level of independence of the EnC from external funding institutions, mostly banks. The debt structure indicates how the EnC can finance new/expanded activities without expecting an immediate return on investment.	
	Reliance on public funding		critically dependent on public funding	targeted utilization of funding	Financial aids, subsidy programs, investment grants, tax exemptions and similar provide a niche environment protected by market forces where an EnC may develop at significantly smaller financial risk. As an EnC establishes itself on the market, reliance on public funding should gradually phase out.	(Ceshin, 2013; Blumer et al., 2013; Seyfang et al., 2013; Ruggiero et al., 2019; QUEST, 2016)
	Integration into existing infrastructure		new stand-alone infrastructure required	compatible and interconnected with existing structures	Building an own infrastructure dedicated to the EnC can be very expensive and time-consuming and may incur additional maintenance costs. Leveraging existing physical assets such as grids, power lines and other technical facilities reduces the overall investment volume for providing EnC services.	(Blumer et al., 2013)
	Business plan exist	Business plan available			A clear business plan helps to define milestones, supervise the progress and ensure common visions of members	(Ceshin, 2013)

Political factors	Relationship with local authorities		sporadic interaction; dependency	bidirectional, eye-level communication; autonomy	Enables access to expert knowledge, support during critical phases and co-design of the (local) energy system. Announcement and support by authorities may increase public acceptance.	(Seyfang et al., 2013; Ceschin 2013)) (Blumer et al., 2013; QUEST, 2016)
	Membership in larger networks		unaware of external networks	1 membership integrated and active in several networks	Integration into external networks (such as chambers, associations, civil society organisations) shows willingness to share knowledge and the amount of support that can be mobilised. Membership status refers to formal roles held by the EnC organisation or by key personnel.	(Seyfang et al., 2013; Susur et al. 2019; Seyfang und Longhurst 2016)
	Bureaucratic barriers		unaware of or overwhelmed by barriers	barriers identified, established strategies for overcoming barriers	Bureaucratic barriers can strongly slow down the development of EnCs. Strategies for overcoming barriers include legal procedures as well as informal processes.	(Blumer et al., 2013)
	Support by local community		oppositional	neutral	actively supportive	Citizens living in the community where the EnC is active are potential members and they may influence local policy-makers to support the EnC.

Technical factors	Number of services provided		single-service	multi-service	A diversified portfolio is more robust against adverse, unforeseen market developments as well as political/regulatory changes. Multiple services enable an EnC to assume a central role in energy islands.	
	Risk registry	Risk registry available			Specifying risks and mitigating/contingent actions enables foresight and early action on upcoming threats.	
	Defects in regular operation		many	(almost) none	Repeated malfunctions, particularly in the initial trial phase after introducing new technologies or services, impair the provision of value to members and undermine trust from external actors.	
	Maturity of applied technology		technology is new and rarely used by other energy communities	proven technology that is successfully used by other energy communities	A newly developed technology increases the risk of technical difficulties in implementation or even breakdown, makes it difficult to learn from best-practice examples and to convince local communities and politicians	(Blumer et al., 2013).
	Scope of value proposition		single-proposition	multi-proposition	Multiple value propositions (financial gain, social prestige, environmental action, etc.) attract and retain more members with selected interests. Robust if public interest in a particular proposition declines or market demand shifts.	
	Growth rate in energy produced/consumed		stagnating	dynamic	An agile and competitive EnC maintains or even expands its current market status.	
	Proportion of energy produced/consumed		production exceeds consumption	production equals consumption	Overreliance on production makes the EnC dependent on feed-in tariffs and energy price volatility. Balance between production and consumption signals self-sufficiency in energy islands.	
	Number of employees	The energy initiative hires its first paid employee.			Hiring employees indicates the presence of a steady stream of revenues and the dedication to build up organisational economic structures. Employees provide readily available expertise.	
	Legal form	The Energy initiative has a formal status as a business entity.			Formal contractual capability enables access to market services and facilitates collaboration with external actors.	
	Licence or permit	The EnC holds the necessary permits or licences to perform its chosen service			In order to perform any energy service, licences and permits are necessary to procure at the regulation authorities. This award of permit or licence is the sinequanon condition of the performance of the service.	
Support by external experts		only internal expertise available	external experts for all areas not covered by internal expertise	Enables access to expert knowledge, support during critical phases and co-design of the (local) energy system. External actors comprise energy utilities and grid operators, local to national governments, environmental NGOs, civil society, etc.	(Blumer et al., 2013; Seyfang et al., 2013; Hatzel et al., 2016)	

Learning factors	Learning through materials		no handbooks, guides, tools used	handbooks, guides, tools are integrated in regular operations	Learning is an important aspect to avoid mistakes. EnCs who learn from others have a clear advantage.	(Susur et al. 2019; Seyfang und Longhurst 2016; Ceschin 2013)
	Members feedback mechanisms	Feedback mechanisms are defined.			Successful development of niche innovations requires to reflect on and incorporate the expectations of members. Feedback may be given orally or in written form, through informal or institutionalized channels; in any case, it should be stated how remarks are received, assessed and acted upon.	
	Knowledge management within key personnel		knowledge is informal and hardly written down	structured documentation, onboarding of new key persons	Learning from each other ensures that skills are built up and experiences enter EnC procedures. Retaining knowledge if key personnel leave the EnC. Training key personnel in taking over other duties or in substituting for other personnel who withdraw temporarily.	
	Transfer to other energy communities		lone wolf attitude	replication in other energy initiatives	Mature, robust business models are adaptable to various contexts. Key personnel of the energy initiative diffuse their knowledge to other, less mature EnCs.	(Seyfang et al., 2013)
	Refining the shared vision		The energy communities mission has never changed.	The energy communities mission is regularly adapted.	Existing members communicate the core values and the mission of the Energy initiative to new members. This encourages existing members to question presuppositions, and allows new members to introduce new perspectives.	

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