ELICITATION AND FORMALIZATION OF LOCAL ENERGY COMMUNITY STAKEHOLDER REQUIREMENTS IN AUSTRIA

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Introduction

As the world shifts towards renewable energy sources, local energy communities (LECs), which collaborate to generate, exchange and store energy, are becoming increasingly popular. In Austria, this development is facilitated by the political goal of becoming carbon neutral by 2040 and made possible on a legal basis by the renewable energy expansion act (Erneuerbaren-Ausbau-Gesetz, EAG), the national implementation of the revised European Union Renewable Energy Directive (RED II) and Internal Electricity Market Directive (IEMD), which provide the common framework for the promotion of energy from renewable sources in the EU [1]. This legislation has been met with rapid adoption, with 145 new LECs in H1 2023 alone.

As pointed out in [2], LECs can potentially bring benefits to the energy system, but are also associated with certain risks. To ensure reliable operation of the overall energy grid during and after this transition phase, it is necessary to thoroughly consider the mass integration of such LECs. The ECOSINT project, which has already been described in [3] and [4], follows a holistic approach that encompasses all relevant stakeholders involved in the set-up and operation of LECs. It mainly aims to develop an information and communications technology (ICT) architecture that allows for large-scale integration into the overall energy system.

The first step in this process was to bring together these stakeholders and to gather, discuss, and harmonize their various requirements, both from an outside view on and an inside view of the LEC. This paper presents the requirements that have been collected and outlines the process of eliciting and formalizing them so that they could serve as a basis to develop the necessary ICT architecture.

Methodology

The advancement of technology and the emergence of new and innovative Smart Grid (SG) applications like LECs have made it possible to address environmental concerns, energy efficiency, renewable integration, etc. This provided new opportunities but has increased the system's complexity further, supplementing the challenges of designing and using these systems. LECs are a class of SG application that can be termed a System of Systems (SoS), as the set of systems "*interact to provide a unique capability that none of the constituent systems can accomplish on its own*", as defined in ISO/IEC/IEEE 21839:2019. The developed methodology for this part of the work is based on the first two *technical processes* of ISO/IEC/IEEE 15288:2023 to cover the *concept* life cycle stage. The approach involved two main phases. Phase one began with the identification of the stakeholders, their classes and the life cycle that they would be involved in.

Stakeholder interests were already reflected to some extent in the composition of the consortium of project ECOSINT. Leveraging the existing understanding of the energy sector and social landscape in the consortium, this group was extended for completeness. Subsequently, representatives for each class of stakeholders were found and invited to a series of workshops[4] to elicit their respective requirements regarding LECs. These workshops involved brainstorming and reflection sessions and

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[4] see https://ecosint.at/?p=339 and https://ecosint.at/?p=393

were aided by preconceived input as well as custom templates to ensure purposeful progress and appropriate outputs. The newly acquired requirements were analysed and processed in phase two to establish the right scope, build the operational concept, prioritize the requirements, characterize the operational environment as well as the stakeholders, perform trade-off analysis, and so on. For the study, well-known formalisms (SysML and UML) and standards such as ISO/IEC/IEEE 42010 and SGAM were utilized.

Results

The overall process resulted in 27 formalized requirements that could be clustered into 3 categories (technical, organizational, and supporting). As exemplary requirements from the technical category, “standardized data exchange” or “resilience” can be named. The organizational requirements include aspects like “cost savings” or “avoidance of bureaucracy” and last, but not least, the “availability of data for simulation” is one example for the supporting category. The 27 requirements can also be condensed into seven prioritized requirements and motivated by a mission analysis process and intense stakeholder discussion. Subsequently, the prioritized requirements can be cross-referenced with three business use cases, namely, self-consumption optimization, grid-friendliness and LEC-internal energy trading. As a result, and for briefness, further analysis can be performed by assessing, ranking and comparing the business use cases by properties deduced from the requirements (as shown in Figure 1), which is also useful for stakeholder discussion and for implementors.

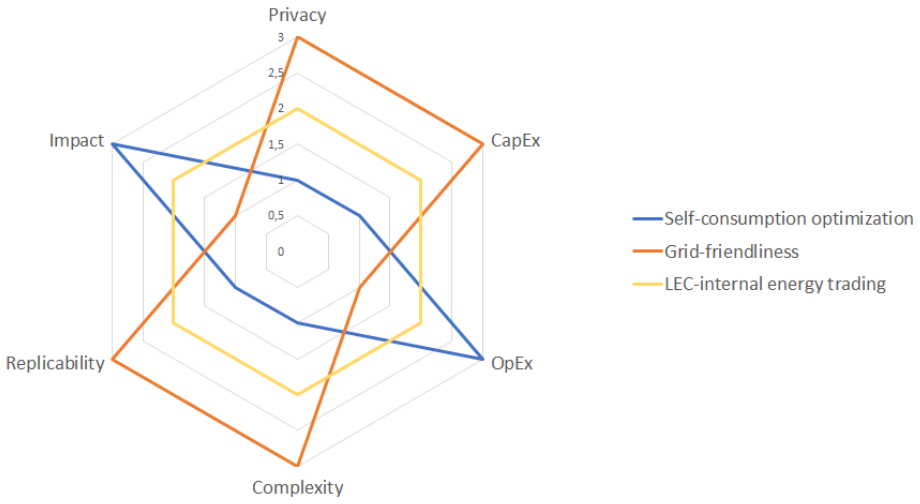

Figure 1: Key parameter assessment and ranking of three main business use cases (1= lowest, 3=highest)

All these considerations were taken int account to make informed suggestions about an ICT architecture that enables successful mass integration of LECs into the energy grid (as described in [4]).

References

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