Addressing Risks and challenges for the pilot sites installing the E-LAND solution

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New technology and access to renewable energy sources enable production of electricity by new actors on the energy markets. One such actor is the energy islands, isolated communities that produce and consume a part or all their energy needs. The E-LAND project is developing a toolbox that use consumers data and external data (weather, energy prices) to deliver an optimal energy schedule, that minimizes the cost of energy production and consumption. The E-LAND solution should support the energy islands to emerge on the energy market using a new technology, with new functionalities, and new ways of thinking performing both their operational and business processes: these changes come with new risks. This paper presents how risks are understood and managed, firstly by the project with regards to the pilot sites, that constitutes a set of first users chosen to represent different industries and energy technologies; and secondly, by the pilot sites themselves. The analysis identified risks with a top-down approach, based on different use cases, designed for each pilot sites. This article is focusing on the development of the risk at the half-way to completion of the project, and the accuracy of the risks seen for the pilot sites as the toolbox is being installed and tested.

Keywords: Energy Island, Smart Grid, E-LAND, Risk Management.

1. Introduction

The goal of the European-funded Horizon 2020 project E-LAND is to provide a solution that link technological, societal, and business challenges that the energy sector faces (E-LAND). E-LAND assumes that the needs in energy supplies are changing according to the new usages of electricity. Traditionally, energy supplies were mainly provided by fossil fuels, large and centralized power plants, combining thermal heat and nuclear plants. Today, environmental concerns, availability of technology, commercial and economic factors, needs for accommodating high energy fluctuation dependencies (seasons, localization and the population), as well as the promotion of renewable energy resources enable the increase of small, decentralized production sites, known as energy islands. The energy islands are communities of prosumers, producing and consuming a part or the total of their energy needs which may experience dependency on external energy supply (E-LAND). These modern shares between local and traditional energy suppliers force a rethink of the traditional management rules for the energy grid and new solutions are required to facilitate the balance on the grid.

One solution resides in the use of the Smart Grids. A Smart Grid (INCITE) provides two-ways communication and services, enabling consumers and providers to share a real time understanding of current and upcoming energy need which leads to improved flexibility for energy production. On this basis, one E-LAND goal is to develop and integrate a tool suite that changes the role of the energy islands from passive customers into active stakeholders in the energy market by providing Smart Grid services to the grid. The introduction of the toolbox presents new functionalities and new ways of communicating, operating, and working as the toolbox is using information from the users to deliver an optimized schedule to manage energy supplies. This paper goes into challenges for the pilot sites installing the E-LAND solution.

2. The E-LAND energy management solution

The following give a short introduction to the E-LAND project, the E-LAND toolbox functionalities, and the E-LAND pilot sites. The risk ownership in E-LAND is described in section 3. For a more thorough full description of E-LAND, see the E-LAND webpage (E-LAND) and open publications in the deliverables section. Three papers presented at ESREL 2020 are describing various parts of E-LAND (C. Esnoul et al.), (Gao et al.) (Jørgensen et al.).

2.1. The E-LAND project

E-LAND is a Horizon 2020 EU project to create novel solutions for decarbonized energy islands, comprising stakeholders across industries and countries around the globe. The E-LAND project consists of 14 partners. Besides Institute for Energy Technology (IFE) the partners are: University of Girona, Schneider Electric, Borg Harbor, GECO Global, Smart Innovation Norway, Intracom SA Telecom Solutions, the Reiner Lemoine Institute, Valahia University of Targoviste, Centre for Resources in Energy Efficiency and Climate Change, the University of St. Gallen, Instrumentación y Componentes INYCOM, BSES Yamuna Power Limited and Auroville.

2.2 The E-LAND toolbox functionalities

E-LAND is developing multi-vector energy optimization algorithms that consider current and future estimations of energy storage needs and end-user flexibility. The main objective of E-LAND is to implement a modular toolbox which uses data on energy consumption, market price and weather forecast to provide an optimal scheduling to product, store, buy and sell energy. A goal for the E-LAND project is to motivate community engagement towards technology and business. The toolbox is therefore intended as a decision-making tool to optimize energy usage but will not be an automatic control solution that governs e.g., battery parks and storage solutions, nor any infrastructures. The high-level concept of the E-LAND toolbox in Figure 1

Proceedings of the 31st European Safety and Reliability Conference
Edited by Bruno Castanier, Marko Cepin, David Bigaud, and Christophe Berenguer
Published by Research Publishing, Singapore.
ISBN: 978-981-18-2016-8; doi:10.3850/978-981-18-2016-8_569-cd

shows the main functional layers of the tools and the connection to the site-specific instances exemplified by pilot cases in the project. Figure 2 illustrates where the E-LAND toolbox is included in an energy management process (Jørgensen et al.).

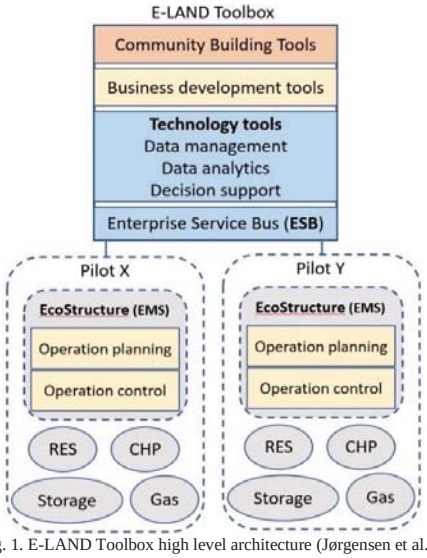

Fig. 1. E-LAND Toolbox high level architecture (Jørgensen et al.).

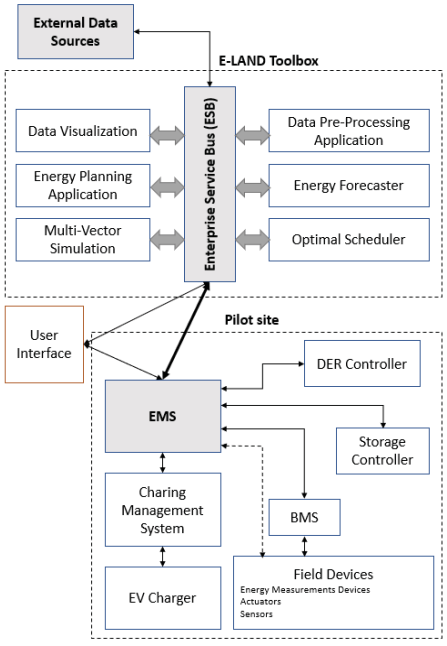

Fig. 2. Components of the E-LAND toolbox and the Pilot sites (Jørgensen et al.).

2.3. Applicability of the toolbox for different Pilot sites

The E-LAND toolbox will be tested by users that is referred to as pilot sites. These pilot sites have been selected to represent variation of needs, interests and energy technology among the partners that create a unique possibility to provide a product with a broad field of impact that is sufficiently general to be applied for stakeholders beyond the participants of the project. The pilot sites represent a large variety of countries, locations climates, populations, cultures, sizes, activities (an industrial harbor in Norway, a technology park in Walqa, the residential buildings of a university in Romania and a megalopolis in India), and span various infrastructures and technologies to produce and store energy (e.g., solar panels, battery, etc.). Table 1 gives an overview of each pilot sites' expectations regarding the use of the toolbox for their activities (E-LAND). The pilot sites will start to test the E-LAND solutions in June 2021.

For the toolbox to include and adapt to the needs of the future users, the data of different communities and partners are identified to model the scope of the toolbox. The needs of different stakeholders are mapped depending on their abilities and resources, and the factors that may impact their engagement (e.g., technology, strategy) are listed. Pilot sites' energy usage, i.e., energy production and consumption will be analyzed to make sure the final toolbox fulfills the needs of the end-users. This process also allows the development of general business models that can be replicated in across regions.

Table 1. Energy needs of three pilot sites of the project, first users of the E-LAND toolbox.

	Spain	Romania	Norway
Needs of optimal management			
Buildings	X		X
Industrial uses	X		
Vehicles		X	X
Optimal scheduling for storage			
Battery H	X		X
Thermal network storage	X		
Excess generation in thermal network		X	X
Optimization of energy			
Capacity/Costs/Maintenance	X	X	X

3. Consideration of the Risk for the E-LAND pilot sites

With the introduction of the toolbox comes new risks. Where the sites previously had locally stored data and local processes to manage their risks, the toolbox challenges the sites to manage their non-local data to develop new processes to handle novel risks.

3.1. Risk ownership in the energy islands

As the energy islands also takes on the role as energy supplier by using the E-LAND solution, they will be facing the same responsibilities as those of the traditional energy grid suppliers and will be responsible for equipment and

infrastructures similarly. The next part describes these additional risks in order to ensure that the E-LAND concept and E-LAND toolbox are sufficiently reliable and will not introduce further risks for the stakeholders. Further we present how the risks were understood by the pilot sites and which methods and tools were used for risk identification, analysis and mitigation. These questions are addressed in the next part.

3.2. Risk management in E-LAND

Overall risk management is performed as proactive risk management of both the project and the product of E-LAND. The analysis identified risks with a top-down approach, based on different use cases, designed for each pilot sites (E-LAND D4.7). While detailed methodology and results of the mitigations have already been presented (C. Esnoul et al.), this article is focusing on the development of the risk and the accuracy foreseen for the pilot sites.

The introduction of the E-LAND toolbox presents the pilot sites with new functionalities and new risks: where the sites previously had locally stored data and local processes to manage their risks, the toolbox challenges the sites to manage their non-local data to develop new processes to handle novel risks. Another example is that the connectivity of the new solutions requires pilot sites to have better control of their own information assets by performing stricter risk management and introducing new processes to sufficiently handle distributed risks.

3.3. Risks development for the pilot sites

A task in the risk management activity is to closely follow the development of this minimum set of requirements and guidelines for security in the project. This is done to ensure that each pilot site is monitored closely and supported during the implementation. For existing equipment where the viability of the common baseline might be less optimal, a good understanding of how risks could impact existing infrastructure is needed.

The pilot sites address different risks in the project. The combined risks and mitigations across pilot sites should be relevant for single sites when the E-LAND toolbox is completed and installed. In addition, the pilots are focused on realizing their technical systems and may miss parts that are not already regarded crucial during the development at work package (WP) level. Thus, the pilots are included as separate entities in the risk management process and are asked for their perception of key risks, separate from the WP's. A collection of the most important risks as seen from each of the three pilots gives a different picture than the risk picture seen by the WPs. The next risk management activity planned in WP4 is to perform a detailed security mapping of assets and threats to identify site specific security requirements for the pilot. This bottom-up approach is intended to compliment the top-down risk analysis performed thus far in the project. The gained site-specific security knowledge will be generalized into the overall solution.

3.4 Pilot site prepare for toolbox implementation

The risk assessment in the E-LAND project is combining best practice security and safety risk assessment methods. However, each different steps of the risk assessment process are mostly unknown or understood differently by the stakeholders at a pilot site. One reason might be differences in the users' objectives on how to use the E-LAND toolbox.

For the possibility to replicate the use of the E-LAND toolbox, a goal in E-LAND is to increase the understanding of the toolbox for future users. This can reduce the potential of risks to arise. For this purpose, a series of flyers have been created to ease the communication and guide the pilot sites through the process, see Figure 3 for an overview of the formatting (larger pictures are available in the appendix). The objectives of the flyers are to reduce the risks, optimize the potential of the solution, and make knowledge about relevant information easily available to each stakeholder.

Fig. 3 The E-LAND Flyers use for risk awareness (E-LAND D4.7).

The selection of a flyer as medium was taken because a flyer is easily accessible, short, precise, and constitutes an illustrative way to present an overview of the process and all the topics that have been undertaken. The flyers are applicable both internal and external to the project. The combination of figures and text provides a redundant way of presenting the information, in order to avoid erroneous interpretations. Additionally, the flyers require reduced efforts for any reader to go through, increasing the chance that the reader will do it.

Another important activity in the preparation can be found within the WP for pilot testing and the WP for business development. In the WP for pilot testing a task force is established which has regular meetings to monitor the advancement and share experiences from one pilot with the other pilots. This could be problems as well as smart solutions. In addition, the task force meetings are a good arena to ask if a problem can arise to a risk for the pilot, the E-LAND toolbox or the possibility to replicate the E-LAND toolbox to new sites. In the WP for business development the focus is turned around. Here the Indian partners in E-LAND has presented their plans for replicating the pilots in India and thereby raised concerns both to implementation of the toolbox as well as how to ensure that mitigations are in place.

4. Discussion

4.1. Differences in the Pilot sites maturity

The three pilots are located in Spain, Romania and Norway. Besides differences in location and size, they also have differences in access to internal competence, management structures, culture, the applicability and understanding of the risk, and degree of how much of the pilot can depend

upon their own resources vs. third parties. While the pilot sites in Spain and in Norway has a short and easy access to one of the E-LAND development partners, the pilot in Romania has no E-LAND development partner close by. This difference becomes even larger in the situation of covid-19. An illustration of this is a quote from one of the engineers in Romania "we have gone through the 700+ pages in the manual, and we think we have managed to get it right." Another difference lays in the actual system configuration at each site. The E-LAND toolbox has to be installed and operate in co-existence with other tools and data services. These tools may as well be managed and operated by third parties which are not members of the E-LAND project. To this can variability to adaptability of tools be added, and capacity for training.

4.2. Who owns the risk?

When and where does the risk transfer from the E-LAND project to the pilot sites? Neither when or where are clear for the pilot sites or the developer of the various parts of the E-LAND toolbox. On the one hand all the risk is by the pilot sites. They are the one using the toolbox, and any wrong decision or failure by the toolbox will have consequence for them. On the other hand, the E-LAND project and the toolbox developers wants to test out their solutions on the pilots. This means that they may be more willing to accept a risk, with the gain that lays in pilot results and feedback. A third stakeholder group here are those that want to do exploration and business on the E-LAND toolbox. For them positive results from the pilot are good references, while problem stories are seen as challenges for replication of the E-LAND toolbox. So far, our hypothesis is that the problems listed here are present, but smaller than in traditional pilot driven projects. Our explanation on this is the joint awareness on risks and mitigations among the E-LAND partners. This again can be linked to the active use of risk communication within the project.

4.3. Is what they promised what we get?

Most system developers and risk analysts are well aware of the "Tree Swing Cartoon" published in the University of London Computer Centre Newsletter No 53, March 1973. By easy drawings the cartoon illustrates the difference between (i) what marketing suggested, (ii) what management approved, (iii) what design by engineers, (iv) what was manufactured, (v) what maintenance installed, and (vi) what the customer wanted. Of course, these phenomena also apply to the E-LAND toolbox.

In E-LAND this phenomenon is also driven by the various ownership relations to risk. The E-LAND toolbox providers try most of all to deliver what was promised and marketed in the H2020 application. The E-LAND pilots address what they experience during installation and which mitigations they need, but these mitigations are not necessarily what was approved in the toolbox deliveries. Furthermore, as installation goes over to operation, we may also expect that we as partners in E-LAND wanted something slightly different.

One interesting point here is also that there is no-one owing the problems when the E-LAND project comes to an end.

If one pilot actually wants to have a modification or extension, there is no funding for it. It is therefore a business risk for E-LAND that the solution will fade away after the projects is ended. In an evaluation of lessons learned from organizing 15 smart city projects in Amsterdam, van Winden and van den Buuse (2017) explores the dimensions and conditions for scaling up and state that: "These projects, often labelled as "smart city" projects, are typically supported by municipalities, funded by subsidies, and run-in partnerships. Many of the projects fade out after the pilot stage and fail to generate scalable solutions that contribute to sustainable urban development. The lack of scaling is widely perceived as a major problem.".

4.4. A specific case

For one of the pilots, it is elaborated upon how the E-LAND toolbox can operate together with another system, and the question on the board are such as "can the E-LAND toolbox trigger an unintended control action?" To address this, we needed to go into the details of two sub-components of the E-LAND toolbox. For the case of illustration, we here assume that one component is a cloud service and the other on a component close to the energy storage or production. In a such case, the responsibility of these two components may be by two different providers which normally do not work together. That triggers questions like "who should take the ownership of the risk" and "who should implement the mitigation". The answer could be either or both suppliers. However, in all three cases this means an extra task and cost for the provider(s). In all three cases the risk is the problem for the pilot owner. These leads to a number of meetings and discussions. One observation there is that the risk remains unchanged as long as they discuss. The risk is actually first reduced when one or both providers sit down and implement one of the proposed changes. Nevertheless, in order to not scare those that may have interest in using the E-LAND toolbox in the future, the outlook is that the implementation work on the actual case is ongoing and is expected to be finished within short time. The active means in E-LAND are once more the use of a task force and the risk awareness in the project.

4.5. Experience from the risk manager

The final observation to report on is that it is motivating to be a risk manager in the E-LAND project. In accordance with the risk management process in E-LAND, see paper presented on the last ESREL (C. Esnoul et al.). A task in the risk management process is that each WP leader and pilot site shall report on the status of his/her risk each month. In practice this has become that the risk managers make a call, and then we have a chat around risk. Through these chats both proposals for mitigations and potentials for new risks has then come up.

5. Conclusions

The E-LAND project is developing a toolbox, that uses energy consumption data to compute a personalized and optimal schedule to manage the energy consumption, production, and storage of energy islands. Inclusion of a new protocol, a new methodology or a new tool into an

existing system adds potential risks for the future user. The main challenge for the pilot sites, the first users that implement the E-LAND solution, is to evaluate the risk for their existing systems even without critical data to manage. In addition, they are working with non-local data and a higher amount of data where their roles and their responsibility regarding their own infrastructure data is changed. The pilot sites also need to perform their own risk analysis that may require other competences and knowledge than the ones formerly used. The gap to assess the new risks can be big for a pilot site to be able to sufficiently address the risk and to take risk ownership. So, for the risk manager in E-LAND, it is not enough to deliver a risk register and their mitigations. The E-LAND project has therefore emphasized risk awareness to help the pilot sites in their preparation and their risk understanding. From the risk manager point of view, the E-LAND project has put in place a series of tools and protocols to gradually built competence and teach partners about risks. The risk understanding among the project partners have been improved through regular meetings and dedicated risks communication. Through these actions the E-LAND project highlights the important notions to consider in risk management. The understanding of the new risks, such as security and privacy, has been made with communication in simple messages under the format of flyers. The flyers address the main and important notions to prioritize. In addition, dedicated workshops with each pilot sites allowed to consider the different levels of maturity of each partner and gave insight of the difficulties a pilot site were facing and how solutions could be found.

At the end, having several pilot sites is enabling us to gather examples and problems across pilots and was an important support for the E-LAND project to create valuable experience on the implementation of the tool as more pilot sites may have the same challenges and frustrations. They can also share solutions. The risk management in the E-LAND project have created trust, easy access to the solution among the partners and the pilot sites. From the risk managers point of view, the process has allowed a better visibility and understanding of the risk, improve knowledge of the challenges faced by different parties and partners, and provided a way to perform an easy risk collection along the project life cycle.

Acknowledgement

The E-LAND project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement No 824388. This document reflects only the authors' views and the Commission is not responsible for any use that may be made of the information contained there.

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Appendix

For more readability the flyers are added in the following.

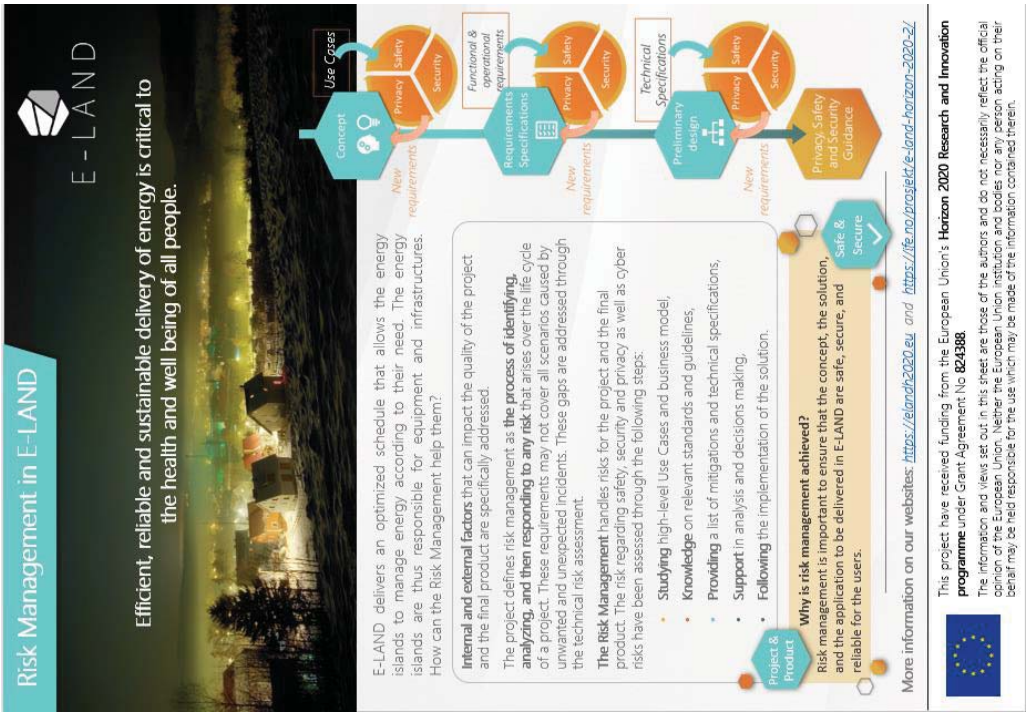

Fig. 4 The E-LAND Flyer for Risk Management (E-LAND D4.7).

Fig. 5 The E-LAND Flyer for Security (E-LAND D4.7).

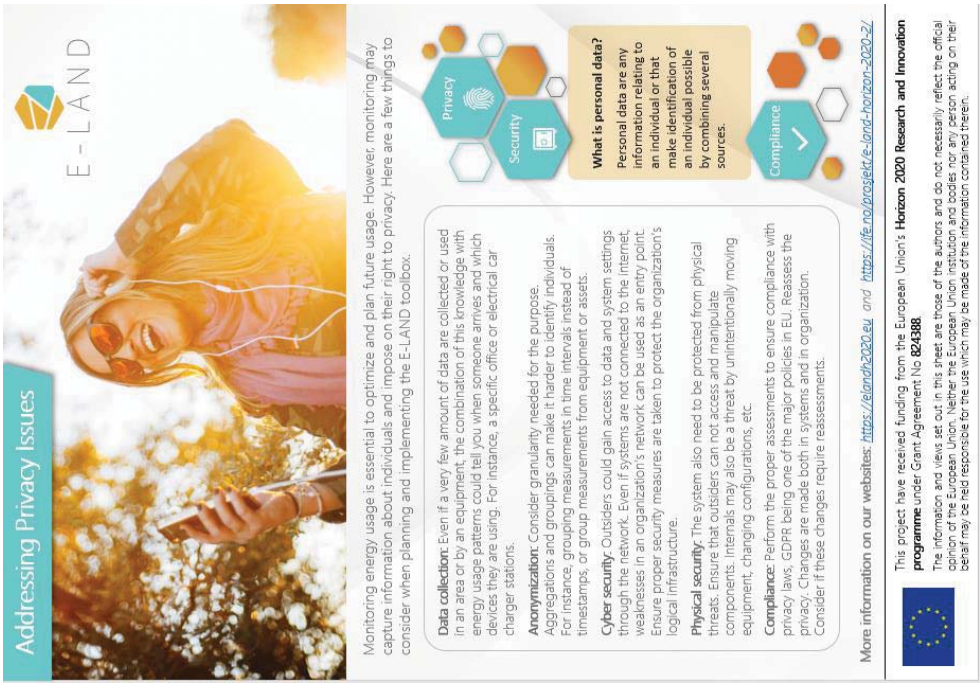

Fig. 6 The E-LAND Flyer for Privacy (E-LAND D4.7).