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Roadmaps for Energy (R4E): How to foster the sustainable energy transition of communities

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Abstract

The sustainable energy transition of communities is one of the main targets within the European energy policies. Consistent energy planning is needed but conditioned by difficulties of city administrations to meet the necessary skills and have the necessary knowledge in order to lead the corresponding transition processes. R4E develops roadmapping capacities of 8 European partner cities (Eindhoven, Forlì, Istanbul, Newcastle upon Tyne, Murcia, Palermo, Sant Cugat de Vallès and Tallinn) together with their local stakeholders, and provides them with the necessary knowledge about innovative energy solutions in the fields of smart buildings, smart mobility and smart urban spaces.

A specific systemic approach to these future energy solutions has been developed, based on so-called Systemic Solutions Maps and Technology Outlooks, in order to strengthen the capacities of the participating stakeholders in designing detailed roadmaps and developing together with the city authorities specific project portfolios.

Keywords: *Sustainable energy transition, Roadmapping, renewable energies, Systemic Solution Maps, participatory processes*

1. Background

Sustainable Energy Transition of society refers to long-term process which transforms radically the exiting energetic reality of a society, mobilizing diverse groups of stakeholders. (Verbong & Rotmans 2012)

Transition management has evolved during the last years offering a structured approach to the complex societal problems and difficult governance related to transition processes. (Loorbach & Rotmans 2010) These processes include generating a long term orientation where to head to as society, for instance through the use of scenarios or roadmaps, but also include leaving options open, dealing with uncertainties.

Transition processes can be organized best in so-called transition management cycles. (Loorbach & Rotmans 2010) and renewable energy communities (RECs) can be drivers of these energy transitions as communities which invest in the production of renewable energy with the aim to cover their own energy needs. (Dóci et al. 2015)

The R4E project (www.roadmapsforenergy.eu) responds to the EE-07-2014 call entitled "Enhancing the capacity of public authorities to plan and implement sustainable energy policies and measures" within the Secure, Clean and Efficient Energy Work Program of HORIZON 2020 of the European Commission. The main challenge of the partners within R4E is to develop visioning and roadmapping capacities within municipalities to initiate joint activities to spur development and implementation of innovative energy solutions in cities.

The implementation of strategies and plans on municipal level suffers from the effects of the recent global economic and financial crisis, the shifting of competences and responsibilities between government levels, difficulties within organizations to meet the necessary, and changing, skills and capacities; and a lack of

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knowledge on the state of the art concerning technological and organizational innovation. This leads to imperfect implementation processes and loss of faith in the usefulness of strategies and action plans.

In order to overcome these barriers, R4E established the following objectives:

- Creating high quality visions and roadmaps that drive collaboration between municipalities, entrepreneurs, knowledge institutes and citizens to achieve longer term ambitious goals through short term decisions and actions
- Implementing with all partners a similar participative process for vision and roadmap development that enables continuous cross-city learning exchange of experiences, challenges and best practices.
- Building an ecosystem of relevant local parties in each city, laying the foundation for extended collaboration between partners to drive innovation for sustainability purposes, through joint projects, e.g. joint pre-commercial procurement projects.

This ambitious approach requires new processes and tools in order to foster understanding, communication and informed, shared decision-making among stakeholders.

2. Introduction

Our western societies are recently experiencing a strong shift towards participation of citizens and all type of interest groups in participatory, multi stakeholder processes, with the aim to find consensus among individual interests regarding societal changes and challenges, especially in the field of transition towards sustainability.

In the technological field so-called user-centered research has been developed in order to capture user insights or user behavior regarding innovations with the aim of shortening product-to-market periods and gaining higher security regarding user adoption and market success of a product or service. New infrastructures and processes have been developed like e.g. Living Labs and Open Innovation strategies.

Similar processes are increasingly taking place in the area of governance and decision making within municipalities, where citizens, entrepreneurs, academics and local entities as “users”, are expected to contribute to collective innovation and decision making processes.

Similar to the questionable role of users as actors in the field of innovation (lack of experts knowledge, lack of motivation for continuity, IP rights and exploitation of results) the capacity of individual stakeholders has to be questioned in overviewing the whole process e.g. of the current transformation processes of cities towards more sustainable energy models. These processes are highly complex and open ended, including technological developments and changes, legislation, governance, societal changes and social innovations, linked to individual as well as collective value discussions and behavior changes regarding our lifestyle.

The R4E project therefor takes a different approach to current energy strategies and plans, developing so-called “Energy Roadmaps”. The unique feature of the Roadmaps approach is that the process of development takes successful implementation through partnership and through an in-depth knowledge of the state of the art, now and in the near future, as a starting point. This approach is based on:

- An ongoing learning process among all stakeholders, acquiring the necessary technical and systemic knowledge of complex transition processes.
- Better communication among all participants, experts, politicians, researchers, entrepreneurs and citizens through a common language and trust building collective processes.
- More consistent and consented outcomes, which increase decisively the possibilities for a successful implementation of resulting action plans.

R4E offers a new strategy for complex transition processes of society towards a sustainable energy future, fostering within participatory processes the knowledge generation and improvement of the diverse stakeholder groups regarding renewable energy technologies, and a systemic view of energy in buildings and the urban context in general.

3. Methodology

R4E applies a specific 4-step process for the project itself, a specific 4-step structure for its desk studies as supporting documents for participatory stakeholder processes, and a specific approach for the learning and communication process of stakeholders through *Systemic Solution Maps* within the desk studies, in order to graphically represent the complexity of any energy-related transition process.

3.1 The 4-step R4E process

The R4E partner cities run through a 4-step R4E process (Figure 1), starting with the *Ambition setting* (step 1), and a *Vision development* and scenario building process (step 2) in order to discuss, define and describe a common desired future for their city with the participation of all type of local stakeholders such as citizens as well as relevant research and industry partners. In a third step partners develop *Energy Roadmaps* as the result of a cooperative process engaging, as in all previous steps, key stakeholders within the region from the business and knowledge sectors.

This results finally in the development of a specific *Project portfolio* (step 4) and well-developed implementation plans supported through a strong commitment of all participants. Figure 2 shows the general R4E approach in four steps.

Fig. 1: 4-step R4E process

The R4E process allows ideally engaging partners and stakeholder groups in a continuous process over 3 years and beyond, creating a strong collaboration based on trust and integration among all participants.

3.2 Desk Study structure

In order to support the participatory processes of the R4E project in generating consistent roadmaps for energy and solid implementation plans, desk studies about the state of the art of energy technologies and related sustainability concepts and solutions are facilitated to the participant cities.

These desk studies include the following 4-step approach in order to structure knowledge and give consistent future outlooks on technologies related to smart energy strategies of cities (Figure 2).

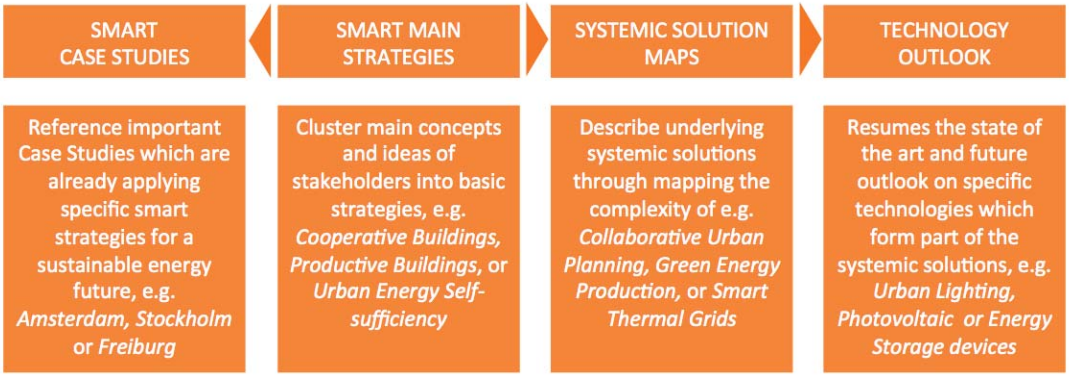

Fig. 2: R4E Desk study structure

After describing and further defining the *Smart Main Strategies* of the partner cities, based on the developed visions and scenarios for their energy future with horizon 2050, so called *Systemic Solutions Maps* are developed in order to represent graphically the complexity of each strategy and its interrelation with diverse concepts and technologies.

A third step consist in specific *Technology Outlooks* about technologies that have been mapped within the *Systemic Solutions Maps,* documenting their current state of the art, their specific challenges and their future perspectives.

In a fourth step *Case Studies* are referenced to the different Systemic Solutions in order to showcase light house projects of urban energy transition, which already apply specific smart strategies or smart technologies for a sustainable energy future.

This desk study structure allows all partners to generate and improve their knowledge in fields like e.g. the energetic refurbishment of existing buildings, or the establishment of smart energy grids with a high amount of distributed renewable energy sources, among many others, gaining a holistic and systemic vision of each strategy. The specific feature of *Systemic Solutions Maps* furthermore allows to be used as individual or collective tool for understanding complexity and interrelations among different strategies and technologies.

3.3 Systemic Solution Maps

Systemic Solution Maps are introduced as comprehensive representation of the inherent complexity of almost any strategy towards a reduced energy demand and a higher degree of sustainability on building level as well as on urban scale.

Systemic Solution Maps (Figure 3) are the connecting elements, which allow setting into the right relation the basic *Smart Main Strategies* for a sustainable energy future and the existing and developing energy technologies as well as related technological solutions described through the *Technology Outlook* section.

The systemic approach allows to map visually the interrelation of different parameters for a specific approach, e.g, in the field of material flows, water consumption or renewable energy generation, facilitating the understanding of the complexity of each specific field of action, the interrelation of technical, organizational and social aspects, as well as the corresponding developing technological solutions, which allow to transport this current representation of complexity into a vision of a possible future.

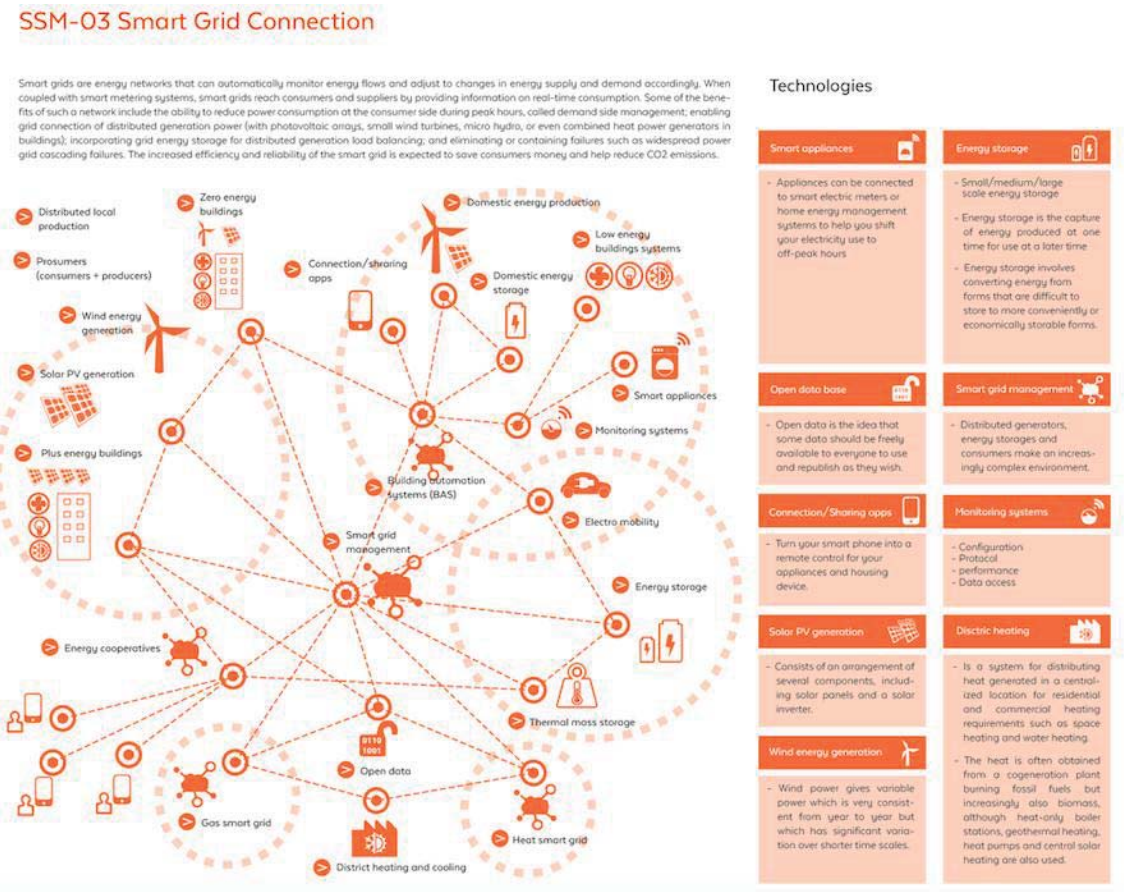

Fig. 3: General Structure of *Systemic Solution Maps*

Stakeholders may read and reflect individually on these *System Solution Maps*, may use them in their discussions and participatory processes as a tool, or even might adapt or further develop them according to their city specific social-economical, climatic, cultural and environmental background.

4. Results

The R4E project has just concluded its second step, *Vision development*, within the overall 4-step process. Desk studies have been almost terminated and will be handed out to partners during October 2016.

A total of 18 *Systemic Solutions Maps* have been developed in the fields of *Smart Buildings* and *Smart Urban Spaces* in order to map the complexity of different and diverse approaches like *Interactive Flexible Space Use, Collaborative Urban Planning*, *Communal Urban Farming, Thermal Smart Grids, Material Accounting Systems*, or *Health and Home Services* in the field or *Smart Urban Spaces*, and concepts like *Shared Use Management, Green Energy production, Smart Retrofitting Solutions, Waste Management, Building Water Management* or *Low Embodied Energy* among others in the field of *Smart Buildings*. Furthermore 50 *Technology Outlooks* have been elaborated resuming the state-of-the art and future potential of mapped technologies.

First *System Solution Maps* and *Technology Outlooks* have been presented to the city partners at the joint *Vision Building Workshop* in Istanbul in May 2016, obtaining valuable input from city representatives regarding the readability of the maps, their usefulness as tools in participatory processes, and most specially about missing or under represented issues, which should be included within the maps, e.g. stronger references to urban resilience strategies or a stronger focus on the complexity of historic buildings within the city context.

This stakeholder feedback has allowed to introduce changes and to improve the documents for their use as supporting tools in the following third step of the R4E process, the city specific *Roadmapping Workshops* from November 2016 on.

Desk studies and the applied methodology of *Systemic Solution Maps* and *Technology Outlooks* will than have to proof that they are useful tools for multi stakeholder processes, and that the applied mapping of complexities and relationships will result in a useful identification of potential synergies and even innovations.

This might contribute to the overall results to be expected of the R4E project after its successful conclusion:

- The empowerment of public authorities to develop, finance and implement ambitious sustainable energy policies and plans in order to implement efficiently recent and future European Energy Directives
- The introduction of a significant number of public officers and stakeholders in a new way of working, necessary for successful development and implementation of such plans
- The development of ambitious but effective and realistic policies and plans with an important impact on the behavior of final consumers

5. Conclusions

The sustainable energy transition of communities requires multi-stakeholder processes, which should be based on a high level of shared knowledge about related concepts, energy technologies and developments in the present and the near future in order to allow the successful collaboration of all important members of a community. The presented overall R4E process, with its desk studies as supporting documents and the specifically developed concept of *Systemic Solutions Maps* and related *Technology Outlooks* may contribute to this important knowledge generation and show their usefulness as tools for multi stakeholder processes towards a sustainable energy transition of cities.

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