Participatory design as a tool to create resourceful communities in Sweden

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Abstract - *For decades, alternative (to carbon) sources of energy in Sweden have been linked to hydro- and nuclear power. However, this is set to change as the Swedish government's agenda has placed extraordinary emphasis on renewables. The implementation of renewables in Sweden poses several challenges. Literature shows that two main aspects deter local communities from embracing large renewable projects: lack of acceptance (of the impacts) and lack of participation (in the making and benefits). Sweden has a long tradition of stakeholder engagement in state-funded projects in the form of participatory meetings and written feedbacks. However, other participatory techniques are less established. Since 2014, we have engaged in research projects dealing with energy landscapes, design thinking, and what we have recently named "resourceful communities". The aim of this chapter is to report on the results of our recent projects that engage with the above-mentioned concepts/ strategies to foster collaboration and understanding between end-users and other stakeholders.*

Keywords - Energy aesthetics, participatory design, energy transition, resourceful communities

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INTRODUCTION: THE RISE OF RENEWABLE ENERGY PROJECTS IN SWEDEN

The Paris agreement calls for transformative steps to lower greenhouse gas emissions and deliver climate-resilient development. The implementation of climate and sustainability policies (see Agenda 2030), alongside the transformation of the European energy system towards a more decentralized system, will push energy production, such as photovoltaic (PV), closer to the final users, the majority of which live in urbanized areas. In Sweden, the country in which we are based, the provision of primary energy is dominated by hydro and, since the 1970s, nuclear power plants. However, since 1980, through an advisory referendum, Sweden has chosen to stop the construction of new reactors and slowly phase out nuclear energy, although a number of power plants were still commissioned through the 1980s and a number of reactors are still active today (Oles & Hammarlund, 2011). Further developments in hydropower are also limited since the exploration of the large untapped rivers is also prohibited by law. Therefore, since the 1990s, the question for alternative sources of energy has been one of the main issues on the Swedish government's agenda.

The energy transition poses several challenges to medium and small-size cities (65% of the population in Sweden) that have little capacity to steer such a process. In Sweden, there is a strong rhetoric for smart and attractive cities (Hidman, 2018). Smart and sustainable urban development is the latest mantra of city makers (i.e., planners, mayors, consultants, business, etc.) and scholars alike (Inkinen et al, 2019). This applies not only to the growing capital cities that are at the intersection of global trade, but also to medium- and small-sized towns located on the nation's periphery. However, recent research shows that seldom are smart-experiments able to transform society and its institutions (Savini & Bertolini, 2019). Most often, smart cities and resilience thinking do nothing to deal with the social and political aspects of human exploitation of nature at planetary scale, i.e. where most of the Earth surface is affected by urban-led extraction processes of raw materials, goods and food, and human bodies are used as cheap labor (Rizzo, 2019a). Although there is ample literature that criticizes smart cities from several angles - corporate storytelling (Vanolo, 2014; Cugurullo, 2018); one size fits all (Kitchin, 2014); political legitimization (Söderström et al, 2014) – our point of departure is that the issue of energy-system transformation is best tackled at the neighborhood-community scale. Based on this, we have set a number of projects to develop, test, and evaluate a method to transform cities into what we have termed "resourceful communities" (Rizzo, 2020).

Resourceful communities are not only "ingenious, able, bright, talented, sharp, capable, creative, clever, imaginative, inventive, quick-witted"[1] but are also communities that put the harnessing, caring, saving, and using of resources at the core of their action. Resourceful communities re-imagine the nexus between resource (extraction-

[1] https://www.thefreedictionary.com/Resourceful

-processing-consumption) and urbanization in non-"predatory" (Rizzo, 2019b) terms, i.e. in ways that go beyond the cheap exploitation of nature by humanity (Moore, 2016). Our hypothesis is that a new paradigm is needed to facilitate the emergence or strengthening of existing resourceful communities, one which includes democratic design processes at the smallest urban scale, the neighborhood, to foster a new concept of energy-aesthetics. Therefore, our main research question is: *how is participatory design able to mobilize social creativity and democratize renewable energy projects?* Methodologically, we will deploy participatory design theory to deal with issues related to acceptance, democracy, and social creativity. In the remainder of this chapter, we will first shed light on the link between community opposition and forms of participation in renewable energy projects. After that, we will briefly present the methodology and results from our two case studies in Piteå and Luleå, both located in northern Sweden. Both cases explore the potential of deploying participatory design in renewable energy projects. In the conclusions, we will provide answers to our research question and problematize our approach.

THE IMPORTANCE OF RESIDENTS/USERS' PARTICIPATION IN RENEWABLE ENERGY PROJECTS

While this chapter reports on the results of two energy projects dealing with PV installations, most of the Swedish literature dealing with implementation issues for renewable energy projects comes from wind-farm studies. We will leverage this body of work because we believe that there are lessons to be learned from the many years of wind farm implementation in Sweden. One such a lesson is that of citizens' opposition to energy projects, a phenomenon sometimes labelled the NIMBY (Not In My Back Yard) syndrome (Wolsink, 2000 and 2007; Aitken, 2010). Today more sophisticated models have been deployed to understand the social, cultural, institutional, and physiological drivers of people's negative attitudes to renewable energy plants. For example, Wustenhagen and others (2007) have modeled social acceptance as the function of three dimensions: socio-political acceptance, i.e. acceptance of the policies and technologies to strengthen renewable energy; community acceptance, i.e. agreement on the siting decisions; and market acceptance, which is related to market adoption and innovation. In the two case studies presented in this chapter we will deal mostly with community acceptance.

Although Sweden is a heavily centralized state, its municipalities enjoy considerable power when it comes to land use. In practice, municipalities can veto any projects within their boundaries (Ek et al., 2013) unless these projects are the expression of national interests, such as natural conservation areas, or to protect people's health and security (Khan, 2003). Also, municipal land use monopoly has meant a great deal of different approaches when it comes to the implementation of renewables – from large, concentrated wind farms to scattered micro-plants (Khan, 2003). This has had both a positive and a negative outcome, where the former has fostered a place-based

approach while the latter has resulted in either extensive landscape impact or total opposition to wind farms (Khan, 2003). In our projects we explore issues related to small-scale, decentralized renewable energy projects because we think that these projects are more likely to engage with community needs and thus speed up the energy transition.

Sweden has a long tradition of stakeholder engagement in state-funded projects in the form of participatory meetings and written feedback. However, other participatory techniques are less established (Henningsson et al., 2014). Furthermore, individual and informal agencies, as well as small associations (in Swedish, förening), do not have the same visibility and influence in the planning process as other institutional stakeholders do. Adaptation to the impacts of energy projects has been shown to be an important factor to understand people's perceptions. It seems that after energy projects have been implemented, the previous negative stand of the affected inhabitants gives way to a more positive attitude (Warren et al., 2005) - this has been found not only for wind energy projects in Sweden but also for different types of energy-related projects, such as transmission lines in Finland (Soini et al., 2011). However, this latter position, people belated acceptance of energy projects, has been contested by Aitken (2010), who argues that people's silence on further energy projects may be also understood as unwillingness to engage in a cause where inhabitants have been previously defeated. Therefore, the way energy projects are designed and implemented may actually contribute to erode people's confidence in the ability to influence government's decisions, and result in the community's distrust of city administrators and energy businesses coupled with indifference to the green-energy cause.

However, besides the issue of engagement in the design stages of renewable energy projects, research has suggested that people are not only motivated primarily by quite abstract arguments but also by more tangible benefits (Bergström, 2007). Research in Sweden has shown that institutional factors, such as ownership, or the possibility to participate and affect how Renewable Energy (RE) is implemented in the local community may also be important (Ek & Matti, 2015; Ek & Persson, 2014). According to a number of studies, the adoption of benefits to foster individual ownership of small renewable facilities appears crucial (Rizzo, 2017). For example in Italy, the combination of market and government incentives has contributed greatly to expand the wind energy capacity of the country, and today Italy comes third in green-energy capacity in Europe, after Germany and Spain (Oles & Hammarlund, 2011). Following the example of Germany (Li et al., 2013), the introduction of Feed-In-Tariffs (FIT) to provide a stable and predictable source of income to individual green-energy users/providers has been crucial in countries such as Italy, Spain, and France.

Therefore, benefits alone cannot be assumed to solve community disagreements about the impact on renewable energy projects. By studying two renewable energy

projects in France and Germany, Jobert et al. (2007) have identified "local integration of the developer, the creation of a network of support, and access to ownership of the park" as the main factors to boost social acceptance. This is particularly true for countries with the weakest institutional framework on green energy, such as France and Italy, and the highest importance placed by their inhabitants on landscape to represent their national identities. A similar issue has been reported in Scotland, one of the countries with the highest potential for wind power in Europe but which is extremely reliant on its landscape, rather than cities, to generate income from tourism-related activities (Warren & McFadyen, 2010). By studying the implementation of an integrated, community-based green-energy project in a small community of Germany's Black Forest (Freiamt), Li et al. (2013) have found that the residents/promoters of the project were not only motivated by financial gains, but also by an intangible sense of pride in being a community 100% supplied by green-energy. Besides economic benefits, communities are motivated by their direct involvement as "prosumers", i.e. dwellers that are at the same time producers and consumers of energy, to make renewable energy possible - rather than solely commercial renewable energy development. Oles & Hammarlund (2011) have suggested that a place-based approach to locate renewable energy projects is needed if public concerns over the impact of the new energy systems are to be addressed. The results of their collaborative (university, county, municipalities) study in central Sweden show that it is not the technology that is perceived as a threat but rather the number, location, and identity of the owners that carry most of the importance for local stakeholders (Oles & Hammarlund, 2011). Therefore, the implementation of renewable energy is increasingly linked to the claim of legitimacy to be democratically viable.

TWO CASE STUDIES

To engage with the issues of democratic legitimacy and place-based approach, we present two case studies carried out in northern Sweden. The first case study is located in Piteå's Science Park, which is one of the locations of Luleå University of Technology.In collaboration with end-users (university employees and students) and stakeholders (the local energy company, the landowner, and the municipality), the project in Piteå sought to create an energy-smart university campus where not only energy production but also the development of public space was democratized. The aim was also to explore how art and architecture, as somewhat opposed to the successful economic driving forces, in the form of public installations, can work together to create an energy-producing public space. In addition, the installations work as a visualization of energy production and consumption, and aim to address and raise awareness of the production of renewable energy and the role energy plays in public spaces. The second case study was carried out in the neighborhood of Porsön in Luleå, and it included, among other elements, one university campus, rental

housing, and a science park (Fig. 1). In this instance, the local stakeholders were also involved (Luleå Energi and the municipality) as well as the students/residents of the area in the context of a university course the authors supervise yearly. The project overall purpose was to develop, test, and assess an approach by which (potential) prosumers could be motivated and empowered to integrate photovoltaic (PV) in the context of urban district regeneration.

Fig. 1: Study area in Luleå with the chosen spots for creative investigation. Source: the authors (2019)

Participatory Design as research strategy

In the authors' work with energy projects in Sweden, Participatory Design was deployed to engage users in the understanding and making of future energy projects. Mazé (2007) describes Participatory Design as a field concerned with the incorporation of end-users as full participants in development processes. It originated in the 1970s as part of the Scandinavian workplace democracy movement, whereby projects were developed with trade unions to incorporate technology in ways that enhanced, rather than replaced, workers' skills and local knowledge. Furthermore, Mazé (2007) compares participatory design to user-centered design, which draws on diverse means of studying, analyzing and incorporating user needs into product development, while participatory design focuses on means for opening up design processes, representations, and products to participation by stakeholders with diverse skills and expertise. Similarly to transdisciplinary urbanism (Rizzo & Galanakis, 2015), mock-ups, games, and enactment, for example, are simple means for everyone to represent and communicate ideas, regardless of design, technical or even language skills.

As previously argued, it is crucial to foster citizens' participation in renewable energy projects. Therefore, the participatory design approach played an important role in the development of both cases, in Piteå and Luleå, as a method to democratize the planning of public space to support the integration of energy-producing installations in the urban context. In addition, the research approach aims to improve the design process as well as the results, and, through collaboration with end-users and stakeholders, make sure that participants' needs are taken into account when developing urban proposals.

Methodology

As part of the concept development and design work in both projects, a series of workshops were held to involve stakeholders and other end-users (i.e. students and employees in and around the area) in the development process. The process was based on a participatory research design developed in a previous study called "sustainable municipality" (Ranhagen, 2011) and being used today in other flagship urban developments across Sweden (e.g., the Royal Seaport redevelopment in Stockholm – see Ranhagen & Frostell, 2014).

Phase 1

Both in Piteå and Luleå, the first workshops involved key actors in the area, such as real estate owners, representatives of the municipality and the energy company, business owners, educational staff, and so forth. They all had a legal or economic interest in the area. Based on the methods of participatory research design developed in "sustainable municipality", the participants developed the guidelines of the project (table 1) through structured brainstorming, a SWOT analysis, and by pointing out the technical potential of the area for developing renewable energy systems.

Existing technology (short term)	Smart engine heating system + combined charging station for electrical vehicles, design to show capacity and use of electricity Solar cells on windows, roofs, balconies Increase in public transport Visible storm water with multifunctional purposes, including aesthetic qualities
Developing technology (medium-long term)	Geoheating and cooling Pool sharing for new types of transportation Smaller and more adaptable solar panels Charging stations and wifi in all public spaces Flexible meeting places New forms of long-term energy storage Piezoelectric development
Experimental technology (long term)	Integrated technology for energy production in both large and small-scale components of buildings Portable stations for production and consumption of renewable energy in all different types of usage

Table 1. Results of the innovation model specifically for the Piteå Science Park.

Phase 2

In the second phase, participants/users (students, workers, etc.) were called upon to create posters and embark in actions on campus and through social media. Participants stated a number of reasons why they wanted to take part, for example they were "Intrigued by posters", "Wanted to influence the way the campus looks", "Interested in design and architecture". Based on the methods from design thinking as formulated by the IDEO founder and Stanford professor David Kelley, this phase was planned as a series of intense sessions focused on hands-on work and prototyping. Kelley (2013) describes "design thinking" as a way of finding human needs and creating new solutions using the tools and the mind-set of design practitioners, and divides the design thinking process into four steps: 1. Inspiration, 2. Synthesis, 3. Ideation and Experimentation and 4. Implementation (Kelley, 2013). In our projects, we went through steps 1 to 4 (see Fig. 2 to 4), while step 2 was formulated in Phase 1 of our methodology.

Fig. 2. Participants' Prototyping in Piteå. Source: the authors (2014)

Inspiration. The challenge and context of the project were presented to the participants. They were informed about the outcomes of Phase 1 as well as introduced to inspirational and innovative projects, which set the framework for the tasks. The challenge presented to the participants was: How can energy-producing installations be created which not only generate energy but also have artistic value and create added value to the people who use the area?

Ideation and Experimentation. The aim was to generate as many ideas as possible in a short time, make a selection of ideas that were further developed and tested through quick prototyping. As part of the design process in phase 2, the element of swapping

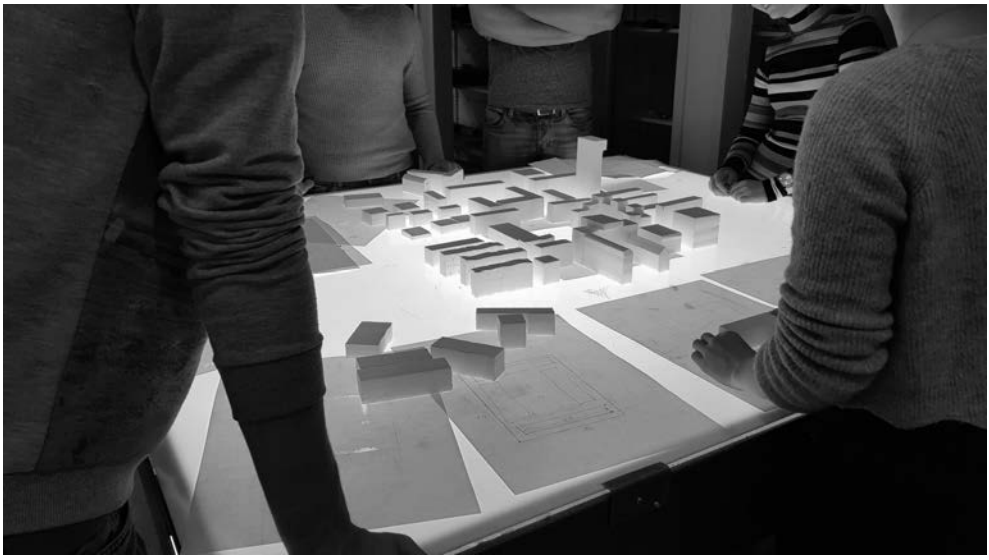

Fig. 3. Participants' prototyping in Luleå. Source: the authors (2018)

ideas between the three groups and working at different "stations" with different focuses for prototyping was added. The groups rotated between the three stations: Material, Form, and Place/Function. The swapping of ideas was used as an attempt to free participants from their first favorite ideas and in this way make the process more open-ended. Furthermore, the focus on material, form, place/function was added as an attempt to liberate participants from ideas about the aesthetics of public art installations as well as the aesthetics of energy stations.

The participants were divided into three teams and introduced to the first task, first individually and then as a group, which consisted in generating as many ideas as possible focused on the challenge presented. Before starting, they were introduced to some selected design thinking "rules" such as "think user-centered", "encourage wild ideas", "return to the challenge", "defer judgment", "go for quantity", and "build on the ideas of others" (Kelley, 2013).

When the teams moved on to the prototyping stations, they left their own ideas behind and took over another team's ideas for further development. The prototyping stations "Material" and "Form" were equipped with materials and tools suitable for quick testing and mocking up ideas. Station "Place/Function" was equipped with a scaled model of the campus area where the participants could work on their prototypes in relation to the design, architecture, and layout of the whole area.

At the end of the workshop, all teams presented their final outcomes. The prototypes were documented and collected for further development. In Piteå, this process was set up as a 2-day collaborative session with sketching and concept development until a final proposal with nine public installations was presented to the stakeholders.

Implementation. While the research project in Luleå is still ongoing, in Piteå after the presentation of the final proposal to the students there was a third meeting with the participants who attended the workshops held in Phase 1. Together, we conducted a criteria analysis based on the different proposals and related the proposals to the first workshop's analysis and innovation model. The participants were also free to elaborate on the given design proposals to optimize the outcome in relation to earlier results. Later, in 2016, the city of Piteå decided to build upon the work developed for the campus by recruiting an interdisciplinary team of practitioners part of which were already involved in Piteå. "Sun Wave" (Fig. 4) is an experimental solar park in which landscape and technical issues merge to face societal and climate issues as well as the needs of a northern community such as Piteå. The park was conceived as a "landscape room" made of 117 solar panels installed on wooden stands. The solar cells are two-sided and at the time of implementation it was the first large-scale PV facility in Sweden.

Fig. 4. Sun wave in Piteå: this experimental solar park was designed and implemented on the basis of the workshops in Piteå. Source: Ekelund, Bergström, Wiklund (2018)

DISCUSSION AND CONCLUSIONS

The production of small-scale solar power can, as is the case with all power production, be characterized by physical, environmental and institutional attributes that are valued by the local citizens. Impacts related to the integration of PV in neighborhoods can be positive as well as negative and may encompass, among other elements, perceptions about the extent to which the local population is involved in the planning and implementation process, who owns the facility, its physical characteristics as well as any monetary benefits associated with renewable energy

establishments (Ek & Matti, 2015; Ek & Persson, 2014). The development of renewable energy from an aesthetical and architectural point of view in a participatory design process defines the need for developing the normative framework. This adds an additional set of values to those associated with setting financial benefits at the centre of the debate. From the experience gained in Piteå and Luleå, there are indicators on the importance of including people both in the development of renewables but also the need to introduce the dialogue based on other normative frameworks.

In this chapter, after sketching the growing importance of renewable energy projects in Sweden, we have reviewed the main factors hindering and promoting community participation in renewable energy projects. We have argued that a more inclusive idea of renewable energy can strengthen the transition to resourceful communities, i.e. communities that are formed by energy prosumers rather than mere consumers. In both case studies presented above, we have worked with users to test participatory design and place-based approaches that could be acceptable to the wider community as well. Our initial research question was: how is participatory design able to mobilize social creativity and democratize renewable energy projects?

We believe that the projects discussed above give indications that there is great interest from companies and citizens to take an active role in the development of public space. The participatory approach helps to democratize this development as well as to create a shared interest among companies and citizens. In addition, the participatory approach is beneficial for the design process itself since it opens up to less conventional outcomes. We found that involving people with a different set of skills and knowledge was more enriching than leaving all of the design work to architects alone. The effects of the proposed installations are most likely to create daily based impacts such as sound, visual moving elements, and solar reflections. However, in this case these attributes are all part of the installations and hence not addressed as problematic or disturbing by the participants, all of whom are a sort of "developers/designers" in this case. This indicates that the aesthetic values of renewables might undergo a similar transformation as, for instance, sound in general. For instance, the sound of water running might be experienced as positive, while the sounds of cars might not.

From a political point of view, the development of sustainable energy systems is dependent on people's experience of their implementation. Through the perception of the built environment, norms based on the experience of past examples are created, which facilitate or, conversely, obstruct their continuous development. These norms usually depend on economic, ecological and social descriptions of energy. To a certain extent the meaning of energy in this study is focused on the aesthetic and artistic expression as a way of questioning the validity of given norms, many of which have a predatory urban character. And in this case the questioning of norms is actually constructed by the very participants of the design process. The results

have shown that questioning the given norms of aesthetic values of renewable energy can greatly contribute to enhance the popularity and uptake of renewable energy systems. However, although the Luleå case study, unlike Piteå, included a large residential area (rental housing), our approach needs to be tested in urban contexts different from that of a university campus, contexts with a different socio-economic setting in which it could perhaps be more difficult for design-based methods to yield results. These possible limitations should be further explored in future studies.

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