

Solarize: Exploring the Development and Diffusion of Socio-Technical Innovation for Energy Transitions

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Dissertation Summary

Introduction

Community-based initiatives offer promising sites of innovation to promote the transition to a more sustainable energy future. Historically, literature on sustainability transitions has focused on technical innovation as the solution, resulting in an underdeveloped understanding of how to foster and facilitate the development, growth, and diffusion of community-based, social innovations (Hielscher et al, 2013). Building on a growing body of literature on community action for sustainability, this research applied socio-technical transitions theory and strategic niche management (SNM) to the case study of Solarize. I aimed to increase the theoretical understanding of community-based initiatives and also provide theory-based recommendations for future development of the Solarize campaign.

Theoretical Context

The modern day energy system has evolved to encompass a complex set of relationships amongst actors seeking to produce, diffuse, and use fossil fuels. The literature on transitions theory (ex. Geels, 2002; Geels, 2004) has emerged in attempt to both increase understanding regarding these connections and understand the different ways to transform a complex system towards a more sustainable future (Geels, 2004; Hielscher et al, 2013).

Transitions literature suggests that radical changes to a system often develop from the bottom up in innovative niches that provide protected spaces from mainstream market forces and nurture alternative pathways for change (Geels, 2002; Seyfang & Smith, 2007).

Strategic Niche Management (SNM)

Strategic Niche Management (SNM) theory aims to conceptualize “the creation, development, and controlled phase-out” of these niche markets and provide a research model to help plan innovative niche experiments and evaluate policies seeking to facilitate change (Weber et al, 1999). Originally developed as a tool to foster the growth and diffusion of technological innovations (Kemp et al, 1998), a growing body of literature has argued for greater exploration of community-based initiatives as innovation and has applied SNM in hopes

of better understanding the potential for a community to foster socio-technical innovation for sustainability.

The application of SNM to community-based initiatives offers alternative insight into the best way to successfully harness community action. According to SNM theory, the development and implementation of successful niche experiments relies on three key interrelated and reinforcing processes. These processes are:

1. The cultivation of shared, specific, and robust **expectations and visions** for the future of the niche.
2. **Experimentation-based learning** at multiple dimensions to help accumulate facts, data, and knowledge regarding relevant cognitive framings and different perceptions and values of the niche.
3. **Building a broad network** constituency behind the new innovation that spans across perspectives facilitates the cooperation and involvement of stakeholders, provides resources, and helps to determine depth and breadth of learning

While fostering the three key processes help niche innovations develop on the local level, these innovations must also grow, diffuse, and engage with the existing system if they seek to change it (Kemp et al, 1998; Weber et al, 1999; Schot & Geels, 2008). Recent work on community-based innovations has identified three main pathways through which community-based initiatives grow and diffuse:

1. **Replication** denotes the process through which a niche grows across contexts by the creation of similar niches in new areas.
2. **Up-scaling** refers to the growth in scale of an initiative.
3. **Translation** underlies the processes through which an innovation is filtered, reformulated, and adopted by other institutions and organizations.

The evaluation of community-based initiatives through the key processes and growth pathways affords the opportunity to generate novel insight into the needs of such innovations and how to overcome many of the challenges they face in shifting a system (Seyfang & Smith, 2007).

Methodology

In order to craft a narrative analysis of Solarize through the SNM framework I drew upon three main sources of information:

1. **Desk-based analysis of document evidence related to Solarize** to provide a foundational understanding of the campaign and issues associated with it.
2. **A national survey of Solarize campaigns** to provide a broad understanding of Solarize, its characteristics, and the experiences associated with it, and

3. Interviews with stakeholders in Solarize campaigns to illustrate a more detailed picture of the dynamics created by Solarize within a community and illustrate dominant themes from the survey.

The survey asked a mixture of open and close-ended questions regarding the motivation behind adopting Solarize, the benefits and challenges of the campaign, and its successes and impacts to date. Open-ended questions were coded for dominant themes to highlight important aspects of the program. I sent the survey to 73 campaign organizers that resulted in a 47% response rate.

Results

About Solarize

Through the desk-based analysis I developed a database of previous Solarize campaigns. I determined Solarize has spread to over 16 states and 86 different communities since 2009, although I believe this is a vast underestimate of the campaign's growth to date¹.

Survey responses revealed a variety of motivations for adopting the Solarize campaign, with the most common answers: 1) increasing solar installations (47% of respondents) 2) environmental concerns (29%) 3) economic factors (23%) and 4) increasing education and outreach (21%). The majority (97%) of campaigns viewed themselves as a success, citing similar reasons as those underlying motivations including 1) increased solar installations (91%) 2) education and outreach (30%) 3) market development (18%) and 4) exceeding goals and expectations (21%).

Conceptualizing Solarize: Application of SNM

A) Key Characteristics

On the whole, I conclude individual Solarize campaigns robustly facilitate and promote the key processes of niche management:

1. **Shared expectations and visions**: Analysis of data on Solarize revealed two main findings regarding the nature of expectations and visions:
 - They are campaign-dependent: While survey respondents and interviewees referenced goals when speaking of campaign success, the nature of these goals and extent to which a community sets them remain campaign-dependent.
 - They are often short-term in nature: While Solarize campaigns often cultivate short-term goals during the program itself, many campaigns reported uncertainty for action beyond the primary campaign timeframe,

¹ Due to time limitations, I restricted my database to campaigns retaining the 'Solarize' name. However, evidence suggests many campaigns adopt the Solarize framework under a different name. Cook (2014) includes such campaigns and estimates 168 campaigns in 17 states have occurred to date.

leaving questions regarding post-Solarize steps to keep a community engaged.

2. **Learning at multiple dimensions:** With regards to learning, I find Solarize promotes learning amongst many actors, organizations, and dimensions.
 - Education of homeowners regarding solar PV, installers about the solar market, and campaign organizers about skills and ideas regarding methods of mobilizing the community lie at the heart of the campaign.
 - Data also provided evidence that ‘going solar’ prompts residents to learn about their energy consumption and reconsider usage.
3. **Network Building:** I find Solarize forges novel relationships between actors and organizations across sectors both within and between Solarize campaigns.
 - Survey results indicated that over 50% of the campaigns reported making contact with local government and businesses, voluntary organizations, state governments, and NGOs during program development and implementation. Notably, less than 50% of campaigns connected with regional and national businesses, and less than 15% connected with the national government, reinforcing the locally based nature of the campaign.
 - In addition, data reveals network building crucial to the growth and diffusion of Solarize: 30% of campaigns heard about Solarize from other campaigns and 97% of Solarize campaigns reported connecting with other Solarize communities to share experiences and materials. While key, I find these networks informal and regionally structured.

B) Growth and Diffusion

In regards to growth and diffusion, while replication represents the dominant means of growth for Solarize, up-scaling and translation have also facilitated the campaigns spread.

1. **Replications:** Replication represents the most clearly defined means by which Solarize has diffused through society with over 86 communities having run Solarize campaigns at least once.
2. **Up-Scaling:** Analysis of survey and interview data reveals up-scaling has occurred mainly through two channels:
 - Up-scaling the level of program organization from the community level to an intermediary organization (such as an NGO or government organization).
 - Growth in the demographic area covered by specific programs, ranging from individual neighborhoods to entire counties.

3. **Translation:** Of the 44% of survey respondents who reported running Solarize more than once, eight respondents referenced making alterations to the model structure, applying it to a new technology, targeting it to a specific population, or altering the model to better accommodate a community's needs.

Discussion

In this research I argue community-based actions play a key role in catalyzing systemic transitions towards a more sustainable energy future. Evaluation of the Solarize campaign through the lens of SNM and socio-technical transitions theory suggest several issues for theoretical development and recommendations for Solarize practitioners to take into consideration.

Contributions to Theoretical Development

1. **Dynamic SNM:** While this research suggests that Solarize fosters each of the key processes of niche development suggested by SNM, I find the theoretical framework struggles to capture the complex dynamics of community innovation, reinforcing previous findings in the literature. A more systematic and targeted conceptualization of the three key characteristics of niche development would increase coherent application of the theory in the literature and also augment the theory's ability to guide the development of community-based, niche innovations.

Recommendations for Practitioners

1. **Dialogue with Installers:** While Solarize addresses both social and technical issues associate with adopting sustainable energy, I find the technical aspects of the program remain underdeveloped. As the campaign continues to develop, as suggested by interviewees, I believe future practitioners should take steps to open dialogue with installers and ask what Solarize could do for them. Open communication would increase installer investment in the campaign and the ability for Solarize to promote significant and long-term market development. I believe this will be particularly important in regions where the solar markets are in early stages of development.
2. **Monitoring and Evaluation:** Increased efforts at monitoring and evaluation of the impacts of Solarize would help further the development of the campaign. I believe these efforts should specifically focus on whether or not the campaign leads to sustained market growth. Some interviewees voiced uncertainty regarding the reality of long-term market growth, a feeling reinforced by a series of news articles from various Solarize campaigns. I believe tangible, transparent data to support these visions would address these uncertainties could prove essential in gaining the trust of installers.
3. **Intermediary Actors:** Evaluation of Solarize revealed that while the diffusion of Solarize has been widespread, it has not always been strategic or managed. The literature on

SNM identifies the importance of intermediary actors such as NGO's or public agencies in connecting a developing niche with the wider system and translating locally based experiences into mobile and generic forms of knowledge. The growth of intermediaries associate with Solarize could help give the campaign's growth more depth and direction.

4. **Network Building:** The use of existing and cultivation of new networks has proven essential to the success of Solarize to date. This highlights the importance of using existing grassroots infrastructure when building a Solarize campaign but also brings into question how Solarize will permeate communities without such infrastructure. While my research does not necessarily provide an answer, this question requires serious reflection if Solarize is to significantly impact the energy system on both a local and national scale.

Concluding Thoughts

Evaluation of Solarize reveals individual community-based initiatives that provide promising examples of a community's potential contribution to addressing sustainable energy concerns. As measured by added renewable capacity, some interviewees reflected that while Solarize does significantly increase the rate of solar PV adoption in a community, total installations were a 'drop in the bucket' compared to what is possible and necessary for a systemic transformation. However, I believe increased capacity represents only one of many wider impacts of Solarize. While Solarize itself lasts only a short time, the program offers a multitude of additional benefits. Its ability to help homeowners rethink their energy practices, provide community activists with a tried and true model of action to inspire new ways of capturing the potential of community-based action, and serve as a link between a range of stakeholders across sectors and scales could prove equally impactful as added capacity alone. I believe this ability to influence the energy transition in so many diverse ways at the same time underlies the campaign's great potential to drive change.

Sample References

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