EUROPEAN POLICYBRIEF

Science Transformation in EuroPe through Citizens involvement in HeAlth, coNservation and enerGy rEsearch

CSI on energy communities in Germany

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INTRODUCTION

The Citizen Science Initiative - as part of the EU-funded Step Change Project[1] - focused on the under-exploited potential of photovoltaic systems on multi-family buildings, mainly implemented through the so-called tenant electricity model. As multi-family buildings accommodate around half of the German housing stock, the involvement of tenants in the production of clean electricity is key to boost the urban energy transition (Moser, et al., 2021).

The research within the Citizen Science Initiative on energy communities in Germany focused on an inclusive research approach by involving multiple actors such as citizen scientists, scientists, policymakers, and the private sector. In addition to the barriers and drivers for the tenant electricity model, the motivations of the citizen scientists to participate in the model were examined. Furthermore, the initiative examines behavioural changes of the citizen scientists (based on the energy culture concept) due to their involvement in local electricity production and consumption.

[1] The EU-funded Step Change Project has implemented five research initiatives, called *Citizen Science Initiatives* (CSIs), in the fields of health, energy, and environment. Overall, the Step Change project builds on the assumption that citizen science can play an important future role by adding value to science and changing the way society views research. The overall objective of the project is to explore the potential of citizen science in the above-mentioned areas and formulate recommendations for better integrating this approach within R&I processes and institutions.

The Step Change conceptual framework

To provide our results with a frame, our CSI has chosen the framework of **Energy Cultures**, which was introduced to analyze and understand the motivations behind changes in energy efficiency behaviors by attending to behavioral drivers (Stephenson, et al., 2010). The three main pillars that characterize the Energy Cultures framework – norms, material culture, and energy practices – interact and influence each other. E.g., one's socialization (norms) affects technological preferences (material culture) and actions (energy practices). The framework's core hypothesis is "that stabilization of behaviour occurs, where norms, practices and technologies are aligned – that is, where the dynamics between the three components are self-reinforcing. Potential for behaviour change arises when one of these components becomes misaligned or shifts […]." (Stephenson, et al., 2010, p. 6125).

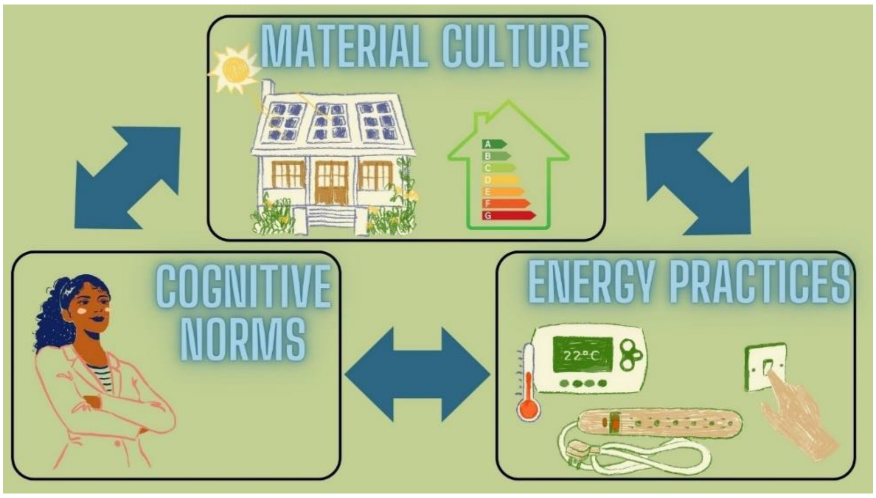

Figure 1: Examples of three main pillars of Energy Cultures (image created by authors)

Results

Motivation for the tenant electricity model

The main motivation for participating in tenant electricity was sustainability and local production of electricity, while the price of electricity played only a minor role. However, for almost a fifth of the participants availability and promotion of the model in the house was the main reason to participate. This means that a certain proportion of tenants can be mobilized without having sustainability as a major concern or being sensitive to low prices.

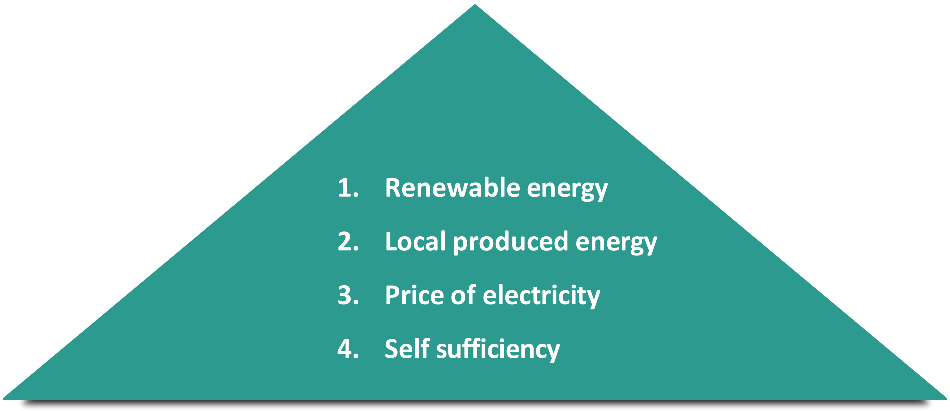

Figure 2: Ranking of motivation for participating in tenant electricity

Behavioural changes in energy culture

Changes in ***energy culture*** were examined from *participation in tenant electricity* projects, receiving *feedback on regular consumption data*, and through *the participation in this Citizen Science Initiative.*

Overall, results show ***tenant electricity*** has led to a stronger exchange among neighbours about further sustainability options in the building and to a higher interest in sustainability or engagement in society.

F*eedback on regular consumption data* was perceived by almost all participants as useful for further measures to save electricity. Energy data collected from installed intelligent meters showed, on average, a reduction in electricity consumption for more than half of the households, compared to the start month of the research period. "Gamification", like comparing the electricity consumption with comparable households, can be seen as a promising new field, which motivates citizens to save even more electricity and become more sustainable.

Participation in the Step Change project prompted about half of the citizen scientists to start tracking their electricity consumption regularly, and around 40% reported improved energy behaviour. Around a third of participants became more aware of energy efficient devices and around one quarter made changes related to energy-intensive activities (e.g., mobility, reducing flights).

A detailed ***cluster analysis*** has been conducted to find different profiles and gain a deeper understanding of the characteristics of the citizen scientists. In total 5 clusters were identified, with differences in energy consumption patterns, energy efficient appliances, knowledge about energy consumption, and changes in energy practices due to the participation in tenant electricity and the research project. When referring to the changes caused by the participation in tenant electricity, one cluster stood out. In this cluster participation led to further interest or action in nearly all the above-mentioned areas. This is of special interest as people of this cluster had the highest relative energy consumption of all five clusters, an overall low material culture (inefficient devices) and low knowledge about classifying their electricity consumption in regard to comparable households. As the cluster covers nearly 20% of the participating citizen scientists, it is diverse in income and household composition. It can be seen as the group on which tenant electricity had the biggest impact, causing the citizens to reflect about and change their energy culture in a positive way.

Barriers for the tenant electricity model

The research allowed us to identify **barriers** for the *tenant electricity model* encompassing both structural and inherent challenges. Structural barriers include:

- **I) a lack of (former) political will to promote the model,**
- **II) resulting in the complexity of the model,**
- **III) and low economic incentives to implement the model on a broader scale.**

In addition to these structural barriers, inherent barriers to the model include:

- **IV) a lack of *information* about the model at all levels and**
- **V) a lack of *initiators* who are able to drive the implementation of the model at the local level.**

Drivers for the tenant electricity model

Drivers for scaling up the model include the reduction of the complexity and bureaucratic hurdles of the model[2] as well as regulations (e.g., mandatory PV for new buildings) and financial incentives to foster the expansion of tenant electricity. Targeted information for residents should be provided by local authorities as well as energy supply actors, while residents can use a bottom-up approach by promoting tenant electricity at owner´s assemblies. A detailed list of drivers is shown in the next chapter "policy recommendations and actions".

POLICY RECOMMENDATIONS AND ACTIONS

The formulation of policy recommendations and concrete actions of the research are adapted to the current political development of the tenant electricity model. The recommendations consider the improvements under the "Solarpaket" from 16th of August 2023 with changes on the tenant electricity model and introduction of community supply within multi-family buildings.

[2] The federal cabinet approved the "Solarpaket" on 16th of August 2023 with improvements on tenant electricity model and introduction of community supply within multi-family buildings. Source: https://www.bundesregierung.de/breg-de/aktuelles/solarpaket-2213726, accessed August 24, 2023

Description of objective	Action	Responsibility	Expected Impact
Simplifying the model	Screening best practice examples from other EU countries. (E.g. Spain, sharing of energy is allowed within a distance of 500m without any grid fees)	Politicians	Selling produced electricity to further households allows higher return on investment
	Requiring grid and metering operators to apply a standardised and cost-efficient metering concept.	Politicians	A standardised and efficient metering concept allows better investment planning for tenant electricity
	Reducing the complexity of the tenant electricity contract by using standard agreements	Energy companies	Standardised tenant electricity contracts enable better understanding of the model for housing owners and tenants and reduce the bureaucratic effort
Economic incentives	Paying a one-time premium to property managers to enable tenant electricity	Politicians	Property managers have a high influence on the implementation of tenant electricity due to their consulting role. Impact depends on amount of one-time premium
	Providing tax benefits to building owners for the adoption of tenant electricity	Politicians	Reduced income tax on revenues from renting photovoltaic plants to tenant electricity providers and reduced income/business tax for housing companies and associations (on >100 kWp PV plants) will leverage the implementation of tenant electricity
	Supporting tenant electricity programs within cities and municipalities in Germany	Local Authorities	Depends on amount of incentives, good practice for tenant electricity e.g. “Münchner Förderprogramm Klimaneutrale Gebäude”
	State mandate: promoting energy cooperatives (when implementing tenant electricity) with state funds	Local Authorities	Federal state programmes supporting energy cooperatives as crucial actors for the energy transition and tenant electricity
	Approach appropriate funding bodies for support in implementing tenant electricity projects	Energy cooperatives	Energy cooperatives receive additional funding for implementing tenant electricity which leads to a higher distribution of the model
	Implementing a 2-tariff system (electricity is cheaper if it has been produced with the PV system)	Tenant electricity provider	Incentive for tenant-electricity users and higher consumption rate of produced electricity results in a higher return on investment

Description of objective	Action	Responsibility	Expected Impact
	Showing the potential increase in real estate value through the use of photovoltaic solutions	Local Authorities, property managers	Owners and housing cooperatives perceive additional benefit of implementing tenant electricity
Regulation	Making it compulsory to install photovoltaic technologies in new buildings	Politicians, local Authorities	Estimated high impact in terms of distributing tenant electricity, especially if it is also compulsory for roof renovations (best practice: state of Baden-Württemberg)
Information	Giving municipalities a role as information providers (e.g. cities could screen PV cadastre and approach owners)	Local Authorities	A proactive way of local authorities convincing owner and tenants of implementing tenant electricity with targeted information and raising awareness about decentralized energy supply.
	Exchanging with other committed owners and/or cooperative members	Owners/housing cooperatives	Crucial for the implementation of the tenant electricity are initiators who are able to drive the implementation of the model at the local level (bottom-up approach)
	Preparing information on the model for the members/ owners' assembly and/or inviting energy companies to present the model to the local communities	Owners/housing cooperatives	Crucial for implementation of the tenant electricity are initiators who are able to drive the implementation of the model at the local level (bottom-up approach)
	Targeted marketing (e.g. for property managers, owners' meetings, housing cooperatives, and energy cooperatives) highlighting both, the financial and ecological (reduced emissions) benefits	Energy companies, Tenant electricity providers	Increasing awareness and supply options through the tenant electricity model
	Referring to the tenant electricity model in billing statements, stating the potential savings in emissions and costs.	Energy companies, Tenant electricity providers	Increasing awareness and supply options through the tenant electricity model
	Including information about the own electricity production and consumption in the electricity bill	Tenant electricity providers	Coining energy culture of existing tenant electricity customers

Description of objective	Action	Responsibility	Expected Impact
	Informing boards of directors of citizen energy cooperatives about the model and its benefits	Energy companies, public authorities	Increasing distribution options for the tenant electricity model
	Realtime feedback on electricity consumption data for the households (through software with "gamification")	Tenant electricity providers	Increasing distribution options for the tenant electricity model, as households can save more energy (In our case: Reduction in electricity consumption for more than half of the households compared to the start month of the research period). "Gamification", like comparing the electricity consumption with comparable households can be seen as a promising new field, which motivates citizens to save energy.
Cooperation	Cooperating with landlords (e.g. Haus und Grund e.V.)	Energy companies, Tenant electricity providers	Increasing distribution options for the tenant electricity model
	Having short response time to tenant electricity providers	Network and metering operators	Good cooperation lowers barriers for the implementation of the model

References

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Project Identity

Project name	Science Transformation in EuroPe through Citizens involvement in HeAlth, coNservation and enerGy rEsearch (STEP CHANGE)
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Consortium	Aarhus Universitet, Aarhus, Denmark Action For Rural Women's Empowerment, Kampala, Uganda Conoscenza e Innovazione scrl, Rome, Italy European Science Engagement Association, Vienna, Austria Oxford University Hospitals NBS Foundation Trust, National Institute For Health Research Oxford Biomedical Research Centre, Headington, UK Science for Change, Hospitalet De Llobregat, Spain Università degli Studi di Roma Tor Vergata, Department of Biology, Rome, Italy Univerza na Primorskem Università del Litorale, Koper, Slovenia Verein Der Europaeischen Burgerwissenschaften E.V. Berlin, Germany Women engage for a common future, Munich, Germany Zentrum Fur Soziale Innovation GMBH, Vienna, Austria
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Further reading	