

Energimyndighetens titel på projektet – svenska <b>Smarta elnät – framtidens elnät för alla?</b>	
Energimyndighetens titel på projektet – engelska <b>Smart grid – a future electricity grid for all?</b>	
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Nyckelord: 5-7 st <b>Smart grids, users, vulnerability, social inclusion</b>	

*Energimyndigheten rekommenderar att denna mall används vid slutrapportering. Om annan slutrapportmall används ska ändå motsvarande innehåll finnas med i den. Innan du skickar in rapporten ska stödtexterna raderas.*

*Huvudsyftet med slutrapporten är att den ska kunna användas för att sprida projektets resultat. Den blir öppet tillgänglig i Energimyndighetens projekt-databas. Om projektet vill lämna in information som inte ska tillgängliggöras via Energimyndighetens projekt-databas ska denna läggas i separat bilaga.*

*Information av administrativ karaktär (formell utvärdering av måluppfyllelse, beskrivning och motivering av avvikelser etc) ska rapporteras i den obligatoriska administrativa bilagan (se mall på Energimyndighetens hemsida). Den administrativa bilagan publiceras inte i Energimyndighetens projekt-databas.*

## Förord

*Här ska stå vilka som har finansierat projekten samt andra som bidragit till ett lyckat projekt t ex referensgrupp.*

The project *Smart grid – a future electricity grid for all?* has been funded within the research and innovation program SamspeL at the Swedish Energy Agency. It has been carried out by the Department of Thematic Studies, Theme Technology and Social Change, Linköping University in cooperation with Umecon AB. Representatives from Vattenfall, PRO, the Swedish Local Fibre Alliance (Svenska Stadsnätsföreningen), Umeå Energi and the Swedish Energy Market Inspectorate have been engaged at different times in the project's reference group and contributed to the discussions of the project disposition and its findings. We very much appreciate the support of all these groups.

## Innehållsförteckning

*Nedan ligger en kod för innehållsförteckning. Förutsatt att du använder formatmallarna för rubriker så kommer rubrikerna automatiskt med i innehållsförteckningen när du klickar på förteckningen och trycker på F9.*

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## Sammanfattning

*En sammanfattande beskrivning av innehållet i slutrapporten på en halv till en sida.*

*I sammanfattningen förklaras vilket problem/utmaning ur ett energiperspektiv som projektet har hanterat? Vad har gjorts för att besvara frågan och lösa utmaningen? Beskriv kort vilka resultat projektet har och hur de kan tolkas och användas. Vilken är den nya kunskap som kommit fram genom projektet? Vad blir nästa steg? Sammanfattningen bör skrivas i "journalistisk anda" med de viktiga resultaten och nyhetsvärdet först.*

Projektet syftar till att göra smarta elnät mer inkluderande genom att öka kunskap om användare som kan bli sårbara eller marginaliserade i smarta elnät. Projektmålen är att identifiera vilka hushållskunder som riskerar att hamna i utanförskap genom smarta elnät, att redogöra för de barriärer som kan uppstå för hushållskunder från att fullt ut dra nytta av smarta elnät och att utveckla strategier för bredare inkludering av hushållskunder i smarta nät. Projektresultat ger insikter om att förstå elkonsumenters sårbarhet och marginalisering genom smarta elnät, inklusive både hur det ska tänkas om sociala grupper som riskerar att marginaliseras i smarta elnät samt vilka barriärer som kan hindra elkonsumenter från att fullt ut delta i smarta elnät.

I projektet har genomförts 20 intervjuer med (a) energibolag, myndigheter som arbetar med energifrågor, testanläggningar och bostadsbolag som har testat olika smarta energiprodukter och -tjänster samt (b) intresseorganisationer och myndigheter som representerar eller har goda kunskaper om sociala grupper som riskerar att marginaliseras i smarta elnät. Fokusgrupper med personer som nyligen fått uppehållstillstånd i Sverige samt de som har bott i landet några år har genomförts.

Spridning av projektresultat har utförts genom fem akademiska publikationer, fyra konferensbidrag, en rapport, en kort sammanfattning av projektresultat för beslutsfattare och industri, en kort film samt en offentlig workshop. Strategier för

att minska risker av marginalisering i smarta elnät presenteras i rapporten och en kort sammanfattning. En debattartikel planeras att skickas in till en dagstidning i Sverige.

## Summary

*En sammanfattande beskrivning av innehållet i slutrapporten på engelska på en halv till en sida. Motsvarande sammanfattning som den svenska.*

The project aims at making smart grids and its related services more inclusive by increasing knowledge on potentially vulnerable and marginalized smart grid users. The project's objectives are to identify types of household consumers that risk becoming marginalized and neglected in smart grids, to describe barriers that can hinder household consumers to make full use of smart grids and to develop strategies for a broader inclusion of household consumers in smart grids. The project findings offer insights into a better understanding of vulnerability and marginalization of electricity consumers in smart grids, including both how to think about social groups that risk being marginalized in smart grids and what barriers that can hinder them to fully participate in smart grids.

In the project, 20 interviews were conducted with (a) the energy companies, public authorities that work with energy matters, test environments and property companies that have tested various smart energy products and services and (b) interest organizations and public authorities that represent or work with social groups that could potentially be marginalized in smart grids. Focus groups with people that had recently received resident permits in Sweden and the ones that had lived in Sweden for several years were carried out.

The dissemination of the project findings has been conducted through five peer-reviewed publications, four conference presentations, a project report, a policy brief, a short video, and a public workshop. Strategies for reducing risks of marginalization of some social groups in smart grids are summarized in the project report and the policy brief. A debate article is being planned to be submitted to a daily newspaper in Sweden.

## Inledning/Bakgrund

*Beskriv bakgrund och skäl till varför projektet har genomförts. Vad är utmaningen/problemet? Orientering inom området; problembakgrund. Vad behöver göras (i energisystemet). Vilka behov i samhället eller på marknaden ska projektet hjälpa till att tillgodose och vilken nytta förväntas projektet bidra med. Lite om kunskapsläget. Hur angrips frågan i detta projekt, vad är syftet, finns det några hypoteser, osv. Huvudman, finansiering, tid som projektet pågått etc.*

Smarts grids is one of the priority strategies in climate and energy policies in Sweden and in other countries. Smart grids are often defined as digitalized electricity grids that encompass new technologies, business models, regulations, smart energy products and services (SOU 2017:2, p. 223). Smart grids may mean

different things related to digitalization of electricity grids depending on a perspective. Electricity consumers are sometimes placed at the center of smart grid visions with expectations to actively engage with smart grids (Gangale, Mengolini, and Onyeji 2013; Geelen, Reinders, and Keyson 2013; Strengers 2013; Wallsten 2017). Household consumers can engage with smart grids through using of smart energy products and services enabled by smart meters for the purposes of visualization of energy consumption and its effectivization, and through becoming prosumers. Smart grid users are envisioned to be “interested, immersed, and engaged in managing their energy demand, and willing and able to embrace new smart technologies and strategies to achieve energy-management goals” (Strengers 2014, p. 25). They are anticipated to have digital competences, technological interests and economic resources to become active smart grid users. At the same time, there are electricity consumers that would not fit to this description, for instance, due to their limited economic resources to invest in smart energy products and services or limited digital competences. Interests and needs of these electricity consumers may be neglected and marginalized in smart grids. Considering the significant public investments in smart grid development and the fact that smart grids may in fact need as many users as possible to operate properly, the challenge that this project works with is how to make smart grids inclusive of needs and interests of many kinds of household consumers, not just the ones that could be seen as a “typical” smart grid user. Moreover, there is a market potential for developing smart energy products and services that target these groups of electricity consumers specifically.

The project aims to identify types of household consumers that risk becoming marginalized and neglected in smart grids, to describe barriers that can hinder household consumers to make full use of smart grids and to develop strategies for a broader inclusion of household consumers in smart grids. The project findings offer insights into understanding of vulnerability and marginalization of electricity consumers in smart grids, including both how to think about social groups that risk being marginalized in smart grids and what barriers that can hinder them to fully participate in smart grids. The project contributes to making smart grids more inclusive by increasing knowledge on potentially vulnerable and marginalized smart grid users. Results of this project are important for successful development and implementation of smart grids that benefit as many as possible electricity consumers and society in general.

The project is situated within the research field on smart grid users. A significant share of the research on smart grid users focuses on drivers and barriers of acceptance of smart energy products and services and perceptions about them (Balta-Ozkan et al. 2013; Balta-Ozkan, Amerighi, and Boteler 2014; Buchanan et al. 2016; Hargreaves, Chilvers, and Hargreaves 2015; Paetz, Dütschke, and Fichtner 2012; Soland et al. 2018). There are also studies that examine the potential for changes in energy behavior in context of social practices (Cecilia; Katzeff, Wessman, and Colombo 2018; Cecilia Katzeff and Wangel 2015). Apart from the often mentioned barriers for smart grid acceptance such as trust to energy companies, Sovacool et al. argue that increased vulnerability and resistance to smart

grids can be the reasons for non-acceptance of smart energy products and services (Sovacool et al. 2017).

At the project start, few studies specifically focused on vulnerable smart grid users (Barnicoat and Danson 2015; Nicholls, Strengers, and Tirado 2017; Sovacool et al. 2017) but this subfield has been growing since then (Shirani et al. 2020; Thomas, Demski, and Pidgeon 2020). Diverse social groups have been listed as potentially becoming more vulnerable in smart grids such as for instance elderly, people with health conditions, tenants, low-income households. The project contributes to this growing subfield by introducing the discussion on what vulnerability and marginalization in smart grids may mean for electricity consumers and for society in general and by suggesting how to go beyond the focus on broad and heterogeneous social groups. It also contributes a systematic review of barriers that can hinder electricity consumers from engaging with smart grids to a full extent.

Apart from increased vulnerability in smart grids, another factor for non-acceptance of smart grids is related to resistance (Sovacool et al. 2017). Studying non-use of smart energy services Kahma and Matschoss come to conclusion that non-interest plays a much higher role than an active resistance (Kahma and Matschoss 2017). Therefore, it becomes crucial to zoom in interest and disinterest of electricity consumers in smart energy products and services. It has been suggested that vulnerable electricity consumers may be even less interested in smart energy products and services (Nicholls, Strengers, and Tirado 2017; Shirani et al. 2020). The project contributes with examination of this suggestion based on potentially vulnerable group of electricity consumers that were not considered in the previous studies. As a project broadly placed within the research of just and equal energy transition, it also contributes to studies on energy democratization and understanding of marginalization and injustice in energy transitions.

The project has been conducted by the Department of Thematic Studies, Tema Technology and Social Change, Linköping University in cooperation with Umecon AB. Umecon AB has expertise in developing products and services for reducing digital exclusion and broad knowledge of questions related to integration. The project has been carried out from October 2017 to September 2021.

## Genomförande

*Beskriv de olika delmomenten/arbetspaketen i projektet samt vilka metoder som har använts. Vilka projektdeltagare/grupper har medverkat i projektet?*

The project implementation was divided in the four phases, including (a) literature review, (b) interviews with the energy industry and stakeholders in smart grid development and interviews with interest organizations and public authorities that work with social groups that could potentially be marginalized in smart grids (c) focus groups with social groups that risk being marginalized in smart grids, (d) dissemination of the project results. The researchers at Tema Technology and Social Change at the Department of Thematic Studies at Linköping University

carried out the work in all phases, in cooperation with project members from Umecon AB in the last two phases.

The literature review was conducted in the beginning of the project and later in the first half of the project implementation when a need for additional literature review was identified. Initially, the research literatures that focus on digital divides and energy poverty were reviewed. It was later complemented by the review of studies of energy justice and energy democracy. The aim of the literature reviews was to identify what social groups have been considered vulnerable and potentially marginalized in smart grids and to find analytical perspectives that could help to understand and explain processes of marginalization of some electricity consumers in development of smart grids.

The interview study includes 20 interviews in total. They were conducted in two rounds, from April to September in 2018 (10 interviews) and from April 2019 to January 2020 (10 interviews). The majority of the interviews were face-to-face with one Skype interview and one via telephone call. The respondents represent two different groups. The first group of respondents consists of the energy companies, public authorities that work with energy matters, test environments and property companies that have tested various smart energy products and services (12 interviews). The interviews were guided by questions of how respondents think about future smart grid development, what role of citizens is expected in future smart grids, who can be expected to be marginalized in smart grids and in what ways, what consequences it may have and what solutions and strategies can they envision.

The second group of respondents includes interest organizations and public authorities that represent or work with social groups that could potentially be marginalized in smart grids (8 interviews). Social groups that were identified to be potentially marginalized in smart grids were selected based on the review of the previous research and interviews with the first group of respondents. The aim of the interviews was to understand how respondents reflect on needs and interests of a social group that they work with in relation to smart grids, what should be considered in smart grid development and how to make smart grids more inclusive in general.

Focus group interviews were carried out at two occasions. At the first occasion in September 2018, two workshops on smart energy products and services were held during a wilderness week (en vildmarksvecka) in Sikfors, Piteå municipality. This week was organized for people that had recently received resident permits in Sweden. The aim of the workshops was to develop and test methods to identify needs, interests, and conditions of a social group.

The second occasion when the focus group interview was conducted took place in Skellefteå in December 2019. The target group was similar to the first focus groups, including also people that had lived in Sweden for several years. In total it was 10 people that took part in this focus group interview. The aim with this focus group was to explore and better understand needs, interests and specific circumstances of potentially vulnerable smart grid users. Organization of the focus group interviews

at both occasions became possible through contact networks of the project members from Umecon AB.

In the project meetings a possibility to organize focus groups with other social groups that may be at risk of marginalization in smart grids was discussed several times. However, due to the pandemics these plans were discontinued since it was deemed unreasonable to attempt to organize a focus group interview through digital channels with social groups that are less used to digital products and services.

Dissemination of the project results have taken place through channels targeting academic audiences and the energy industry and stakeholders to smart grid development. The various aspects of the project findings were presented at the 14<sup>th</sup> Conference of European Sociological Association in August 2019, 5<sup>th</sup> Energy and Society conference in February 2021, and 15<sup>th</sup> Conference of European Sociological Association in September 2021. The research was also presented at the international workshop “*We are on a mission*”. *Exploring the role of future imaginaries* in Berlin in 2018. The short video about the project was produced by PowerCircle. It is available at [framtidenssystem.se](http://framtidenssystem.se) which aims to collect knowledge and disseminate information about the projects within SamspeL program to the public sector, the energy industry, stakeholders to electricity grid development and researchers. A public workshop where the findings were presented and discussed was organized in June 2021. The findings will also be made available through a report for the stakeholders and a policy brief. Writing a debate article for a daily newspaper in Sweden is currently under way.

## Resultat

*Beskriv resultat och slutsatser som genererats inom ramen för projektet.*

*Här beskrivs de resultat som får vara offentliga eftersom alla slutrapporter ska vara sökbara i Energimyndighetens projektdatabas.*

*Information som projektledaren bedömer som konfidentiell och ej ska publiceras externt kan rapporteras i bilagor. Bilagor som inte ska publiceras externt ska märkas upp genom att ”KÄNSLIG INFORMATION” skrivs in i dokumentets rubrik. Alternativt kan dokumentet vattenstämplas med ”KÄNSLIG INFORMATION”. Dessutom ska i filnamnet läggas in ordet ”KÄNSLIG INFORMATION”.*

The **literature review** of the research on smart grid users demonstrates that the research on electricity consumers that can be marginalized or even excluded in smart grids or not able to fully benefit from smart grids is limited, although it has been growing. Several social groups have been identified as potentially more vulnerable in smart grids, including low-income households, low-educated electricity consumers, elderly, consumers with disabilities and health conditions, inhabitants of rural areas, tenants in rented accommodation, sole parents, immigrants.

The result of the **interviews** is the collection of empirical material that gives possibility to analyze how stakeholders reflect on the role of electricity consumers

in future energy systems, what social groups can become marginalized or excluded and how marginalization can take place. The respondents identify social groups that risk being marginalized in smart grids in a similar way to the previous studies on smart grid users. This project contributes to the existing body of knowledge by providing a more nuanced understanding about electricity consumers that can be affected negatively in smart grids. The respondents emphasize that all mentioned social groups are heterogeneous in nature and, therefore, they could not be seen as generally vulnerable in smart grids. At the same time, some electricity consumers in the mentioned groups could become significantly more marginalized in smart grids than they were before and, specifically, if they do not have a support to adopt to smart grids.

The interviews with interest organizations that represent social groups of interest for this project or public authorities that work with them demonstrate that smart grids have been discussed to limited extent or not at all in these organizations. At the same time, digitalization and accessibility of digital products and services has been a big issue for them. Some respondents emphasize importance of following principles of universal design when smart energy products and services are developed.

The respondents often point out the crucial role of incentives that can stimulate consumer engagement with smart energy products and services. While importance of economic incentives is often emphasized, other incentives such as contribution to climate change mitigation and control over home are also mentioned. Some respondents however do not consider that economic incentives could create a significant difference in terms of electricity engagement with smart energy products and services.

Interest is often named as another important factor for electricity consumers to engage with smart energy products and services. The respondents acknowledge that some social groups may be more interested in smart energy products and services than others and there is no expectation that everyone will be interested to be actively involved in monitoring and managing electricity load through smart energy products and services. Electricity consumers' interest and disinterest in smart energy products and services requires further discussion, specifically, in relation to the question of how disinterest can be taken into account in smart grid development. The respondents' ideas about what could affect vulnerable consumer engagement in smart grids suggests that there is a need for a discussion of what vulnerability and marginalization in smart grids could mean.

Interest in becoming active smart grid users and engagement in smart energy product and services are anticipated to differ and be higher among citizens living in single-family houses than among citizens that own or rent an apartment, even if smart grids are expected to be for the benefit of society in general. This group of users is considered to have greater interest, economic incentives and capacities to become active smart grid users. It is important to consider potential implications of one group being more visible in discussions of future energy systems and its effects on smart grid development. The interviews demonstrate that it is important that



users are placed in the center of smart grid development and this development is based on various interests, needs and conditions.

The results from the first **focus groups** are findings that a group of people that have recently received residence cards in Sweden is very heterogeneous with different needs, interests, background and levels of education. It leads to conclusion that it is not possible to think about the whole group as particularly vulnerable to smart grids. Another result from these focus groups concerned testing of methods for carrying out this type of interviews. The findings of the second focus group were that respondents generally think about energy matters, and they are used to saving energy. Much attention was given to possibilities of adapting daily routines to a more sustainable energy behavior. Being a non-native Swedish speaker may be a hindrance in communication with the energy companies.

The analysis of how interview respondents reflect on electricity consumers and smart grid users that can become marginalized in smart grids became the basis for the **first article** that is submitted to a journal (draft attached). The previous research on vulnerable smart grid users has to a large extent focused on such groups as low-income households and elderly with some attention to other social groups that can be negatively affected in smart grids. One of the findings of this analysis is that national contexts can play a role on how vulnerable electricity consumers can be understood. That means that it is important to continue the discussion on who and how can become at risk of marginalization in smart grids. Another finding of that analysis is that respondents consider that not only that far from all in identified social groups are at risk of marginalization in smart grids, but some vulnerable consumers can also be affected to a higher degree than others. Such social groups as elderly rural inhabitants, elderly with immigration background and consumers with low income/low education levels were mentioned several times as potentially more vulnerable in smart grids. The third finding is that some respondents consider that the digital divides among electricity consumers can increase in smart grids. The discussion of meanings and implications of energy democratization based on the case of smart grids will be the result of the **second** article (draft available upon request).

In addition to the 2 articles promised in the project plan, further scientific papers are planned or are about to be published. The **third article** (work in progress) presents the analysis of conditions and circumstances that can lead to marginalization in smart grids. Based on the analysis of material collected in the project, it is deemed to be more productive to understand marginalization of some electricity consumers in terms of conditions and circumstances than specific sociodemographic groups. To compose a list of conditions and circumstances that can contribute to marginalization of electricity consumers in smart grids, several analytical approaches are consulted, including energy poverty, energy democracy and justice, STS research on infrastructures, digital divides literature as well as empirical material collected in the project. Conditions and circumstances that can make some consumers more vulnerable in smart grids lie at structural and individual levels, including, for instance, policies and regulations, access to infrastructure, skills, and competences (energy and digital literacy), economic

resources. The analysis of the respondents' reflections on the role of consumer (dis-)interest in adaptation of smart energy products and services will be the result of the **fourth article** (work in progress). Consumer interest and lack of thereof can be crucial for diffusion of smart energy products and services. The analysis of empirical material suggests that the argument about less interest in smart energy products and services among vulnerable consumer groups requires a more nuanced discussion. Moreover, visions of consumer engagement in smart grids seem to have been changing with less expectations of everyday consumer engagement with smart energy products and services. The result of the analysis in a **book chapter** (accepted for publication, draft attached) points out that while smart grids are imagined contributing to a more democratic and inclusive energy system, little change in terms of power relations and is observed in practice. Diversity of user perspectives do not seem to be in focus of the smart grid development.

The analysis of empirical materials results in the **list of strategies** that can reduce the risk of marginalization of some groups of consumers in smart grids. The list of strategies is presented in the policy brief (in the attachment). The strategies include such measures as inclusion of diverse social groups in product and service development, enhancing trust to actors in the energy systems, information campaigns for raising awareness smart grids and increasing energy literacy, infrastructure development, specific measures targeting electricity consumers who are less used to using digital products and services.

## Diskussion

*Diskussion med tolkning av resultaten, resultaten sätts i ett energisammanhang. Vad kan de komma att betyda för utvecklingen av ett hållbart energisystem. Vad behöver göras härnäst? Beskriv gärna vilka effekter i samhället som projektet kan förväntas leda till.*

The study of how social groups will not only be positively affected by smart grids began with the question of how to define vulnerability and marginalization in smart grids. In the previous studies, vulnerable consumer groups are often understood in socioeconomic terms and in connection with energy poverty. In an attempt to identify what consumer marginalization in smart grids may mean in the Swedish context, the analysis of how stakeholders reflect on marginalization and vulnerability of electricity consumers in smart grids was conducted. Energy poverty seems to be much less relevant in the Swedish context. Instead, stakeholders discuss the question of marginalization and vulnerability in smart grids in terms of what kind of households can be interested and may benefit from smart energy products and services. House owners, including specifically houses with electric heating, are expected to have economic incentives and interest to engage with smart energy products and services. They are much more often referred to when users of smart energy products and services are discussed. Inhabitants of own and rented apartments are not considered to have the same level of incentives and interest. Electricity consumers that do not have economic incentives to engage with smart

energy products and services seems to be less in focus when electricity consumers in smart grids are considered. It leads to conclusions that marginalization and vulnerability of electricity consumers in smart grids may be understood differently in various national energy contexts. Therefore, further studies that specifically scrutinize how marginalization and vulnerability of electricity consumers in different national energy contexts may be understood are needed. Although respondents acknowledge that some consumers may have a harder time to adapt to smart grids, consumer marginalization in smart grids does not seem to be paid specific attention. For a majority of interest organizations that work with identified social groups that took part in the interview study, smart grids have not been a subject of discussion, although many of them work with matters related to digitalization. The analysis demonstrates that it is important to pay attention to differentiation in terms of citizens' uptake of smart energy products and services as it may deepen digital divides and contribute to raising inequalities in society.

The analysis of the empirical material presents a more nuanced understanding of what social groups can become marginalized in smart grids. It is not possible to define these social groups in broad terms because only some citizens in the above-mentioned social groups will be affected. Instead, a more precise understanding of who will be negatively affected in smart grids is required to reduce risks of marginalization. As potentially raising inequality among citizens in smart grids has been mentioned several times in the interviews, it seems that the way to go about user marginalization in smart grids is to start with targeted actions for considering social groups that have been identified as more at risk of marginalization than any other groups, such as elderly in the rural areas, elderly with immigration background and consumers with lower socioeconomic status. The results of the project demonstrate that another way of thinking about reducing risk of electricity consumer marginalization in smart grids is to focus instead on conditions and circumstances of marginalization and exclusion, rather than on social groups.

Smart grids are still in the process of development, and it is yet unclear what exactly smart grids will imply for electricity consumers and what adjustment in energy behavior they will be asked to do, if any at all. It seems that many respondents do not think that electricity consumers will be engaged with smart energy products and services daily. They anticipate that electricity consumers will become more aware about energy consumption and may become engaged in some ways, for instance, through buying and installing smart energy products and services that provide automatized solutions for adopting household energy behavior to needs of energy systems. In this early-stage development, it is important that diversity of user perspectives, needs and interests is not only acknowledged by actors in the energy system but also actively taken into consideration in planning and developing smart grids. A possible way of embracing diversity of user perspectives in smart grids could be to place interests and needs of consumers that risk being marginalized and neglected at the center of development. In case electricity consumers are not expected to directly interact with smart grids, it is not least important to develop automatized smart energy solutions with consideration of various needs and interests. For instance, people with some health conditions may be particularly sensitive to in-house temperature and could be negatively affected if they do not

have an opportunity to override automatic pre-set temperature. Without mainstreaming the focus on inclusion in smart grid development, there are risks that trust in energy companies will decrease and that fewer consumers will accept smart grids. In the future it seems worthwhile to conduct research on how consumer needs and energy consumption behavior are inscribed and designed into automatic solutions in smart grids and how electricity consumers can participate in the design and development of smart grids.

Respondents often associate non-engagement with disinterest related to generally limited interest to digital products and services or lack of incentives to engage with smart energy products and services. The analysis demonstrates that electricity consumers are expected to differ in terms of the level of interest and engagement as well as they are considered to have different levels of energy and digital literacy and competences. In future development of smart grids and smart energy products and services, it is important to ensure that flexibility is embedded in smart grids, so electricity consumers have opportunities to choose the depth of interaction with smart energy products and services. This can also increase trust in energy companies and energy systems as needs of consumers will be at the center of engagement with smart grids.

The analysis of focus group interviews suggests that further studies of (dis-)interest and potential engagement with smart grids among electricity consumers in the social groups identified as potentially more vulnerable in smart grids are needed. The material based on focus groups collected in the project is limited but it opens new ways of thinking about interest and engagement among electricity consumers that could be potentially more vulnerable in smart grids. The argument about less interest in smart grids among vulnerable groups of consumers needs to be tested with a broader selection of electricity consumers with various backgrounds. Since the project is based to a large extent on interviews with actors in energy systems and interest organizations that represent social groups that are identified as more vulnerable in smart grids, there is a need to understand more how electricity consumer in these groups would reflect on these matters.

## Publikationslista

*Slutrapporten ska i förekommande fall innehålla en publikationslista och, där så är möjligt, annat relevant material från projektet. Vad har publicerats, var/i vilket sammanhang har det skett, samt ge en kort sammanfattning av exempelvis förekommande artiklar med fokus på vad vi kan lära av projektet. Det kan t ex vara korta sammandrag av skrivna artiklar, både publicerade och manus.*

### - **Book chapter**

Tarasova, E., Rohracher, H. (accepted for publication, draft attached).  
Democratizing energy through smart grids? Discourses of empowerment vs practices of marginalization. In Pasqualetti, M.J., Keahey J., Nadesan, M.H. (eds.), Democratizing Energy: Imaginaries, Transitions, Risks

***Abstract***

The empowerment of users, their active role in managing electricity use or as micro-producers, and the potential for self-sufficient local energy communities play an important role in the legitimization of smart grids and are highlighted in many policy documents. However, the extent to which energy system configurations associated with smart grids actually empower users and are socially inclusive is an open question. In this chapter, we briefly discuss the social inclusivity of smart grid roll-out in Sweden as an element of a democratic energy system and focus on how interests and needs of some users may be disregarded and even “designed out” in the implementation process of smart grids.

**- Peer-reviewed original article 1**

Tarasova, E. (submitted to Energy Policy, draft attached). Stakeholder perspectives on smart grids’ effects on vulnerable consumers in Sweden

***Abstract***

Electricity consumers are expected to play more active roles in energy systems in future. One direction of energy system transformation where changing roles of electricity consumers have become especially clearly articulated is smart grids. It is important to understand what hinders and drives consumer engagement with smart energy technologies. Several researchers have pointed out that little attention has been given to such barriers for uptake of smart energy technologies as increasing vulnerability and resistance, although this field of study is growing. The article aims to contribute to this discussion by applying the perspective of social exclusion to studying negative effects of smart grids on households and by inquiring how manifold of stakeholders, including actors involved in developing smart grids, public authorities dealing with energy issues and interest organizations that work with various segments of society, reflect on effects of smart grids on household consumers. Based on 30 semi-structured interviews, the analysis presents three narratives about negative effects of smart grids on consumers. Narratives range from limited expectations of negative consequences to apprehension of intensification of digital divides and unevenness of negative effects.

**- Peer-reviewed original article 2**

Tarasova, E. (draft available upon request). Democratizing energy systems through citizen engagement in smart grids?

***Abstract***

Citizens are anticipated to become empowered in the energy systems through becoming active users, prosumers, and small-scale producers by politicians at the EU and national levels as well as by the energy industries. Prospects of increased citizen engagement have sparked a debate about potential democratization of energy systems. Democratization of energy systems is often associated with decentralization of renewable energy production and the growth of renewable energy communities, also called sometimes energy democracy movements. The purpose of this paper is to contribute to understanding of what democratization of

energy systems may imply, exploring ideas of energy democratization in context of smart grid development. Since energy democratization often associates with increased participation in energy governance and in ownership and control of renewable energy production, it seems to correspond with the model of participatory democracy to a large extent. This paper explores potential of understanding energy democratization instead based on the model of deliberative democracy, and more specifically, its focus on inclusion in communication as proposed by Marion Young. Democratization can be understood not only as formal inclusion in participatory structures but also as discursive inclusion and recognition of interests in rhetoric and narratives. Smart grid development differs from decentralized renewable energy production in several respects, therefore, the analysis in this paper highlights new dimensions of potential energy system democratization. Studying energy democratization in case of smart grids shifts attention from examining participation in energy production to considering inclusion in planning, designing, and operating of new solutions in the energy systems. The analysis draws on the previous research, relevant text materials and interviews with stakeholders in smart grid development.

- **Peer-reviewed original article 3**

Tarasova, E. Rohracher, H. (work in progress). Conceptualizing marginalization and exclusions in energy transitions

***Abstract***

Just and inclusive energy transitions are regarded crucial for sustainable transformations of energy systems both by politicians and researchers. Accordingly, studies that touch upon uneven impacts, injustices and exclusions that can emerge and strengthen in energy transitions are growing, apparently becoming a new subfield in the energy justice research. A need arises to categorize how marginalization and exclusion of some interests and needs in energy transitions can occur. This paper aims to develop a conceptual typology of dimensions of marginalization and exclusions in energy transitions. It first asks how marginalization and exclusion in energy transitions can be understood conceptually and then applies this typology to the case of smart grids, inquiring what mechanisms of marginalization and exclusion are articulated by stakeholders in smart grid development. Such analytical perspectives as energy poverty, energy democracy, energy justice, STS studies, infrastructure studies, digital divide literatures are considered, resulting in the list of potential dimensions of marginalization and exclusion. Marginalization and exclusion of social groups in energy transitions can be shaped by economic, social, political, and legal conditions and depend on circumstances related to knowledge, infrastructure, design, communication, health. Stakeholders in smart grid development discuss potential marginalization and exclusion as conditioned by economic resources, state of infrastructure, laws and regulations, inclusion in design, knowledge, skills, awareness, and interest. At the same time, political aspects of justice and public participation as well as health

conditions are not considered in relation to potential marginalization and exclusion in smart grids.

- **Peer-reviewed original article 4**

Tarasova, E. (work in progress). On the role of consumers' (dis-)interest in adoption of smart grids

**Abstract**

Smart grid imaginaries often put forward visions of users as interested in managing their electricity load and engaging with smart energy products and services. Together with other factors, consumer interest is often considered to contribute to acceptance and adoption of smart energy solutions. Interest of consumers in smart energy solutions thus seems to be central in smart grid development. At the same time, there are growing empirical accounts that demonstrate that consumer interest in smart energy solutions is limited, complemented by proposition that vulnerable consumer groups may have even less interest in smart energy products and services. This paper sets out to explore and unpack the role of (dis-)interest of electricity consumers in smart grids. First, it is examined how stakeholders in the energy systems reason about (dis-)interest for consumer engagement in smart grids. Second, it is discussed whether potentially vulnerable consumer groups are less interested in smart energy solutions than other social groups. The first part of analysis is built on semi-structured interviews with state, business, and third sector actors and the second one uses the material from one focus group interview with electricity consumers.

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