

# CITIZENS, EVERYDAY LIFE AND TENSIONS IN THE ENERGY TRANSITION

## 1. Aims and objectives

### 1.1. Significance of the research in relation to current knowledge and underlying premises

Energy is fundamental to modern society. Even more than before, climate change and the ongoing energy transition have made energy the subject of public debate. A trend toward electrification, digitalisation and distributed production is occurring as renewable energy sources like wind, solar and ambient energy are becoming the cheapest forms of energy generation (IRENA 2019). Building owners are becoming energy producers, while there are strong pressures to electrify transport and make it multimodal. With increasing intermittent power production, users are expected to become more flexible (i.e., to practice demand response) and the need for energy storage facilities grows. All these developments are reflected in political debates on taxes and charges, subsidies and regulations, the roles of energy companies and citizens, and the availability of novel energy solutions in residential areas. They are also reflected in everyday patterns of home maintenance and mobility. However, the societal impacts of the energy transition on citizens' everyday lives have yet not gained much attention in the Finnish social science community.

Most energy transition research builds on the inevitability of a transition from a societal perspective. Sociological analyses of tensions in the energy transition have focused on incumbent companies (Heiskanen et al. 2018), but less on sources of tension in citizen's everyday lives. Tensions in the energy transition, however, are manifested in citizen counter-movements. For example, resistance to wind power has gained momentum in several parts of the world (Avila 2018), smart meters –central to the energy transition– have provoked opposition in several countries (de Wildt et al. 2019), the electrification of transport raises arguments both pro and contra (Ortar and Ryhaug 2019), and one of the most visible examples of resistance have been the mass protests by the *Gillets Jaunes* against transport fuel taxation in France (de Wildt et al. 2019). While these may seem to be isolated cases, populist parties can transform such incidents into a formidable counterforce to the energy transition and climate change mitigation in general (Fraune and Knodt 2018).

There is increasing research on local and organised counter-movements, but beneath this surface ferment, citizens' daily concerns, practices and competences have gained limited attention in energy transition research. While, for example, Geels (2005) has shown the myriad changes in consumers' capabilities, routines, daily surroundings and preferences that were necessary for the internal combustion engine to become part of our everyday life, current energy transition research has devoted less attention to the new everyday infrastructures, skills and images that are required for a low-carbon transition (Schot et al. 2016). This is the case even though the energy transition places great expectations on "active citizens"<sup>1</sup> as well as on citizens' investments in energy renovations, heat pumps, building automation required for demand response, solar panels and electric vehicles. While some citizens have made such investments (Heiskanen et al. 2017), others resist such innovations or simply cannot afford them (Matschoss et al. 2015; Kahma and Matschoss 2017).

### 1.2 Research questions

Our study focuses on challenges encountered by ordinary citizens in the energy transition. By ordinary citizens, we refer to such consumers and employees of organisations who have not until

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<sup>1</sup> See e.g. EC Clean Energy Package <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans>

recently actively participated in energy policy discussions, or whose voices have not been heard in energy policy. This includes consumers, residents, housing maintenance staff and energy company employees. Because the everyday life tensions in the energy transition are specific to particular everyday practices, we investigate them through case studies aiming to answer the following questions:

1. How do ordinary citizens deal with different aspects of the energy transitions? In particular, what thoughts, actions and reactions do concrete manifestations of the energy transition such as electric cars, energy-smart buildings, energy companies' new offerings and the need to renovate raise among affected groups in society?
2. How does citizens' relationship with traditional energy sector actors change in the energy transition? How and why are expectations toward active citizens met or not met when adopting technologies and solutions related to the energy transition in everyday life?
3. What patterns of inclusion or exclusion are created by manifestations of the energy transition, such as demands on low-income citizens created by energy renovations, deployment of renewable energy, or the onmarch of electric vehicles?
4. How can we conceptualize the affordances of new technologies and practices for inclusion or exclusion of affected groups, such as building users or car owners, drawing on theories of practice and material participation, and in particular, the related competences and identities?
5. What solutions can be found to solve tensions of the energy transition? For example, can inclusion be increased and exclusion decreased by developing more diverse references for identification (e.g. through community initiatives) and by addressing the transition's practical consequences in unconventional ways (e.g. through alternative legislative proposals)?

### **1.3. Expected research results and their anticipated scientific impact, potential for scientific breakthroughs and for promoting scientific renewal**

Our study focuses on tensions in the energy transition from the perspective of citizens' everyday lives. It thus complements current (mainly location-based) research on resistance to transitions (Raven et al. 2008; Scheer et al. 2017), ownership of the energy transition (Mey and Diesendorf 2018; Moss et al. 2015) and energy justice (Jenkins et al. 2016). It provides a new perspective to this debate by zooming into sites of conflict that are defined by everyday life situations rather than specific geographical localities. We do so by drawing on practice theory (Shove et al. 2012; Nicolini 2011), actor-network theory (Callon 1998; Jolivet and Heiskanen 2010), and Marres' (2011) concept of material participation (Jalas et al. 2014; Martiskainen et al. 2018; Ryhaug et al. 2018), which all take seriously the mobilisation of (multi-local) materials and infrastructures in political debates. Through our empirical research, we attempt to develop the link between competence and inclusion in the energy transition by exploring how new competences of using and producing energy relate to particular practices and create identities (cf. Holland and Lave 2019) and affordances for participation (Autio et al. 2009).

A global energy transition is both ongoing and necessary. However, it is not likely to materialise according to expectations, and it is slowed down by various bottlenecks, tensions and opposing forces, some of which are linked to ordinary citizens and their lifeworlds. This study will produce new scientific knowledge on how ordinary citizens relate to the roles expected from them, and how they act in relation to new technologies and practices in the energy transition. Moreover, the research contributes to finding ways in which the energy transition can be more inclusive of citizens and their

diversity (MacArthur and Matthewman 2018). In this way, the research contributes to the emerging research literature on "who owns the energy transition" (Mey and Diesendorf 2018; Moss et al. 2015).

## 2. Implementation

### 2.1. Work plan and schedule

The objective of the study is to analyse critical points of abrasion in the energy transition, with a special focus on the Finnish context and the perspective of ordinary citizens and their everyday lives. We draw on, but extend and specify, recent research on inclusion or exclusion in the energy transition (e.g., Sarrica et al. 2016; Labussière and Nadaï 2018) with a specific focus on everyday life as a site for tensions, with the aim to develop an empirically based conceptualisation of inclusion through material participation and competence in the energy transition.

The research draws on four case studies focusing on key implications for ordinary citizens of the energy transition. These cases are selected on the basis of prior research, where we identified key tensions in the energy transition from an everyday practice perspective:

1. **Equity effects of the electrification of transport:** The electrification of transport has been a subject of debate for some years now in Finland and several other countries (Mathiesen et al 2015; Sierzchula et al. 2014): alongside practical issues such as the future availability of cheap used cars, electric vehicles also relate to certain policies, images and identities that raise opposition (Sovacool et al. 2018). This opposition relates to particular images attached to electric vehicles, to practicalities yet unresolved in policies, but also to competencies and routinised practices that are closely tied to identities and feelings of efficacy that are challenged by a pending disruption of established mobility practices. Previous research has found a research gap in these concerns related to social justice (Sovacool et al. 2018).
2. **The changing relationship between energy companies and consumers:** The changing relationship between energy companies and consumers is a direct outcome of the energy transition, with a shift from centralised to decentralised energy systems. In the conventional centralised system roles for and expectations towards both energy providers and energy end-users were clear: heat and electricity were traded as marketable goods, and sold and bought as bulk products. Along with distributed energy generation, end-users are becoming prosumers (Juntunen 2014) and are given more responsibility for market flexibility and increasing the share of renewable energy, which inevitably changes the traditional relationships between energy companies and their customers.
3. **Energy-smart buildings and their users:** Buildings are expected to be key sites of the energy transition, but many of the existing buildings demonstrating 'smart' solutions do not function as expected. Designers often blame this on users. In previous research, we have recognised diverse competence requirements and failures in such buildings and in education in the buildings and energy sector (Heiskanen et al. 2017). This case study allows us to delve deeper into the interaction between diverse building users, and the vocabularies and practices for dealing with energy-smart buildings at the original experimental sites that have now been in operation for about 10 years, and the ways in which conflicts and tensions are solved.
4. **Energy poverty among low-income building owners:** Although energy poverty is still rather rare in Finland, it is expected to increase within the next decade due to urbanisation, ageing buildings and population, increasing pressure towards energy efficiency in buildings and new

needs for energy use due to global warming, such as air conditioning (Shove et al. 2012). These problems are particularly prevalent among the 60 000 to 100 000 low-income building owners, who are under risk of falling into energy poverty (Runsten et al. 2015). As these households often live in rural areas, they also suffer from the loss of nearby services, and thus experience many types of energy poverty. Until now, energy poverty has been seen as a social policy question, and not much studied as part of energy policy. Moreover, energy poverty, or the risk of it, has not been studied from the perspective of everyday practices and the ways the home is used.

The project draws on four case studies and concludes with a synthesis of findings across cases. The case studies draw on multiple data sources and research methods. The research designs of each case study are presented below, while the schedule is displayed in Figure 1.

### *Case 1: Equity effects of the electrification of transport*

This case study builds first on a thorough analysis of the problems related to the electrification of transport, including both practical problems and perceptions of exclusion and exclusionary discourses. In this, we draw on both conventional and social media data and analysis of expert reports concerning the mobility transition. Analysis draws on actor-network based approaches, such as “framing and overflowing” (Callon 1998), which take seriously both the material, discursive and the technologically mediated construction of problems and solutions (see Jolivet and Heiskanen 2010).

Our analysis focuses on particular issues identified in the Transition Arena<sup>2</sup>, a deliberative forum involving 23 Finnish experts, persons of influence and visionaries from different sectors of society. Experts envisage not only electrification of transportation, but also a shift to services, sharing and autonomous vehicles in the field of personal mobility, entailing the need for a cultural change. The Transition Arena recognised the need for specific service concepts for rural areas. However, many official reports fail to acknowledge the specific problems encountered by, e.g., rural low-income residents in gaining access to any of these developments. Considering the resistance visible in the Finnish media, some citizens seem to have a different view of the social impacts of electrification than experts do. In order to respect the materiality of the issues, textual media data concerning different registers of public discussion is complemented with case studies of demonstrations representing particular phenomena in the mobility transition such as autonomous vehicles, attempts to develop rural mobility-as-a-service solutions, and services for electric vehicle sharing.

Through empirically grounded analysis of the texts and events unfolding in cases, using topic modelling combined with manual coding using NVivo software, we investigate the attempts to “frame” the mobility transition and the “overflows” that occur when participants subvert the mobility transition agenda and link it to other concerns, some drawn from genuine problems with or outside their own life experience, and others perhaps drawn from globally circulating counter-discourses or alternative frames. By pinpointing particular controversies and “following” the actor networks, we aim to identify the types of alternative frames, or attachments (Marres 2007) developed by participants, as well as the specific material conditions and competences engendering these attachments.

The analysis of the tension and the parties involved in these serves as the basis for designing interactive workshops where ordinary citizens and public officials and their expert advisors are invited to further analyse problems and search for solutions to them.

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<sup>2</sup>See <https://www.aalto.fi/en/news/finnish-energy-transition-arena-report-launched-experts-highlight-a-need-for-a-thorough>

### *Case 2: The changing relationship between energy companies and consumers*

This case study explores changes in the interlinked practices of energy companies and consumers in the process of the energy transition. It focuses on the different expectations of energy companies in the development of new services, and citizen-prosumers developing their own ideas of the energy transition, and how the practices of these parties meet, or fail to meet, in the search for energy provision based on services rather than bulk delivery of energy.

The case will be carried out through interviews and observations in a large energy company. We will interview the employees who are designing new products and business models to understand how customers are conceptualised and what kind of expectations of customers business developers have. We will also interview employees from other units, such as sales and marketing to analyse how customers are perceived in mainstream business. We will do participatory observations on the business development process of a new product that conceptualise customers somehow differently (such as providing technology and services instead of /or in parallel to heat and electricity) to understand what kind of bottlenecks and difficulties there are to change the traditional customer relationship. We will especially focus on finding out how customer relationships are conceptualised when developing new business models. How do business developers take customers into account in the business development, for example through co-creation? How is the value of new business models being constructed and conceptualised? How do business developers interpret the changing customer relationships within energy transition?

Yet engaging citizens is not merely a matter of producing services for consumers. Given the previous monopoly of energy companies, the energy transition raises issues of who has the right to produce energy in cities. Thus, the case study also explores new prosumer-based initiatives, such as citizen-driven initiatives to install ground-source heat pumps, and the challenges these face from city officials, energy company employees and energy practices in the home. Such cases can show how the relation between energy companies and their customers is framed by wider institutions: examples include tensions in city space usage and permitting, such as who owns the underground land in cities and how this has an impact on whether new energy solutions can be installed or not.

### *Case 3: Energy-smart buildings and their users*

This case study focuses on how competence for managing energy smart buildings emerges, and what it entails. The analysis draws on and combines diverse theories of situated practice (Orlikowski 2002), as well as insights from science and technology studies and focuses on developing new empirically grounded conceptualisations of the relationship between competence, inclusion and identification. Through this analysis, we aim to understand and conceptualise energy-smart buildings as sites for residents and staff to gain inclusion, or remain excluded from the energy transition.

In previous projects, we have assembled a large amount of qualitative data on the challenges of residents and maintenance staff in using energy-smart, i.e., energy producing and saving as well as demand-response capable buildings (mm. Huomo 2017; Kalliola 2016; Lähteenoja 2018; Korhonen 2017; Korhonen and Heiskanen 2017; Heiskanen et al. 2015; Heiskanen et al. 2017), focusing on necessary and missing competences in demonstration buildings. Our aim is to deepen these case studies and conduct longitudinal research on them to deepen our understanding of the nature of the problems and potential resolutions emerging from the lived experience of residents, housing company boards, house managers and maintenance staff. Expanding on previous research, we will conduct follow-up research in Smart Kalasatama, Adjutantitalo in Espoo, as well as Viikki Environment

House, which is an energy-smart office building built in 2011 by the City of Helsinki in order to serve as an example for other similar initiatives.

#### *Case 4: Energy poverty among low-income building owners*

Energy poverty, although identified as a potential risk for many people in the near future, has been only little studied in Finland and the need for further research has been acknowledged (Runsten et al. 2015). The aim of this case study is to fill this research gap by a qualitative study on the everyday practices of people identified as being energy poor or under risk of it, especially low-income people who own their homes in rural areas, but cannot afford to renovate or switch to non-fossil heating sources.

Utilizing experiences from our previous projects on consumption practices of low-income households (Hirvilammi et al. 2014; Laakso 2012) and methods developed for challenging energy-intensive practices at home (Heiskanen et al. 2018), we encourage the participating households to reflect on their daily energy consumption in deliberative interviews conducted in their homes, with special focus on the competences related to saving energy and meanings associated with sufficiency or the right to energy, as well as feelings of exclusion. We also discuss the households' efforts towards energy efficiency and use of renewable energy sources, and the difficulties faced during these efforts.

As part of this case study, we also invite experts from different fields (relevant ministries, municipal actors, researchers, NGOs) to discuss the experiences of the studied households, and to co-create knowledge on the ways to overcome the challenges faced by these people. The aim of the workshop is also to find concrete solutions to energy poverty and its risk in Finland by bringing together different policy sectors.

#### *Synthesis on citizen competence, inclusion, participation and identification in energy transition*

The synthesis aims to develop an overarching conceptual contribution from all four case studies, which explores the relationships between competence, inclusion, affordances for participation and identification (or non-identification) with the energy transition. Drawing on research on situated practice (Orlikowski 2002; Skjølsvold et al. 2017; Holland and Lave 2019), our aim is to identify the pathways through which the specific materials, competences and meanings tied to particular energy-related practices create affordances for participation (see Autio et al. 2009; Fayard and Weeks 2014), i.e., what practices (and practitioners) are facilitated by the material and social construction of the environment and technology, and how these create particular relations between people, practices and socio-technical systems. In particular, on the basis of our rich empirical material, we aim to elaborate on the concepts of competence and material participation in closing or opening affordances for citizenship in the energy transition. For this purpose, we pay attention not only to problems indicating tensions in the energy transition, but also to potential and provisional solutions to these problems emerging from everyday practice.

Through this work, we aim to conceptually tie together strands of literature (Callon 1998; Orlikowski 2002; Marres 2007) that contribute to an understanding of citizenship in the energy transition, but have not been used in previous work on energy justice (Jenkins et al. 2016). Since this requires a framework for making observations of these phenomena across all case studies, the work on the synthesis is started at the beginning of the project (see Figure 1) in the form of an integrative literature review, and time is dedicated to reading, discussions and joint analysis throughout the project.

In addition to the academic synthesis, collaboration within the research team feeds into the interactive workshops, which both provide research material and serve as central ways to promote utilisation of the research results. From our new conceptualisation, we expect to find ways to diversify the ways in which people can identify with the energy transition, through a recognition and expansion of their existing competences and identities, as well as unconventional ways to mitigate harms related to the energy transition.

**Figure 1. GANTT chart of the project schedule**

Research activity	2020		2021				2022				2023				2024	
	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II
Ethical review/data mgmt																
CASE STUDY 1: data																
CASE STUDY 1: analysis																
CASE STUDY 1. publication																
CASE STUDY 2: data																
CASE STUDY 2: analysis																
CASE STUDY 2: publication																
CASE STUDY 3: data																
CASE STUDY 3: analysis																
CASE STUDY 3: publication																
CASE STUDY 4: data																
CASE STUDY 4: analysis																
CASE STUDY 4: publication																
Synthesis																
Interactive workshops																

## 2.2. Research data and material, methods, and research environment

The project draws on four case studies focusing on contemporary issues in the Finnish energy transition and concludes with a synthesis of findings across cases. The case studies draw on multiple data sources and research methods as outlined in Table 1.

**Table 1. Empirical methods applied in the sub-projects**

	Media analysis	Document analysis	Interviews	Register/secondary data	Observations	Interactive workshop
CASE1	x	x	x	x		x
CASE2		x	x	x	x	
CASE3	x	x	x	x	x	
CASE4			x	x	x	x

The main focus is on qualitative or semi-quantitative methods, since our questions pertain to emerging issues that need to be articulated and interpreted in order to uncover and understand the nature of the tensions and potential avenues for resolving them. Moreover, there is very little existing research on

these questions in Finland. However, each case study combines qualitative observations with available register and secondary data. In this way, each case study is contextualised and positioned into the broader Finnish and international context. Moreover, the research period and our access to prior data from the Smart Energy Transition and Intermediaries in the Energy Transition projects allow us to investigate change and the evolution of issues within our cases. We hold the IPRs for all existing data that we plan to use.

All case studies will be conducted at the University of Helsinki and the Centre for Consumer Society Research (CCSR). The university and this particular unit as multidisciplinary research environments have an excellent infrastructure for this kind of research. Among others, the expertise and research infrastructures (e.g. Futusome and Suomi24 social media datasets) pertaining to social media analysis at the CCSR will greatly benefit the research in this project. A large dataset of smart energy pilots has also been assembled by our team ([energiakokeilut.fi](http://energiakokeilut.fi)), which offers a wealth of alternative research sites.

### **2.3. Risk assessment and alternative implementation strategies**

A critical point of success is the choice of case studies. While we have spent several years analysing and observing the social issues related to the energy transition and the debate concerning it is just emerging, and hence other empirical issues might turn out to be equally important. We will seriously consider our research foci each year and consider minor refocusing if necessary and possible. Access to data should not be a problem, since we have existing relationships with the relevant parties and sites of research. However, if access problems should for some reason arise, we will consider alternative sites, and we have several such alternatives in reserve.

Personnel issues might cause risks, for example, if key persons leave and we cannot find good replacements. However, the University of Helsinki is a large organisation and we have a wide network of people from which to recruit.

## **3. RESEARCH TEAM AND COLLABORATORS**

### **3.1. Project personnel and their relevant merits**

The proposal has grown directly out of previous research by the team, in particular the Strategic Research Council funded project Smart Energy Transition (SET), in which four of the team members have collaborated and in which the PI served as work package leader and member of the project management team. The work package in which these team members worked has focused on competences in the energy transition and explored necessary and missing competences through 20 case studies and several article publications. The SET project also involved intensive public outreach, such as a dedicated Energy Transition Arena, as well as analyses of key investment gaps, which have drawn our attention to the subjects of the case studies as critical tensions in the energy transition. This previous experience enables us to deepen our analysis into a stronger social science contribution to relevant debates that have not gained much attention yet in Finland.

The team has other previous merits (Table 3): The PI *Eva Heiskanen* has coordinated an EU FP7 project on adapting energy programmes to context, as well as served as work package/sub-project leader in several other European and Academy of Finland projects, which have focused critically on the users' perspective on buildings, energy efficiency, renewable energy and demand response. *Kaisa Matschoss*'s research has focused on studying experimentation and innovation in the energy sector, the roles of innovation intermediaries in energy transition, sustainable use of energy by households



and on citizen engagement in sustainability. *Eeva-Lotta Apajalahti* has studied household energy practices and activities of large energy companies within sociotechnical transition, contributing to practices theories, organisational path dependence and sociological field theory. *Senja Laakso* has studied everyday practices in households and their change, especially from the perspective of sustainable wellbeing. *Jenny Rinkinen* has studied energy use and policy in everyday life in Finland, the UK and Southeast Asia with a specific focus on technologies of heating, building use and domestic appliances. *Tuija Kajoskoski* has conducted quantitative cross-national research on households' energy consumption practices and the role of community in changing energy use practices.

**Table 3: Research team and their merits**

Team member	Tasks and roles	Competences	Merits
Eva Heiskanen, Professor	Project leader, focus on case study 1, 3 and synthesis	Case study research, qualitative research, societal aspects of the energy transition	See cv and list of publications
Kaisa Matschoss, University Researcher	Focus on case study 3, interactive workshops, contribution to synthesis and supervision of PhDs	Public participation, social innovation, societal aspects of the energy transition	Google scholar link: <a href="https://scholar.google.fi/citations?hl=en&amp;user=9Ld2A8wAAAAJ">https://scholar.google.fi/citations?hl=en&amp;user=9Ld2A8wAAAAJ</a> UH research portal: <a href="https://researchportal.helsinki.fi/en/persons/kaisa-matschoss">https://researchportal.helsinki.fi/en/persons/kaisa-matschoss</a>
Eeva-Lotta Apajalahti, postdoctoral researcher	Case study 2, contribution to synthesis and supervision of PhDs	Organisation research, social aspects of the transition, household energy practices, case study research, qualitative research methods	Google scholar link: <a href="https://scholar.google.com/citations?user=ZLJx5j4AAAAJ&amp;hl=fi">https://scholar.google.com/citations?user=ZLJx5j4AAAAJ&amp;hl=fi</a>
Senja Laakso, postdoctoral researcher	Case study 4, contribution to synthesis and supervision of PhDs	Qualitative research, participatory approaches, everyday practices and energy consumption	Google scholar link: <a href="https://scholar.google.fi/citations?user=qq-4D44AAAAJ&amp;hl=fi&amp;oi=ao">https://scholar.google.fi/citations?user=qq-4D44AAAAJ&amp;hl=fi&amp;oi=ao</a>
Jenny Rinkinen, postdoctoral researcher	Case study 3, contribution to synthesis and supervision of PhDs	Energy policy, qualitative research, buildings and users, theories of practice and consumption	Google scholar link: <a href="https://scholar.google.fi/citations?user=CemIYQMMAAAJ&amp;hl=fi&amp;oi=ao">https://scholar.google.fi/citations?user=CemIYQMMAAAJ&amp;hl=fi&amp;oi=ao</a>
Tuija Kajoskoski, doctoral student	Case studies 1 and 4, contribution to synthesis, dissertation.	Energy consumption practices, research methods	Master's thesis and research article on energy practices

The research team has strong mutual ties and have all worked together on several previous projects. This supports communications within this project, which aims to go far beyond anything we have done before. The research collaboration enables the participants to expand their scope and break new paths for their research careers:

- Doctoral training: Two doctoral students will be engaged in the project, one from the start and one after the project has consolidated its work (with other funding). The doctoral students will be supervised by Professor Eva Heiskanen, Dr Kaisa Matschoss, as well as postdoctoral researchers working in the project. This will provide a consistent environment to develop supervisory skills, as well as a supportive team for the PhD students to conduct their work in.
- Post-doctoral training: There is a strong component of post-doctoral training since three people in a post-doc position are involved. These are people who have funded much of their research career through project funding, and now have a chance to elaborate more academic vistas for their future work. Additionally, the collaborative nature of the project allows these three very accomplished post docs to learn from each other.

### 3.2. Collaborators and their key merits in terms of the project

The research is performed in close collaboration with several national and international collaborators (Table 4), all of which are closely networked to the research team. The national collaborators are selected as key beneficiaries of the study and stakeholders who can utilise the research results both conceptually and practically. We interact with them regularly and through this interaction know that they understand how they can benefit from our study. The national collaborators will also provide participants for our interactive workshops.

We have longstanding collaboration with the international partners working on similar topics (Table 4). Research mobility is planned to DIST, IIIIEE and University of Leeds. The PI Heiskanen has worked at Linköping University, Thematic Study on Technology and Social Change, where for example the research project *Households as infrastructure junctions* led by Harald Rohrer is investigating ‘zones of friction and traction’ in Sweden from a similar perspective, as well as at IIIIEE Lund, where collaboration is planned with Per Mickwitz, Lena Neija and Jenny Palm. The team has also worked with and co-authored publications with staff from Aalborg University Copenhagen, Centre for Design, Innovation and Sustainable Transition (DIST). The PI is also a member of the advisory board for the Zero Energy Neighbourhoods (ZEN) Centre at Norwegian University of Science and Technology (NTNU), which deals with similar tensions in a Norwegian context. Prof Middlemiss at the University of Leeds has developed a capabilities approach to energy poverty. Collaboration will be in the form of co-authored publications drawing on comparative data from the different countries, as well as in the form of further joint research proposals.

**Table 4. Collaborators and their key merits in terms of the project**

National	International
Ministry of Environment (contact Taina Nikula)	Linköping University, Technology and Social Change (contact Harald Rohrer)
Finnish Environment Institute (contact Jyri Seppälä)	Aalborg University Copenhagen, Centre for Design, Innovation and Sustainable Transition (contact Inge Røpke)
RAL – Construction Quality Association (contact Tuula Råman)	Lund University, International Institute for Industrial Environmental Economics (IIIIEE) (contact Per Mickwitz)
Ministry of Transport and Communications (contact Saara Jääskeläinen)	ZEN Centre, NTNU, Norway (contact Thomas Berker)
Motiva Ltd (contact Päivi Laitila)	University of Leeds (contact Lucie Middlemiss)

## 4. Responsible science

### 4.1. Research ethics

The project aims to give a voice to those not hitherto heard in the energy transition discussion. We are thus highly committed to the Belmont Report Principles (respect for persons, beneficence and justice), the guidelines for the responsible conduct of research formulated by the Finnish National Board on Research Integrity TENK and the RCR guidelines for handling alleged violations of conduct. We shall also follow ALLEA's (All European Academies) European Code of Conduct for Research Integrity when engaging in international collaboration.

In order to meet these commitments, a pre-emptive approach to research ethics is critical for our work. We will start by conducting a careful ethical analysis of the stakeholders affected by and affecting the research, the relevant guidelines, rules and legislation influencing our research, and the alternatives for resolving ethical issues that we and our stakeholders have.

Participation in our research is based on informed consent, strict anonymity of subjects and the right to withdraw from our research. Intelligible and accessible GDPR-compliant privacy notices and appropriate consent forms to be used in all case studies will be developed, based on relevant guidelines and our recent experience in a European project involving complex data collection.

Particular attention is devoted to research ethics when conducting research with people in a vulnerable position (especially Case study 4), and hence a more detailed research plan will be sent for preliminary ethical review to the University of Helsinki Ethical Review Board in the Humanities and Social and Behavioural Sciences before starting the empirical data collection. Since we are dealing with sensitive topics, we will also review carefully our research findings and consider the ramifications of communicating our research results. There are genuine risks of amplifying controversies and, on the other hand, of casting discussants in a negative light. Hence, we extend our ethical analysis to our communications and hold regular reviews to avoid unethical or socially undesirable outcomes.

### 4.2 Promoting open science

Our publication plan (Table 5) supports open science. Our ways of promoting open data are outlined in our Data Management Plan (Appendix). We have reserved funds for gold open access publishing. If these funds are not sufficient, the remaining publications will be published under green open access.

**Table 5. Publication plan**

Project phase	Publications	Open access
Case study 1	Two journal articles, in e.g. <i>Science and Technology Studies</i> and <i>Local Environment</i>	Gold or green
Case study 2	Two journal articles, in e.g. <i>Organization studies</i> and <i>Technology Analysis and Strategic Management</i> or <i>Environmental Innovation and Societal Transitions</i>	Gold or green
Case study 3	Two journal articles, in e.g. <i>Building Research and Information</i> and <i>Environmental Innovation and Societal Transitions</i>	Gold or green
Case study 4	Two journal articles, in e.g. <i>Journal of Consumer Culture</i> and <i>Energy Research &amp; Social Science</i>	Gold or green
Synthesis	Two journal articles in e.g. <i>Science and Technology Studies</i> and <i>Science, Technology and Human Values</i>	Gold or green

### **4.3. Promoting equality and non-discrimination**

The research team will promote equality and non-discrimination throughout the research process. The research team at present is all-female, so we attempt to recruit a male PhD student to the team, and will make sure that this recruitment occurs through a non-discriminatory process.

The entire purpose of the project is to promote equality in all its forms (gender, class, ethnicity and age) by seeking to include and give a voice to people who have been marginalised in the energy transition. This includes, among others, low-income people, people with less formal education and people living in rural areas.

## **5. Societal effects and impact**

### **5.1. Effects and impact beyond academia**

This research arises from concern for the social impacts of the energy transition and its (still lacking) capacity to mobilise society as a whole. It also arises from close interaction with politicians, officials and ordinary citizens during the Smart Energy Transition project. From this experience, we know there is demand for our research results in society. We regularly offer advice to public officials and are asked questions that this research aims to address, such as “how to engage a wider group of people in our change efforts?” and “how to deal with skepticism toward the energy transition?”.

Our impact is based on our academically uncompromising research to find genuine answers to these questions. Our impact will be reached in several ways: (1) in close collaboration with people from ministries, agencies and contracted experts dealing with these issues on a daily basis, in meetings, workshops and forums, (2) by introducing new concepts and ways of viewing the energy transition in society that are more inclusive, through invited talks, the media and blog posts and (3) through direct engagement in social and conventional media as well as in-person debates concerning particular aspects of the energy transition, such as electric vehicles or fuel poverty, with an aim to set these debates on a more communicative and constructive basis. In this last task, our longstanding collaboration with the Carbon Neutral Municipalities (HINKU) forum offers us several venues, at city halls, schools and public events. We are used to engaging in such events weekly, and would be pleased to continue doing so with the better research results provided by this project.

### **5.2. Considering principles of sustainable development**

Our research responds to the challenges placed by the sustainable development goals. By facilitating a just and inclusive energy transition, we contribute to sustainable employment, sustainable society and local communities, a carbon-neutral society, a resource-wise economy, as well as lifestyles respectful of the carrying capacity of nature. By constructively engaging with those who are marginalised in the current discussion, we contribute to equal prospects for wellbeing, a participatory society for citizens, as well as the UN SDG of Peace, Justice and Strong Institutions. By providing direct policy support, we contribute to decision-making respectful of nature. In addition, we commit the principles of sustainable development in our daily work, including in the procurement of travel services.

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