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Mainstreaming P2P Electricity Markets on the Community Level

Master Thesis

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Abstract

Peer-to-peer (P2P) electricity markets are an alternative electricity market design allowing for a more consumer-centric model of the electricity market, enabling the integration of renewable energy technologies (RETs). Households are highly significant in this market design, but in-depth research on their roles in making P2P electricity markets a viable alternative to the current Dutch electricity market design (i.e., mainstreaming the innovation) is limited. This study aims to fill this knowledge gap by determining the attitudes of Dutch households toward P2P electricity markets and how these attitudes are shaped. Moreover, it aims to describe how P2P electricity markets can bridge conflicting attitudes and increase social cohesion. I apply the theory of institutional logics to describe how attitudes differ and the theory of public deliberation to describe how deliberative processes can overcome these differences in P2P electricity markets. I distinguish between households characterized by conservative or egalitarian logics and by whether or not the households prosumes (produce and consume) electricity. My results indicate that conservative households generally have a moderately low willingness to participate, influenced by a realistic attitude towards P2P electricity markets. In contrast, egalitarian households generally have a high willingness to participate, influenced by an optimistic attitude towards P2P electricity markets. Prosumption was not found to have a consistent impact. The impact P2P electricity markets can have on social cohesion is likely positive, but conclusive findings cannot be derived from the results. P2P electricity markets can become a viable alternative to the current electricity system by initially focusing on communities mainly consisting of egalitarian households as early adopters of the innovation, developing the innovation, and broadening the scope to other (i.e., conservative) households in later stages of the mainstreaming process. Mainstreaming of the innovation would also become more likely when used complementary to the current system to overcome practical limitations.

Keywords: Peer-to-peer electricity markets, electricity trading, prosumer, attitudes, institutional logics, public deliberation, mainstreaming

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List of acronyms

CC – Conservative consuming
CP – Conservative prosuming
DER – Distributed energy resource
DES – Decentralized electricity system
DG – Distributed generation
DLT – Distributed ledger technologies
EC – Egalitarian consuming
EP – Egalitarian prosuming
ICT – Information and communications technology
LEM – Local electricity market
MLP – Multi-level perspective
PV – Photovoltaic
P2P – Peer-to-peer
RET – Renewable energy technology
RWA – Right-wing Authoritarianism
SDO – Social Dominance Orientation

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1. Introduction

1.1 Background

The Dutch government has stated its intentions to reduce CO_2 emissions by at least 55% by 2030, 70% by 2035, and 80% by 2040 compared to 1990 levels as well as be climate neutral by 2050 (Rijksoverheid, n.d.). It aims to achieve this by constructing the necessary energy infrastructure, greening of industry, increasing the share of sustainable transport, and creating a more sustainable build environment. To realize these goals, the government has made a €35 billion climate- and transition fund available for the upcoming decade. To reduce emissions, the uptake of renewable energy technologies (RETs) has accelerated over the past decades (DNE, 2022). RETs like solar photovoltaics (PVs) and wind are widespread and contribute to reducing CO2 emissions. They offer clean methods of production relying on inexhaustible sources, making them inherently resilient and sustainable. The increased uptake of RETs also alters the electricity system. Traditionally, electricity has been produced and distributed centrally through a relatively simple supply chain. Electricity is generated at power plants and transported to companies and households through the electricity grid. As the amount of RETs in the electricity system increases, electricity generation gets more distributed. Distributed generation (DG) is defined by Ackerman et al. (2001) as "an electric power generation source that is connected directly to the distribution network or on the customer side of the meter". The increase in DG increases the decentralization of the electricity system creating decentralized electricity systems (DESs).

While making an important contribution, these RETs depend on the weather conditions for the amount of electricity they can generate. Their natural intermittency creates fluctuations in electricity production, leading to imbalances in electricity supply and demand. In the case of solar PV, peak generation is generally not simultaneous to peak demand leading to generation surpluses during sunnier periods and shortages in darker periods. The volatility of the electricity production of RETs increases the pressure on the grid and creates the need for power plants to supply additional electricity in periods of low renewable electricity supply (Sims et al., 2011). Moreover, the current grid infrastructure is inadequate to deal with the fast-increasing volumes of renewable electricity generation due to its limited capacity (IEA, 2021). Grid infrastructure must be modernized to effectively integrate distributed energy resources (DERs) and become more efficient, flexible, resilient, and scalable (Ruth & Kroposki, 2014). As penetration levels of RETs increase, the limited capacity of the grid becomes a more

significant problem when insufficient storage capacity is available, thereby raising the need for additional investments (Denholm & Margolis, 2007).

In response to the problems related to increased amounts of RETs in the electricity system, alternative market designs have been proposed that allow for a bottom-up approach. These types of market organizations are generally known as consumer-centric electricity markets (Peng & Poudineh, 2017). The consumer-centric market is dependent on peer-to-peer (P2P) and community-based systems which are decentralized structures where peers cooperate by producing and trading electricity, otherwise known as local electricity markets (LEMs) (Giotitsas et al., 2015; Hvelplund, 2006). P2P electricity markets revolve around the direct trading of electricity with peers, known as P2P electricity trading. P2P electricity trading originates from a response to overgeneration by electricity prosumers (producers and consumers); instead of feeding electricity back to the grid, an electricity prosumer may wish to trade electricity directly with local electricity consumers. A P2P electricity market based on RETs has several advantages over centralized electricity systems: mitigate CO2 emissions, increase renewable electricity accessibility, improve electricity security and independence, reduce transmission and distribution losses, reduce the capital costs for upgrades, and improve economic and social development (Panwar et al., 2011; Ellabban et al., 2014; Green & Newman, 2017).

P2P electricity markets can be structured in different ways (see Figure 1). Parag & Sovacool (2016) explain that based on the degree of decentralization, three types of P2P market designs can be distinguished: (1) full or decentralized P2P market; (2) community-based or centralized market; and (3) hybrid P2P market. In a full P2P market design, peers directly trade electricity. The lack of supervision characterizes this type of design; hence, two peers can negotiate a price and agree on a certain amount of electricity transaction. Full P2P electricity markets are a wholly distributed structure to peers characterized by small-scale participants, local electricity generation and consumption, close geographical proximity, and the trading of surplus electricity (Morstyn et al., 2018; Brown et al., 2019). The trading of surplus electricity among peers is known as P2P electricity trading. Through P2P electricity trading, prosumers are compensated more fairly for their surplus electricity than in the current system that relies on feed-in tariffs or net-metering, which comes down to a fixed rate (Peck & Wagman, 2017). In a community-based market design, the trading of electricity within a community is managed by a community manager. The community manager also links the community with the rest of the electricity system (Sousa et al., 2019). Market participants in this design are usually geographically close, such as a neighboring group of prosumers (Verschae et al., 2016). The

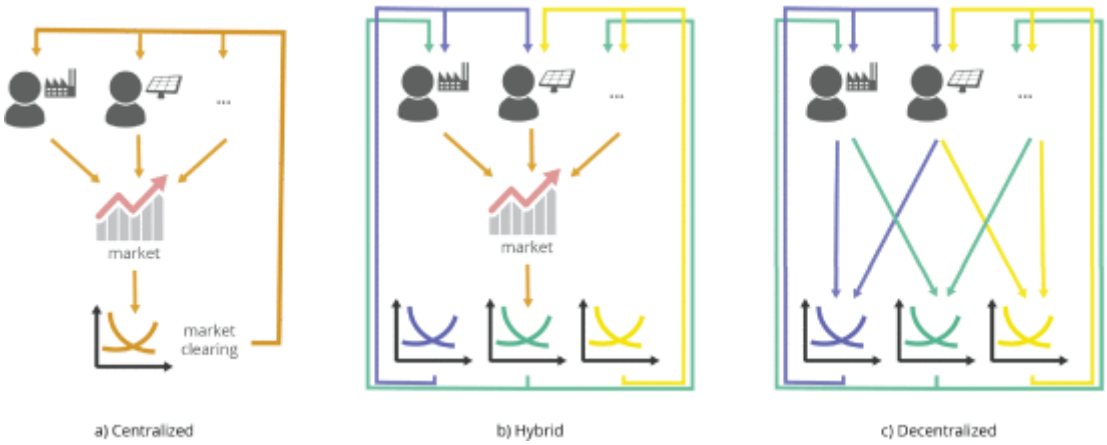
other two designs are combined in a hybrid P2P market design, resulting in multiple layers in which electricity can be traded. Communities or electricity collectives can trade with individual peers and vice versa. At the high level, peers or electricity collectives are trading directly while also interacting with existing markets. At the low level, the electricity collectives are similar to a community-based market where a community manager oversees the transactions within the community (Capper et al., 2022). Hybrid market designs generally operate on a larger scale than full P2P and community-based designs (Morstyn et al., 2019).

The decentralization needed for P2P electricity markets requires distributed market platforms which are made possible due to technological advances in information and communications technology (ICT), multi-agent systems, and distributed ledger technologies (DLT) (Ullah & Park, 2021). DLTs or blockchains are shared digital data structures (i.e., ledgers) that allow for the secure storage of digital transactions without a central authority (Andoni et al., 2019). They aggregate transactions into blocks that are secured through cryptography. Moreover, blockchains use smart contracts and a decentralized consensus mechanism to allow for decentralized P2P networks (Swan, 2015). Therefore, they allow for the decentralization and digitalization of the electricity system.

While attracting substantial research interests, P2P electricity markets are mainly studied from a technological or economic perspective (e.g., Long et al., 2018; An et al., 2020). The social aspects of the implementation of P2P electricity markets are much less well studied. Most of the research on the social aspects is quantitative and focuses on finding the preferences of households or individuals regarding P2P electricity markets (see section 2). In this study, I intend to focus on the new relationships between end-users (i.e., households) that will be formed through the implementation of this innovation. The bottom-up market design alters the roles of electricity producers and consumers and their interrelationships. Previously un- or loosely related households are forced into association for the buying and selling of their electricity. The values and practices of these households are not necessarily aligned. Different values and practices will likely create different attitudes towards P2P electricity markets. For P2P electricity markets to be successfully implemented, it is important to be aware of the varying attitudes toward P2P electricity markets as these can create drivers and barriers to its implementation. Moreover, as households become related when engaging in P2P electricity markets, the social cohesion in a community could also increase, thereby creating additional benefits for communities and households. The opposite might also be true as increased association between households within a community could cause more conflict.

Figure 1

P2P electricity market designs



Note. From *Developments and Challenges in Local Electricity Markets: A Comprehensive Review*, by S. Bjarghov *et al*., 2021, p. 58912, *IEEE Access.*

1.2 Research objective and research questions

This study aims to identify the different attitudes of households characterized by either conservative or egalitarian values towards P2P electricity markets in the Netherlands are; to explain how P2P electricity markets can impact the social cohesion within electricity trading communities in the Netherlands; and, to make recommendations on how to make P2P electricity markets a viable alternative to the current electricity market design, from a social perspective. These aims will be fulfilled by answering the following research questions:

1. How can the P2P electricity market design become a viable alternative to the current Dutch electricity market design on the community level, from a social perspective?
    a. What are the attitudes of different Dutch households towards P2P electricity markets?
    b. How do conservative and egalitarian values affect households' attitudes towards P2P electricity markets in the Netherlands?
    c. How can P2P electricity markets contribute to increasing social cohesion within a community?

1.3 Outline

The study is structured as follows: In section 2, I will discuss the different P2P electricity market designs as well as the existing literature on the social dimensions of P2P electricity markets. In section 3, I will explain the theory of institutional logics that has been used to determine households' values and describe how they influence their attitudes towards P2P electricity markets, and the theory of public deliberation that has been used to determine the impacts P2P electricity markets can have on social cohesion. Section 4 includes the methods used for data collection and analysis. In section 5, I will analyze the results which will be discussed in section 6. Finally, the study is concluded in section 7.

2. The social dimensions of P2P electricity markets

Most studies on P2P electricity markets focus on the technological and pricing aspects, whereas the social dimensions are less well studied. A literature search focused on finding academic social studies related to P2P electricity markets shows that the studies by Reuter and Loock (2017), Mengelkamp et al. (2018), Mengelkamp et al. (2019), Hackbarth and Löbbe (2020), Hahnel et al. (2020), Pumphrey et al. (2020), Wilkinson et al. (2020), and Georgarakis et al. (2021) appear to be the only academic studies investigating the preferences, intentions, and perceptions of, and drivers and barriers for households to participate in P2P electricity markets.

Reuter and Loock (2017) conducted a survey among households in Switzerland, Norway, Spain, and Germany to find the drivers and barriers for households to participate in LEMs. They found that on average, 74 percent of households are willing to sell their excess electricity, while 77 percent would consider participating in LEMs. According to their results, households' intentions to participate are positively influenced by the number of technological devices in the household and the energy consciousness and knowledge. Socio-demographic characteristics such as gender, living area, ownership status, or country of origin were found not to have a serious impact on willingness to participate. In contrast, a higher age has a negative influence on it. The most important drivers to participate are the environmental and economic benefits of LEMs, while the most important barriers are energy security, bureaucracy, coordination among neighbors, and data privacy.

Mengelkamp et al. (2018) carried out a survey to test whether community identity (i.e., feeling a strong connection with the local community), technology affinity, price consciousness, the importance of green products, and regionality influence the willingness of

German electricity customers to participate in LEMs. They found that community identity, the affinity toward technology, and the importance of green products are intrinsic motivations that influence customers' willingness to participate in LEMs. Price consciousness and regionality were found to be insignificant factors. Similarly, Mengelkamp et al. (2019) performed an adaptive choice-based conjoint analysis to find which attributes of LEMs are important to residential electricity customers. According to their results, the decision to participate in LEMs is mainly determined by economic factors (monthly costs and investment costs). Other non-economic attributes (interaction frequency, supplier, electricity source, and data privacy) are cumulatively as important as the monthly costs. Respondents were shown to be willing to pay extra monthly costs for regional electricity.

Hackbarth and Löbbe (2020) conducted a survey among 4,742 electricity consuming or prosuming German households to find out their attitudes, preferences, and intentions regarding P2P electricity trading. The authors found that the openness towards P2P electricity trading is the main factor influencing households' intention to participate. Openness towards P2P electricity trading was found to be largely determined by knowledge about the product and technology in general and a positive attitude towards the environment, regionality, and production transparency. Respondents indicating independence from their energy supplier and energy costs as important were less willing to participate in P2P electricity trading. For those interested in participation, ideological reasons such as the option to share electricity also seemed to outweigh monetary concerns. Finally, lower age segments and higher educated respondents were found to be more interested in participation. Hahnel et al. (2020) carried out a similar study and found that prosumers have a higher intention to participate in P2P electricity markets than consumers. Moreover, prosumers represented a younger age category, were higher educated, more interested in RETs, were more willing to invest in RETs, and were less conservative regarding their political ideology than consumers.

Pumphrey et al. (2020) researched drivers and barriers to the uptake of P2P electricity trading among prosumers and consumers. They found that both prosumers and consumers identified ease of use of the technology and automation of receiving and transmitting electricity and costs and prices as key factors determining their willingness to participate in P2P electricity markets. For prosumers, the power and image associated with reducing environmental impacts and playing a role as electricity exporter in the LEM were found to be important determinants of their positive attitudes toward P2P electricity trading. User empowerment, demand response, and control were not found to be important factors for either group.

Wilkinson et al. (2020) studied a trial of a P2P electricity trading model using blockchain technology in Western Australia using focus groups. Participants were concerned with the financial impacts of P2P electricity trading, stating to be discouraged from participating if they would be worse off financially. Participants were also dissatisfied with the purely market-driven design of the trading platform which did not align with community values. They expressed a desire to support the local community through P2P electricity trading and trade with individuals of one's choice. Moreover, participants found the design to be too similar to the stock market, being afraid that this would disadvantage the uneducated in their ability to trade. Finally, prosumers sometimes felt they were exposed to too high risks by selling their own electricity into a market with a limited number of consumers as this could lead to lower returns on their investment.

Georgarakis et al. (2021) researched prosumers' preferences for P2P electricity trading in the Netherlands using a discrete choice experiment. They found that environmental attributes were the most important factor affecting prosumers' opinions on P2P electricity trading by a margin. The second most important factor was the additional effort of participation, followed by the economic aspects. Improved efficiency, self-sufficiency, and social connection were also relatively important factors and scored similarly to economic aspects.

When comparing the studies on the social dimensions of P2P electricity markets, it becomes clear that they show varying results regarding households' intentions and motivations to participate. Five studies found that the environmental benefits of the increased use of green electricity as an important driver of the intention to participate (Reuter & Loock, 2017; Mengelkamp et al., 2018; Hackbarth & Löbbe, 2020; Hahnel et al., 2020; Georgarakis et al., 2021). The studies show varying results regarding the importance of economic factors. Four studies found that households were very concerned with the financial impacts of participating in LEMs, stating it as one of the most important factors determining their willingness to participate (Reuter & Loock, 2017; Mengelkamp et al., 2019; Wilkinson et al., 2020; Pumphrey et al., 2020), while three other studies showed that economic factors were much less important to households (Mengelkamp et al., 2018; Hackbarth & Löbbe, 2020; Georgarakis et al., 2020). Several studies also found that social and ideological motives matter for households' intention to participate. The possibility of sharing electricity to support the local community was mentioned as an important consideration for participating in P2P electricity markets (Hackbarth & Löbbe, 2020; Wilkinson et al., 2020). Moreover, other social factors such as a strong community identity (i.e., strong connection with the local community), alignment with community values, and self-sufficiency also influenced households' willingness to participate

(Mengelkamp et al., 2018; Hackbarth & Löbbe, 2020; Wilkinson et al., 2020; Georgarakis et al., 2021). The increased regionality associated with LEMs was found to have a positive impact on participation intention by Hackbarth and Löbbe (2020), while Mengelkamp et al. (2018) found it to be insignificant. Furthermore, other intrinsic motivations such as the power and image of being a prosumer in a LEM, independence from an electricity supplier, higher interest in and higher willingness to invest in RETs, the importance of green products, and electricity consciousness were shown to impact motivation to participate (Reuter & Loock, 2017; Mengelkamp et al., 2018; Hahnel et al., 2020; Hackbarth & Löbbe, 2020; Pumphrey et al., 2020). Technological affinity and experience were also found to be highly important for households' intention to participate, households with a small number of technological devices or little affinity with technology showed to be less willing to partake in P2P electricity markets than their more technologically savvy counterparts (Reuter & Loock, 2017; Mengelkamp et al., 2018; Hackbarth & Löbbe, 2020). Moreover, multiple studies showed that ease of use of the platform and the amount of effort needed for participating in a LEM are very important for households' willingness to participate (Pumphrey et al., 2020; Wilkinson et al., 2020; Georgarakis et al., 2021). These studies showed that households are strongly discouraged from participating if the platform is inaccessible and difficult to use as well as when the task of trading electricity takes too much time. Finally, Reuter and Loock (2017) and Hackbarth and Löbbe (2020) show that higher age and lower education levels negatively impact the intention to participate in P2P electricity markets. The impact of other demographic characteristics was found to not have a significant impact by these studies.

3. Theory

3.1 P2P electricity markets as a niche innovation

Rip and Kemp (1998) described technologies as configurations that fulfill societal functions. These sociotechnical configurations are embedded within a broader system of aligned heterogeneous elements. In this sense, technological transitions can be understood as consisting of a change from one sociotechnical configuration to another (Geels, 2002). This means that besides the substitution of a technology, other elements are changed as well. Transitions can also be described through the multi-level perspective (MLP) which is an analytical concept explaining transitions as the outcome of alignments between evolutions at multiple levels (Geels & Schot, 2007). The MLP describes three analytical and heuristic conceptual levels of

analysis: niche innovations, sociotechnical regimes, and the sociotechnical landscape (Geels, 2002). Niches form the micro-level and act as 'incubation rooms' where innovations take place and are protected from the market. Regimes form the meso-level and comprise three interlinked dimensions (Geels, 2005): a network of actors and social groups; formal, normative, and cognitive rules that guide the activity of actors; and material and technical elements. The landscape forms the macro-level, the broader exogenous context in which the regimes and niches exist. Following this conceptualization, a transition would be the change from one sociotechnical regime to another which can occur through interactions between processes at these three levels (Geels & Schot, 2007).

Following the typology of the MLP, the P2P electricity market design would be described as a technological niche and the regime would be the current Dutch electricity system. When protected from mainstream selection forces, a niche innovation can develop, grow, and eventually challenge the status quo (i.e., the regime) (Schot & Geels, 2008). This process is known as mainstreaming. The mainstreaming of an innovation means it becomes able to compete with mainstream markets in the sociotechnical regime (Geels, 2005). For P2P electricity markets, mainstreaming means becoming a viable alternative for the current electricity market design. The MLP is useful for describing the challenges that a technological niche like the P2P electricity market design faces with regard to the mainstreaming process. The analysis of the niche can emphasize the mechanisms and strategies that are useful for the survival of the innovation. However, it is also important to unpack the socio-technical regime to clarify and understand the social and technological elements that might be encountered by the niche (Smith et al., 2010). The interactions between the niche and the elements of the regime cause the innovation to be adapted and 'translated' by different actors acting out of different interests (Smith, 2007). In the context of the P2P electricity market, the translation process is relevant to understand as there are many different actors with different interests in the Dutch electricity system. Each actor will act according to different values, leading to different translations of the niche. This research will focus on community actors.

3.2 Institutional logics

To understand the translation process, it is important to understand the different attitudes of community actors towards P2P electricity markets. A theory that is useful to explain and understand the decisions and underlying motivations of actors concerning the translation

process is institutional logics. Institutional logics was first introduced by Alford and Friedland (1985) who used it to describe contradictory practices and beliefs within the institutions of modern Western societies. They identified capitalism, state bureaucracy, and political democracy as three competing types of institutions that are based on different practices and beliefs that shape how individuals experience political struggles. Friedland and Alford (1991) built on this and explored institutional logics in the context of the interrelationships between individuals, organizations, and society. They consider institutions supra-organizational patterns of activity through which individuals and organizations give meaning to their experiences and produce and reproduce their material practices. Similarly, Thornton and Ocasio (1999, p.804) defined institutional logics as "the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality." Thornton and Ocasio (2008) explain it as a meta-theoretical approach to explaining how the underlying logics of action shape heterogeneity, stability, and change in both individuals and organizations. The concept aims to explain actors' behavior by understanding the actual way of operating as well as the underlying belief system on which their behavior is based. In simple terms, this concept aims to explain why and how actors behave the way they do. It is important to note that while institutional logics shape the behavior of actors, actors also have the capability to transform institutional logics as institutions are socially constructed, hence are comprised by the actions of actors (Thornton et al., 2012). By understanding why community actors engage in certain behavior, it also becomes clearer how to eliminate any potential barriers to the implementation of P2P electricity trading created by that behavior.

Wittmayer et al. (2021) used institutional logics to analyze the mainstreaming of renewable energy prosumerism from multiple actor perspectives. They differentiate between four types of logics: state, market, community, and non-profit. They explain that how an innovation is mainstreamed is different for different logics. A community logic's main feature is its informality and that it is founded on shared values. For mainstreaming an innovation in a community logic it needs to become integrated with the shared value of the community; this process is known as socialization or communalization (Weber, 1978). In my research, I will focus on the differences in logics within communities. A Community is more than a geographically bounded unit; it is defined as a unit based on shared beliefs and values and a sense of belonging. These shared beliefs can have a significant impact on the way social actors behave (Brint, 2001). For instance, Lounsbury (2007) found that different community logics in

Boston and New York lead to different operations with regard to mutual funds. Lee and Lounsbury (2015) showed that communities with politically conservative logics created less pressure on toxic polluters to reduce their emissions than communities with proenvironmental logics.

In my research, I will differentiate between four types of households. I used the conservative dimension of Lee and Lounsbury (2015) and added an egalitarian dimension; hence I will distinguish between conservative and egalitarian logics. Conservatism and egalitarianism are two contrasting types of logics that each come with a specific set of values that contribute to shaping households' attitudes towards P2P electricity markets differently. To make it more relevant to P2P electricity markets, I will further divide these categories into households that are either electricity consuming or also engage in prosumption. The different households will therefore be categorized as: (1) *conservative consuming (CC)*; (2) *conservative prosuming (CP)*; (3) *egalitarian consuming (EC)*; and (4) *egalitarian prosuming (EP)*.

Generally, conservatism is associated with right-wing politics and egalitarianism with left-wing politics. The left-to-right dimension is associated with distinct ideological attitudes which can be described through the constructs of Right-Wing Authoritarianism (RWA) and Social Dominance Orientation (SDO) (Duckitt & Sibley, 2009). RWA is strongly correlated with values and beliefs related to the dimension of conservatism (security, conformity, and tradition) versus openness (stimulation and openness), whereas SDO is strongly correlated with values and beliefs related to the dimension of self-enhancement (achievement, power, hedonism) versus self-transcendence (universalism, benevolence) (Duckitt & Sibley, 2010). Therefore, they suggest that "RWA seems to be the social attitudinal expression of values of collective security and order (social cohesion, order, stability, and tradition) as opposed to values of personal freedom and self-expression, whereas SDO is the social attitudinal expression of values of personal or group power, dominance, and superiority as opposed to egalitarianism, humanitarianism, and universalism". Individuals who score high on RWA or SDO are oriented toward right-wing conservative politics but differ in their specific preferences (Duckitt & Sibley, 2009). Individuals who score low on these dimensions are oriented toward left-wing politics (Ibid). Similarly, Jost et al. (2003) found that several social-cognitive motives predict conservatism, namely: "epistemic motives (Dogmatism, intolerance of ambiguity; Uncertainty avoidance; Need for order, structure, closure), existential motives (Self-esteem; Loss prevention; Terror management), and ideological motives (Rationalization of self-interest; Group-based dominance; System justification)."

The egalitarian logic constitutes the other end of the spectrum with values based on a desire for equality and openness to change. Egalitarianism is a political philosophy characterized by the view that all are worth equal and of equal status (Arneson, 2013). In terms of RWA and SDO as explained by Duckitt and Sibley (2009) and Duckitt an Sibley (2010), typical egalitarian values are openness, self-transcendence, personal freedom, and self-expression.

Table 1

Conservative and egalitarian values

Conservative logic	**Egalitarian logic**
• Conservation, Tradition • Self-enhancement, Rationalization of self-interest • Order, Security • Uncertainty avoidance • Loss prevention	• Openness • Universalism, Egalitarianism, Humanitarianism • Personal freedom, Self-expression,

Reference: Jost et al. (2003); Duckitt & Sibley (2009); Duckitt & Sibley (2010)

The values associated with different political-ideological orientations are an integral part of the different logics. The different values underlying different political ideologies are summarized in table 1. I expect to find differences in the attitudes towards P2P electricity markets between these communities based on the different logics. In turn, these differences would lead to different communalization processes for communities consisting of households characterized by a specific logic. Moreover, I argue that in P2P electricity markets, it is likely that previously un- or loosely related households are forced into association, thereby potentially creating electricity trading communities consisting of households with conflicting logics. The exact effects of P2P electricity market's interference with conflicting logics are unknown to date. The process of becoming integrated with community values (i.e., the communalization process) could become problematic as different logics will lead to different attitudes towards P2P electricity markets which can create challenges to the implementation of the technology. On the one hand, through the forced exchange between households with opposing values in

P2P electricity markets, polarization within the community could be increased and the communalization process could be impeded. Following such a negative vision, P2P electricity markets would only work in communities with homogeneous logics. On the other hand, the forced exchange between households could also help to build trust between households, thereby increasing social cohesion within a community. Following this vision, P2P electricity markets would also work in communities with heterogeneous logics.

3.3 Public deliberation to bridge conflicting logics

When households with conflicting logics are forced into association through the formation of P2P electricity markets it may lead to several issues. In the early stages, households with different attitudes towards P2P electricity markets might have varying opinions on how the market should be designed, managed, and coordinated. In later stages, households might have varying opinions on how other households should act within the market. Although this could lead to conflict and impede the functioning of the market, the increased involvement regarding electricity production and consumption as a community can also create other outcomes. The concept of public deliberation describes how citizens examine an issue, identify potential solutions, and establish evaluative criteria to select the optimal solution (Gastil, 2000). Fishkin (1995) describes public deliberation in a similar manner but introduces the notion of "incompleteness." He argues that deliberation is about improving the completeness of the debate by considering all participants' arguments and ensuring the information required to understand a particular argument is present, thereby making the process more deliberative. In the community formed by the P2P electricity market, face-to-face deliberation is relevant for negotiating rules regarding the market structure, electricity consumption behavior, and possibly electricity prices. Burkhalter et al. (2002) defined the process of face-to-face public deliberation as needing to fulfill three criteria: (1) carefully weigh information and views; (2) be an egalitarian process that includes satisfactory speaking opportunities and heedful listening by participants; and (3) include dialogue that helps overcome differences among participants' different manners of speaking and knowing.

The academic literature notes several positive impacts of public deliberation: increased engagement and activity in civic affairs (Barber, 1984); increased tolerance for opposing views (Gutmann & Thompson, 1996); and increased social capital (Fishkin, 1995). Moreover, conflict will be less determined by a win-lose attitude as people will recognize their

interdependence regardless of their conflicting social identities (Chambers, 1996). According to Mendelberg (2002): "deliberation is expected to lead to empathy with the other and a broadened sense of people's own interests through an egalitarian, open-minded and reciprocal process of reasoned argumentation." Therefore, public deliberation has the potential to mitigate the potential negative effects of the forced association between conflicting logics created by the P2P electricity market. Through deliberation in the P2P electricity market, households with different logics could become increasingly tolerant of one another and increase social cohesion.

4. Methodology

This study presents an exploratory research approach based on a qualitative design. The exploratory status of this research allows for answering the research questions, which have not been studied in-depth before. The qualitative design allows for gaining more in-depth information which is necessary to create an understanding of the logics (Thornton & Ocasio, 2008), and their effects on attitudes towards P2P electricity markets.

Reay and Jones (2016) describe three analytical techniques to capture logics qualitatively: pattern deducing, pattern matching, and pattern inducing. In pattern deducing, the researcher will identify texts or sites relevant to the study and reflect on the context and actions of the subjects of the study. Thereafter, the researcher prepares the texts for coding and analysis and develops a coding scheme. Finally, the researcher defines and counts the unit of analysis; these can be words, phrases, images, or objects. This technique allows the researcher to reveal patterns using large amounts of empirical data. This approach is deductive and interpretive. Pattern matching involves identifying patterns through comparison with the 'ideal type.' The ideal type is defined by identifying and explaining patterns of behavior associated with the ideal type of a certain logic. When identified, the researcher can evaluate and compare its data with the ideal type to identify similarities and differences. Pattern inducing is a bottom-up process in which the researcher gathers raw data to identify patterns. This technique allows the researcher to identify logics by analyzing and coding textual data. The main assumption of this approach is that a particular logic is best understood by looking at it from the inside. This type of research is interpretive and relies on the inclusion of text segments and quotes in the study.

In this study, it is important to define how the different types of logics affect households' attitudes towards P2P electricity market and how this could impact the formation of P2P electricity markets through identifying patterns among households. Considering the

exploratory research design, this is best done through a bottom-up approach. Therefore, **pattern inducing** is the most appropriate technique. Moreover, while the technical aspects of P2P electricity markets are well-studied, little research focuses on the social dimensions of these markets, thereby making the pattern deducing and pattern matching techniques less appropriate.

4.1 Data collection

4.1.1 The sample

The sample consists of six households and the interviewees represent the different household categories (section 2.2). To achieve an equal distribution of egalitarian and conservative households, I selected a variety of households that fit the required characteristics; this was determined after they filled in the initial survey. Thus, not all people that filled in the survey were interviewed. Identification of households is random and is made by going door-to-door in several neighborhoods in the city of Coevorden, located in the South-East of the province of Drenthe, Netherlands. To ensure the sample consists of respondents representative of the demographic affected by P2P electricity markets, consideration is given to the heterogeneity of the sample.

The participants represent a relatively equal mix regarding both factors (Table 2). For each participant, a complete profile is created based on their survey responses. As can be seen in the table, each category is represented by at least one interviewee. In the results section, the profile abbreviations (CC; CP; EC; EP) are mentioned when using quotes from a specific interviewee.

4.1.2 Determination of logic category

The main method for data collection is interviews. However, before each interview, it needs to be established in which type of logic category (CC; CP; EC; EP) the interviewee fits. Therefore, the interviewees need to fill in a short background survey from which their logic category can be derived. The survey initially asks several questions focused on demographic characteristic. Thereafter, the questions focus on finding whether the interviewee is more akin to the conservative or egalitarian logic. The data from the surveys is solely used for creating a profile of the interviewee and is not used for any other purpose in this study. See appendix A for an

overview of the survey questions. The personal data will be recorded, stored, and protected in compliance with European privacy law (EU, 2016). After submission of the thesis, all data will be deleted.

Table 2

Household characteristics of the sample

Variable	Value	Interviewee(s)
Gender	Male	1, 3, 4, 6
	Female	2, 5
Age	Less than 18	-
	18-39	4, 5
	40-60	1, 2
	60+	3, 6
Education	High school degree	6
	Vocational college degree	2
	Applied sciences degree	1, 3
	University degree	4, 5
	Doctorate	-
Monthly income	Less than €2000	6
	€2000 – €3999	2, 4, 5
	€4000 – €5999	1
	More than €6000	3
Accommodation type	Rental house	-
	Rental appartement	-
	House ownership	1, 2, 3, 4, 5, 6
	Appartement ownership	-
Prosumer	Yes	1, 2, 6
	No	3, 4, 5
Type of logic	Conservative	3, 5, 6
	Egalitarian	1, 2, 4
Interviewee profile	Conservative consuming (CC)	3, 5
	Conservative prosuming (CP)	6
	Egalitarian consuming (EC)	4
	Egalitarian prosuming (EP)	1, 2

4.1.3 Interviews

To obtain the textual data needed to apply the pattern inducing technique, interviews are an appropriate method for data collection (Reay & Jones, 2016). The questions aim to extract a comprehensive description of interviewees' attitudes towards P2P electricity markets based on their particular logic. When aware of the logics, I can describe how their logics and attitudes could influence the communalization process and what this implies for the implementation of P2P electricity markets.

The interviews are semi-structured and the questions are similar for all interviewees. The first questions are general and focused on the interviewee's views and opinions about climate change, the energy transition, and prosumption. Thereafter, interviewees are given an explanation about P2P electricity markets and asked if they would consider participating in such a market and what would be their motivation to do or not to do so. Several following questions focus on interviewees' specific preferences regarding the design of a P2P electricity market. In this part of the interview, questions aim to identify how interviewees believe the market should function and how it should be organized. At the end of the section with questions relating to motivations to participate, behavioral impacts, and preferences regarding P2P electricity markets, interviewees are asked whether they think, considering all aspects and impacts previously discussed, the advantages of implementing P2P electricity markets outweigh the disadvantages. In short, the interviewees are asked if they think P2P electricity markets could be a good alternative to the current electricity system. In the last part of the interview, the interviewees are subjected to a hypothetical situation in a P2P electricity market. In this hypothetical situation, households are participating in the local market and mutual dependence exists between the households in the community. Two different households in the community can have large differences in values and worldviews. The goal of this experimental element is to test whether the relationships between households created by the interdependence central to P2P electricity markets could lead to increased social cohesion within a community. This set of questions starts with a question on the openness towards households with different values and practices with whom the interviewee would need to cooperate. Finally, participants are asked whether they think participation in a P2P electricity market would increase social bonding between the households and social cohesion.

A limitation to the chosen manner of data collection is that I derive conclusions for an entire logic category based on the responses of individuals. Therefore, it is important to select respondents that accurately represent the different logics.

The interviews will all be done online via Microsoft Teams and each interview will be audio-recorded and transcribed in Dutch. Any quotes used in this study will be translated into English. The personal data will be recorded, stored, and protected in compliance with European privacy law (EU, 2016). After submission of the thesis, all data will be deleted. Before each interview, interviewees signed a consent form which allowed me to record, transcribe and use the data gathered from the interview. The interviewees have also been offered to read a draft of the thesis. This is in line with the University of Twente's Ethics Committee (EC BMS, n.d.).

4.2 Data analysis

To reveal patterns and identify logics using the pattern inducing technique, it is important to include text segments and quotes in the study. Moreover, Thornton and Ocasio (2008) explain that the theory of institutional logics is especially suitable for interpretive methods of analysis. Therefore, I will analyze each document using discourse analysis. Discourse analysis is a qualitative, interpretive, and constructionist method of analysis and will allow me to gain a more in-depth and comprehensive understanding of the logics that determine an actor's attitude toward P2P electricity trading (Saragih et al., 2021). Hardy et al. (2004) explain that discourse analysis is unique in the sense that it focuses on how reality is produced rather than interpreting social reality as it is. Discourses thus create social reality and studying them gives the researcher an understanding of how interviewees construct and experience their realities.

This method is appropriate for this study as it allows for the systematic uncovering of how the different logics guide actors' attitudes towards P2P electricity markets. The conservative and egalitarian logics also determine how interviewees experience and give meaning to their social realities. Through the pattern inducing technique, I aim to identify how a logic creates specific patterns. In turn, this gives me an understanding of how attitudes towards P2P electricity markets are formed by an actor's logics. This is important to understand as it gives the researcher more in-depth knowledge on what guides an actor's attitudes, hence also helping in understanding what would be needed to alter or reinforce an actor's attitude. To accurately show the patterns for the conservative and egalitarian logics, respectively, I show the number of interviewees representative of a specific statement relative to the total number of interviewees in the logic category in brackets behind the statement (e.g. egalitarian households are generally concerned about climate change (2/3)).

5. Results

5.1 Views on climate and energy

All participants but one thought of climate change as an issue to be taken seriously; some believe it is more serious than others. Overall, egalitarian respondents viewed it as a more serious issue than conservative respondents. Interviewee 6 (CP) expressed he does not worry about climate change and believes human actions are not the cause of global warming.

Most participants expressed some familiarity with the energy transitions. While no one considered him- or herself an expert of the topic, all were familiar with what it entails and what the motives and goals behind it are. All participants considered it a positive and necessary transition. Most interviewees characterized by a more egalitarian logic (2/3) emphasized the motives behind their commitment, as interviewee 2 (EP) noted:

"I view the energy transition as absolutely necessary. The environment and its preservation is one of the most important things we are currently dealing with because I think a clean world is at the basis of everything and is essential in providing our children a future."

The other interviewees characterized by a more conservative logic considered it important but were personally less involved and motivated to contribute.

When asked about how conscious they were engaged in their electricity use, a clear division was noticeable between the egalitarian prosuming households and the other (CC, CP, EC) households. Egalitarian prosuming households stated they were more consciously engaged with their electricity use and made active attempts to lessen their use, while the other households noted much less interest in, and engagement with their electricity use. For example, as interviewee 1 (EP) put it:

"I am quite conscious about my electricity use. I try to let machines such as the dishwasher and the washing machine run during daytime when electricity generation from our panels is highest."

Interviewee 3 (CC) and interviewee 6 (CP), on the other hand, stated:

"No, I am not really conscious about my electricity use. I do not actively try to save electricity and use less." – Interviewee 3 (CC)

"For pure economic reasons we installed solar panels. It is not like I am conscious about every kilowatt of electricity." – Interviewee 6 (CP)

The egalitarian prosuming households stated the increase in consciousness regarding their electricity use was a result of more insight into their electricity production and consumption. The prosuming interviewees (3/3) became interested in solar PVs by the financial returns it could provide them as well as the positive ecological impacts associated with RETs (2/3). All noted that it needed to be affordable in the first place. All stated that their decision to purchase and install solar PV was motivated by the financial benefits of RETs. The egalitarian prosuming households were also motivated by the ecological impacts of renewable electricity. Moreover, all mentioned the feed-in tariff as an important motivation.

When asked about whether or not having solar PVs has impacted their electricity use, prosumers gave varying responses. Most (2/3) stated that it made them more conscious about their electricity use, while the other (1/3) said that because the feed-in tariff provided him with financial returns, he did not feel motivated to become more consciously engaged in electricity use.

Consumers noted practical and financial reasons for not prosuming. One interviewee did not have a suitable roof for solar PV and the two other consuming interviewees currently lacked the funds to purchase them.

5.2 Motivations and concerns

There was a clear division noticeable between egalitarian and conservative respondents regarding their stated likelihood of participation. All egalitarian households showed a high willingness to participate, while conservative households generally showed less willingness (1/3 willing to participate). The conservative households expressed concerns about the practical limitations of a P2P electricity market. As can be seen from the following quotes:

"I do see some practical problems. [...] I am not sure whether such a system would be able to meet the electricity demands. Also, who is responsible when electricity can't be delivered, do I than have to deal with the angry consumers?" – Interviewee 3 (CC)

"I do not want to spend any extra effort on my electricity. I am not interested in negotiating with my neighbors on 15 kilowatts of electricity." – Interviewee 6 (CP)

Besides the practical obstacles related to generation capacity and increased effort, conservative households' willingness to participate was mostly motivated by the financial impacts of participation (3/3). All conservative households stated they only wanted to participate if the costs of electricity would be lower than in the current system. Moreover, interviewee 3 (CC) noted that the surplus electricity generated by prosuming households would need to be fairly compensated financially. Finally, the social benefits that the ability to share electricity with the community would bring were also mentioned as a motivation. As interviewee 5 (CC) expressed:

"I would put my self-interest first. […] I would want to gain something from participating. I would not want to do it if it is only going to cost me something. That being said, I do think it would have a lot of advantages for the unity of the community because of the common interests it creates."

Egalitarian households expressed a variety of motivations to participate. All mentioned the social impacts of P2P electricity markets as an important motivation. The perceived social impacts included the ability to share electricity with the local community and the common goal created by being responsible for the local market. The common goal was expected to create a sense of solidarity within the community as well as increase awareness and involvement regarding the community's total electricity production and consumption:

"I think that when we as a neighborhood would be responsible for our little electricity market, you would create a certain awareness like: What do we use and what do we generate? What can we do to lessen our consumption? If we can create an insight into that and we as a community can be 100 percent self-sufficient, I think that would be fantastic. That would also create solidarity." – Interviewee 1 (EP)

The more efficient use of renewable electricity was also mentioned as an important motivation to participate. Moreover, the environmental benefits created by the increased availability of renewable electricity were found important. Similar to conservative households, the egalitarian households also expressed the importance of the financial impacts of participation. While stating its importance, egalitarian households emphasized it less than their conservative counterparts. They (3/3) showed willingness to pay more for their electricity to support the local community and exploit the other benefits associated with P2P electricity markets. As interviewee 5 (EC) put it:

"I would not mind paying €100,- per month extra if I know it would benefit the environment. Also, I would rather grant my neighbor a few cents more than one of those large suppliers. However, it would be the most attractive if it is below the price of the electricity providers."

All egalitarian households showed motivation to play a larger role in the transition to a cleaner electricity system. The increased responsibility created by the greater autonomy of a more independent electricity system was also seen as an opportunity to make the transition more socially equitable as well as giving participants more power to manage the transition on a local scale.

While being positive, the egalitarian households (3/3) also expressed several concerns related to the practical feasibility and unintentional social and financial consequences of P2P electricity markets. One interviewee expressed concerns that a P2P marketplace would become too much like a stock market which would lead to competition among households:

"I think that when the design becomes too much like a stock market, you will create competition and commercialism which would go paired with a lot of gossiping and hassle. I think that might ruin the neighborhood." – Interviewee 2 (EP)

Other concerns were related to the dependence on other households in the community for the functioning of a P2P electricity market. Some (2/3) expressed that, for a well-functioning market, all participants in a community should have similar attitudes towards electricity consumption. These interviewees felt that the system would not function properly when households with very electricity-intensive practices participated. Moreover, all expressed the desire for strict agreements between households so that every participant would be able to fulfill its electricity needs. This desire was also shared by the conservative households.

"I think there should be agreements and assurances that ensure that you buy and sell electricity according to certain rules. Not that if my neighbor moves, the next one does not want to sell electricity to me anymore, so to speak." – Interviewee 5 (EC)

Similar to conservative households, egalitarian households shared their practical concerns. For the egalitarian households, these were related to the generation capacity in a community and supply security. They were willing to spend additional efforts to participate in P2P electricity markets.

5.3 Impact on behavior

All interviewees except interviewee 6 thought participating would impact their electricity consumption to some extent. Overall, egalitarian households found it likelier that they would alter use patterns or lessen use than conservative households. On the household level, both conservative and egalitarian households mentioned that participating would lead them to be more conscious about their electricity use. The underlying motivations to become more conscious about their electricity use differed for conservative and egalitarian households:

"I think I would become even more conscious about my electricity use. It is a combination of factors, it is your own responsibility to meet the electricity needs of your community and you will think better about efficiency and cooperation." – Interviewee 1 (EP)

"I would at most become a little more conscious about my electricity use. If I can save more, I can sell more." – Interviewee 3 (CC)

Egalitarian households (3/3) also put greater emphasis on the electricity use consciousness of the community as a whole, something which conservative households did not consider. According to egalitarian households, participants should coordinate their use patterns so that everybody can meet their electricity needs, also when the amount of electricity available is lower. They advocated for high levels of coordination and proposed that certain mechanisms should be implemented to manage the community's electricity use patterns based on the amount of available electricity. As Interviewee 1 (EP) explained:

"There should be a smart algorithm in place that allows a certain amount of electricity consumption at a certain time so that you can't run all machines at all times."

Besides showing greater willingness to save electricity, egalitarian households (3/3) were also more willing to compromise on comfort to ensure the system functions well than their conservative counterparts. The conservative households were less open to changing their habits for the P2P electricity market.

"I do realize it is all luxury. I would without hesitation get rid of my dishwasher for the functioning of the market, no problem." – Interviewee 4 (EC)

"I would rather not sacrifice comfort. It would not be a problem if it is a small intervention but it should not be at the cost of my quality of life, I find that just as important." – Interviewee 3 (CC)

Again here, the dependence on the practices of other households in the community was emphasized. Because of the high interdependency, several households (3/3C; 2/3E) expressed their fears that they would bear the burdens of low supply when other households would not be as motivated to save electricity.

"If I have to sacrifice some of my comfort because another household uses too much, I would find that frustrating. If I am doing my best to save electricity and someone else does not, I will bear the consequences." – Interviewee 5 (CC)

Moreover, the interviewees believed that solely relying on their community would not always be sufficient for fulfilling their electricity demands. In times of low supply, all interviewees thought it should be possible for the grid to back up the local market. Most households (2/3C; 2/3E) argued that self-sufficiency of the P2P electricity market is not always realistic. The egalitarian households did emphasize it should be the ultimate goal.

5.4 Design preferences

No noticeable differences were observed between the different types of households regarding their beliefs on how the market should function and how it should be organized. However, there were slight variations in how the interviewees thought the local market should be designed and organized. Most interviewees (2/3C; 3/3E) advocated for a central authority that oversees the transactions, manages the market, and ensures the rules and agreements are being followed. The interviewees had varying opinions on what kind of form this authority should take but all thought the market would not function properly without it. Reasons for preferring a market with a central authority were the enforcement of rules and regulations, a lack of knowledge about the functioning of the P2P market, the scale of the market, and the exclusion of human emotions from the trading process. Reasons for preferring a full P2P market (i.e., a market where peers directly trade with each other) were the extra costs of hiring a central authority and the independence and control of not having a central authority. Some of the interviewees also preferred to have the possibility to both directly trade with peers and have a central governing body.

"I think there should be a body that ensures that you sell electricity according to certain rules, that ensures a certain responsibility to your clients." – Interviewee 4 (EC)

"If you have one central manager, it is already becoming similar to the old system again, plus the manager also brings extra costs" – Interviewee 3 (CC)

"I would prefer a larger market with a central manager because that would make the community less vulnerable to supply shortages; and then, as a part of the larger market, we as a street or neighborhood can trade directly with each other." – Interviewee 2 (EP)

Except for interviewee 1 (EP), none of the interviewees would want to know with whom they are trading electricity. Interviewee 1 (EP) had a very pragmatic perspective on the topic and would want to know for what purpose the buyer purchases the electricity.

"If the neighbor sits in his jacuzzi on a daily basis and uses enormous amounts of electricity to warm it. I would not want to deliver my electricity for such a purpose. I would rather deliver it to people who are very conscious about their electricity use." – Interviewee 1 (EP)

This pragmatic perspective is the exact point that concerned the other interviewees. They were worried that making conscious decisions about with whom to trade electricity would lead to frustration, social conflicts, and exclusion. Most participants viewed knowing with whom you trade as a trade-off between a type of social control of households' electricity practices and negative social consequences. They believed the social consequences would be more significant than any benefits provided by being able to choose a trading partner. Therefore, all other interviewees preferred an anonymized version.

"Then you start to ask yourself what is someone doing all day, where is my electricity going? I think people would start to make choices and I do not think that should be the goal." – Interviewee 5 (CC)

"I think you should approach it as a shared project. If it becomes too personal, I am afraid it would lead to frustration and conflict." – Interviewee 2 (EP)

Others (2/3C) were not concerned with the social impacts of knowing your trading partner but simply did not think it was important.

"I do not think it is important. If someone uses more, I can sell him more." – Interviewee 3 (CC)

5.5 Comparison to the current system

The egalitarian households (3/3) believed the advantages of P2P electricity markets largely outweigh the disadvantages, hence thought it could be a viable alternative for the current system. The conservative households (2/3) were more skeptical and generally saw more disadvantages to the P2P market design. Therefore, they preferred the current system.

As previously mentioned, the egalitarian households perceived fewer barriers to participating in P2P electricity markets. Moreover, they believed it could offer many benefits in terms of increased consciousness regarding electricity used compared to the current system.

"In the current system, you just plug in your devices and do not think about anything. It is just there and you have enormous amounts at your disposal if you just pay. I think being a part of

your own little electricity company creates a lot of awareness regarding what is produced and consumed." – Interviewee 1 (EP)

While being positive, the egalitarian households also had their concerns regarding complete reliance on the community for electricity supply. Therefore, many proposed a combination of the current system and the P2P system in which the current system can act as a backup when needed.

For the conservative households, the practical barriers associated with P2P electricity markets were considered the largest disadvantage. Most thought the concept could potentially play a role in the future electricity system, but skepticism was the overall sentiment. The interviewees were mostly deterred by the potentially higher costs, additional effort, the increased interdependency within the community, and the capacity problems of the P2P market compared to the current system. The convenience and supply security of the current system were the main arguments given for preferring the current system.

"I find the increased dependence on others a big risk. It makes you dependent on the actions and decisions of others." – Interviewee 5 (CC)

"In the current system, everything is arranged, I do not have much control over it but also no responsibility and it does not cost me any effort." – Interviewee 3 (CC)

While skeptical, most conservative households (2/3) did think that the P2P system could be superior to the current system in some aspects. They mentioned the additional control it gives participants in choosing their source of supply as a benefit. They also stated to be very cost-driven in their decision-making; they would consider the P2P system more seriously if it would be cheaper than the current system.

Some of the conservative households (2/3) also proposed a combination of the current system and the P2P system. Overall, they preferred the current system. One interviewee would not consider the P2P system under any circumstance:

"I would try to prevent having to participate as long as possible." – Interviewee 6 (CP)

5.6 Impacts on social cohesion

The main difference in the responses to questions related to concerns about other households' practices was that the egalitarian households (3/3) generally were more concerned with the practices of their fellow households and placed higher expectations on them than the conservative households (1/3).

"I would have difficulties participating with households that do not think about what and how much they consume at all." – Interviewee 1 (EP)

"I would not care about who I am cooperating with as longs as the electricity is cheaper than what I pay now." – Interviewee 3 (CC)

Throughout the interview, it became clear that most interviewees (1/3C; 3/3E) already considered the social impacts participating in a P2P electricity market could have within the electricity trading community. Many interviewees already mentioned the effects it might have on social cohesion and unity within a community without asking. All participants thought it could positively impact social cohesion under the right circumstances. The egalitarian households were mostly worried about the fairness of the system regarding the value it creates for participating households. They stated multiple times that they believe social cohesion might be negatively impacted if profits are unequally distributed. Moreover, they believed that, to increase the social cohesion in the community, participation should be voluntary, and everybody should perceive the project as valuable.

"I think it can go in two directions. If everybody sees it is better for the climate, better for the household, better for the wallet, and we do it together, we get treated equally, and we profit equally, it creates solidarity. But, if one household profits much more than another, you create resentment." – Interviewee 4 (EC)

"If you can get the entire neighborhood behind it, it gives a certain amount of social connection but you should not push people to do something they do not want to do; that creates resistance. The project should be presented simply and everybody should see the value of it as a solution for the larger world problems but also for the advantages it can provide themselves."
– Interviewee 2 (EP)

The conservative households also believed that participation in the P2P electricity market could increase social cohesion but had fewer concerns. A recurring theme was the practical feasibility of the project and the conflicts that might be created by a lack thereof. They believed that social cohesion might be negatively impacted by conflicts created by the increase in dependency on other households for electricity supply.

"I think it can create social cohesion as long as you do not get into conflicts when there is too little electricity." – Interviewee 3 (CC)

For the conservative households, the common goal and equal profitability were also important considerations for a potential increase in social cohesion.

"I think we can do more together than alone and if everybody feels that we have that common goal and we are all profiting, it can definitely create a lot of social bonding." – Interviewee 5 (CC)

6. Discussion

6.1 The influence of different logics

My findings indicate that multiple significant differences exist between households with different logics. For both logics, different patterns could be induced which led to differences in their attitudes towards P2P electricity markets. This became already apparent when asked about their views on the energy transition and energy in general. While all think the energy transition is a force of positive change, egalitarian households are more personally involved and motivated to contribute and play a role in the transition. This also leads to different levels of consciousness regarding electricity use, which are significantly higher for egalitarian households. Moreover, electricity use consciousness is also impacted by prosuming which further increases the awareness of electricity consumption, but only for egalitarian households. For prosuming households. The motivation to contribute to the energy transitions by using RETs is financial for all households, and also environmental reasons for the egalitarian households. For the consuming households, the motivation to potentially start prosuming is the same as for the prosuming households; all are financially incentivized, and the egalitarian

households are also environmentally motivated; this is in accordance with the findings of Pumphrey et al. (2020) and Wilkinson et al. (2020). Households characterized by the egalitarian logic are more motivated by the environmental impacts of RETs and feel a greater need to contribute to the larger problem that is climate change. Conservative households are motivated by the financial impacts first and the sustainable aspects second. These findings indicate that the conservative households have a larger focus on self-enhancement which is in accordance with the findings of Duckitt and Sibley (2010).

The differences in motivation to contribute to the energy transition and consciousness regarding electricity consumption also appeared to affect households' motivation to participate in P2P electricity markets. The willingness of conservative households to participate is generally lower as they are more concerned with the practical feasibility, the potential loss of comfort, and the potential additional effort and costs than the egalitarian households. Their main motivation to participate is financial; if they are going to improve financially, they are more likely to participate. Conversely, if they will be worse off financially, they are less likely to participate. The importance of financial impacts was also found by Mengelkamp et al. (2019), Pumphrey et al. (2020), and Wilkinson et al. (2020). While the egalitarian households are also concerned with the financial impacts, they are equally concerned with the environmental impacts. They are also more focused on what participation in P2P electricity markets could lead to in terms of increased electricity savings, more efficient use of RETs, and increased awareness regarding electricity production and consumption than the conservative households. Moreover, egalitarian households are less concerned with spending additional effort or costs and think participating in P2P electricity markets would make them more conscious of their electricity consumption. These findings challenge the findings of Pumphrey et al. (2020), Wilkinson et al. (2020), and Georgarakis et al. (2021), who found that ease of use and no additional effort needed are significant motivations to participate. While seemingly contradictory, these factors are undoubtedly also important for egalitarian households to some extent.

Similar to the findings of Mengelkamp et al. (2018), Hackbarth and Löbbe (2020), Wilkinson et al. (2020), and Georgarakis et al. (2021), all households think that being jointly responsible for the production of electricity and fulfillment of electricity needs can have positive social impacts. However, they do believe that the social impacts will only be positive when the market fulfills certain criteria. All households want strict organization and regulation to ensure the system is fair and they are secured of sufficient electricity supply. Most households advocate for a central authority that governs the market, oversees transactions, and

ensures rules are being followed. Moreover, households mostly prefer an anonymized trading platform as they are afraid that knowing who their trading partner is would lead to conflict and exclusion of certain households based on individual preferences.

Egalitarian households place higher expectations on themselves in terms of electricity use consciousness, reduction of electricity consumption, and making sacrifices (i.e., extra costs or efforts and willingness to sacrifice comfort) for the functioning of the market than conservative households. However, they also expect other households to make similar efforts. Contrarily, conservative households place lower expectations on themselves but also place lower expectations on other households. As conservative households are less willing to sacrifice comfort, exert additional effort, incur additional costs, and adapt to the community's needs; this could be a potential point of friction between egalitarian and conservative households when they would participate in a P2P electricity market together.

Overall, egalitarian households have a positive attitude towards P2P electricity markets and see more advantages than disadvantages to participation. They believe it could be a good alternative to the current system but also have some practical concerns. Therefore, they think that in the current situation, it should serve as complementary to the current electricity system, while in the future, a completely self-sufficient system should be the goal. Conservative households are significantly less positive and, in some cases, very negative. They are mostly discouraged from participating by the risk they associate with the P2P electricity market in terms of increased interdependence and limited generation capacity within the community. Moreover, conservative households prefer the current system because of its convenience; it requires little effort and supply is virtually unlimited. In its current form, they do not believe the P2P electricity market is a suitable replacement for the current system. Table 3 shows the responses per profile category.

Table 3

Response summaries per profile

Responses	**CC**	**CP**	**EC**	**EP**
Concern about climate change	• Moderate	• Low	• High	• High

Responses	**CC**	**CP**	**EC**	**EP**
Attitude towards energy transition	• Positive • Feeling low personal involvement • Not motivated to contribute	• Positive • Feeling low personal involvement • Slightly motivated to contribute	• Positive • Feeling moderate personal involvement • Motivated to contribute	• Positive • Feeling high personal involvement • Very motivated to contribute
Electricity use consciousness	• Low	• Low	• Moderate	• High
Motivation to prosume	-	• Financial	-	• Ecological and financial
*Motivation to **not** prosume*	• Practical	-	• Financial	-
Motivations to participate in P2P electricity markets	• Financial benefits • Social benefits	• Social benefits	• Environmental benefits • Financial benefits • Social benefits	• Environmental benefits • Financial benefits • Social benefits • Increased awareness of electricity production and consumption

Responses	**CC**	**CP**	**EC**	**EP**
*Motivations to **not** participate in P2P electricity markets*	• Practical barriers • Additional effort • Additional costs • Loss of comfort • Dependence on other households	• Additional effort • Additional costs	• Electricity use behavior of other households • Dependence on other households	• Electricity use behavior of other households
Impact of participation on behavior	• Perhaps slightly more conscious about electricity consumption	• No impact	• Slightly more conscious about electricity consumption	• More conscious about electricity consumption • Coordinate use patterns within the community according to electricity supply
Design preferences	• Full P2P /Hybrid market	-	• Community-based market	• Community-based /Hybrid P2P market
Comparison to current system	• More disadvantages than advantages • Prefers current system	• More disadvantages than advantages • Strongly prefers current system	• More advantages than disadvantages • Prefers P2P system • In current form complementary to current system	• More advantages than disadvantages • Prefers P2P system • In current form complementary to current system

6.2 Patterns

From the responses, two diverging patterns per category are identifiable. For the conservative households, the focus on the financial aspects and impacts of P2P electricity markets stands out. They are mainly interested in participation when they expect to gain something from it financially. Other benefits, such as positive social and environmental impacts, are not as important to them and would not convince them to participate if they would not improve financially. Moreover, their attitudes are also negatively impacted when they need to significantly alter their behavior regarding electricity consumption and use patterns. They also emphasize practical concerns and are concerned with the potential loss of comfort and convenience, increased interdependency between households, and additional effort needed to participate. These are significant alterations compared to the status quo and indicate that conservative households are generally less willing to participate in P2P electricity markets as they are more easily deterred from participating based on their criteria. The attitudes of conservative households are also characterized by a focus on personal gain with a smaller focus on the community. Based on the identified patterns, conservative households can be argued to have a more **realistic** attitude toward P2P electricity markets, driven by practicality. They focus predominantly on the concrete, practical consequences that participation would imply and are less convinced by the hypothetical benefits of P2P electricity markets.

For egalitarian households, the environmental and social impacts are more important than the financial impacts. While financial benefits would motivate the egalitarian households to participate, they would not be deterred from participating in case of higher costs. Egalitarian households are also open to potentially losing comfort and making a greater effort for the market. This attitude seems to be motivated by a deeper belief that the current way of living is unsustainable and needs to be adapted to deal with issues such as climate change and the energy transition. They are motivated to make an impact and are willing to adapt their behavior to do so. However, they also expect other households to adapt their behavior to some extent. This community focus stood out for the egalitarian households; their attitudes are formed by thinking in terms of achieving environmental, social, and financial benefits through coordinated and efficient practices as a community as a whole. Based on the identified patterns, egalitarian households can be argued to have a more **optimistic** attitude towards P2P electricity markets, driven by ideology. They are less deterred by the practical limitations of the market design and generally have fewer concerns than conservative households. Instead, they are

mainly focused on the potential benefits of P2P electricity markets and strongly believe that the impact can be positive.

Table 4

Patterns per logic

Conservative	**Egalitarian**
• **Realistic attitude, driven by practicality**	• **Optimistic attitude, driven by ideology**
• Low to moderate willingness to participate	• High to very high willingness to participate
• Mainly financially motivated	• Mainly environmentally and socially motivated
• Environmental and social impacts second to financial impacts	• Financial impacts second to environmental and social impacts
• Focus on personal gain/self-interest	• Community focus
• Little focus on community	
• Low willingness to alter behavior for the P2P electricity market	• High willingness to alter behavior for the P2P electricity market
• Bothered by practical limitations, dependence on other households, and inconvenience of P2P electricity market	• High expectations of other households w.r.t. electricity consumption and use consciousness
• Prefer central governing authority as well as possibilities for full P2P trading	• Prefer central governing authority as well as possibilities for full P2P trading
• Prefer current system	• Prefer a combination of P2P electricity market and current system
• Participation would increase willingness to prosume and prosumption increases willingness to participate	• Participation would increase willingness to prosume and prosumption increases willingness to participate

Prosumption does not seem to have a consistent impact across logics on households' attitudes towards P2P electricity markets. For egalitarian households, it leads to an increased

focus on electricity production and consumption consciousness and increased motivation to participate in P2P electricity markets. It has no impact on conservative households. Contrarily, not prosuming does have a consistent impact across logics. Consuming households are worried about the power asymmetry between them and the prosuming households in a P2P electricity market. They fear that the dependency on prosuming households could have significant negative consequences for fulfilling their electricity needs. Moreover, the consuming households all showed increased motivation to start prosuming when participating in a P2P electricity market. Table 4 shows the patterns per logic.

6.3 Barriers and drivers to implementation

The main differences between the two logics are in willingness to participate, motivation, personal versus community focus, willingness for self-sacrifice and behavior alterations. These differences in attitudes are potential points of friction, thereby creating barriers to the implementation of the P2P electricity markets. For instance, the financial motivation of conservative households versus the environmental and social motivations of egalitarian households could lead to frustrations as these motives are likely to lead to different behaviors for both households. This also relates to the difference in expectations of other households; egalitarian households are generally more concerned with the behavior of other participants than conservative households. The community focus of egalitarian households combined with a high willingness to adapt to the needs of the community versus the personal focus of conservative households with a low willingness to adapt to the needs of the community is also likely to affect the behavior of respective households in different ways, again potentially leading to frustrations between households. Moreover, the difference in willingness to participate increases the difficulty of forming P2P electricity markets as communities are generally not uniform concerning logic. These differences in attitudes could impede the functioning of P2P electricity markets and hence can become barriers that need to be overcome.

While significant differences exist between the households, consensus exists in some areas. All households agree that there is a need for strict organization and coordination within the electricity trading community. There is widespread agreement that a central authority should govern the market and oversee transactions. Moreover, while there are differences in what motivates households to participate, most households (5/6) view the financial, environmental, and social impacts as potential drivers of participation. When a P2P electricity

market can create positive impacts regarding these factors, it could drive the participation rate and increase the likelihood of mainstreaming. Finally, as participation leads to an increased willingness to prosume and prosumption increases the willingness to participate, participation could create a positive feedback cycle of increased prosumption and increased willingness to participate. Therefore, participation could increase RET uptake and positively impact attitudes towards P2P electricity markets.

6.4 The ability of P2P electricity markets to bridge conflicting logics

As described above, households' differences in logic lead to different attitudes towards P2P electricity markets. Nevertheless, regardless of households' type of logic, they believe that participation with other households in a P2P electricity market could lead to more social cohesion within a community. All households show willingness to engage with other households regardless of those households' values. The common goal created by the P2P electricity market can lead to increased social connections among participating households, thereby increasing social capital. The deliberation needed for organizing the market and the shared responsibility over the market would increase engagement with the community and social capital within the community (Fishkin, 1995; Barber, 1984). Moreover, households could become more tolerant of the differences in attitude towards P2P electricity markets of households with different logics (Gutmann & Thompson, 1996). This is especially relevant for egalitarian households as they place greater emphasis on the behavior of other households.

Increased engagement, social capital, and tolerance of opposing views are potential positive consequences of participation in the P2P electricity market. However, all households emphasize the importance of a strictly organized market to allow for a fair and secure system regarding the distribution of benefits and security of supply. Such organization is needed to allow for social benefits to occur.

The differences in attitudes need not impede the functioning of the P2P electricity market if proper deliberative processes are at play within the community. The public face-to-face deliberative process needs to fulfill the requirements of Burkhalter et al. (2002)[1] to be

[1] Burkhalter et al. (2002) defined the process of face-to-face public deliberation as needing to fulfill three criteria: (1) carefully weigh information and views; (2) be an egalitarian process that includes satisfactory speaking opportunities and heedful listening by participants; and (3) include dialogue that helps overcome differences among participants' different manners of speaking and knowing.

effective. Therefore, while the findings indicate that P2P electricity markets could bridge conflicting logics, a conclusive result cannot be derived from the findings as the findings rely on several assumptions due to the exploratory nature of the research. Nonetheless, under the right circumstances (i.e., a well-organized market and appropriate deliberative processes), social cohesion among participating households can increase. Evidence that social cohesion can decrease was not found; however, such an outcome may also be possible.

6.5 The influence of demographic characteristics

Conservative or egalitarian ideologies are not the only forces that determine households' attitudes towards P2P electricity markets. For sociotechnical transitions, factors like gender, age, and education also play an important role.

Males are generally more concerned with the P2P electricity markets' practical limitations and show greater engagement with electricity production and consumption in their households. Females show more consideration for the social aspects and impacts of P2P electricity markets. Overall, age appears to be negatively correlated to the willingness to participate. Younger respondents show a greater willingness to participate than their elder counterparts which supports the findings of Reuter and Loock (2017), Hahnel et al. (2020), and Hackbarth and Löbbe (2020). Respondents with a higher educational level generally have a more positive attitude towards P2P electricity markets, thereby also supporting the findings of Hahnel et al. (2020) and Hackbarth and Löbbe (2020). The lower (less than €2000) and higher (more than €6000) incomes showed less willingness to participate and have a generally less positive attitude towards P2P electricity markets than the middle incomes.

7. Conclusion

7.1 Summary of main results and recommendations for policymakers and the market

From a social perspective, this study aimed to answer how P2P electricity markets can become a viable alternative to the current Dutch electricity market design on the community level. To answer this question, I focused on differences in attitudes towards P2P electricity markets among households; how conservative and egalitarian logics shape households' attitudes towards P2P electricity markets; and how P2P electricity markets can contribute to increasing social cohesion within a community. It provides new insight into the role that institutional

logics play in the formation of attitudes towards P2P electricity trading, thereby showing multiple barriers and drivers to the mainstreaming of the innovation on a community level. Using data gathered from interviews with six different households in the city of Coevorden, Netherlands, I was able to show different patterns among households with different logics regarding their attitudes towards P2P electricity markets. Therefore, this study adds to the limited knowledge available on what determines users' attitudes towards P2P electricity markets by giving a more in-depth explanation. The two types of logics used in this study are the egalitarian and the conservative logic. A further division was made between households that prosume (produce and consume) electricity through microgeneration technologies and households that only consume electricity. Thus, the households were categorized as either conservative consuming (CC); conservative prosuming (CP); egalitarian consuming (EC); or, egalitarian prosuming (EP).

My findings indicate that the main difference in attitudes towards P2P electricity markets between different types of households can be explained by differences in logics. The conservative households were found to have a **realistic** attitude toward P2P electricity markets; they are less convinced by hypothetical benefits and emphasize the concrete, practical shortcomings of the market design. This resulted in a more reluctant stated likelihood of participation as they showed significant concern for the practical limitations of P2P electricity markets (i.e., generation capacity and supply security), the financial consequences of participation, and the additional needed effort. Motivations for conservative households to consider participation were found to be financial gains and social benefits. Contrarily, the egalitarian households were found to have an **optimistic** attitude towards P2P electricity markets; they mostly focus on the potential benefits the market can provide and belief in the feasibility of attaining those benefits. This resulted in a greater willingness to participate with a lesser focus on practical concerns. Their main motivations for this were found to be the perceived positive environmental impacts of increased microgeneration, social benefits, potential financial benefits, and increased awareness regarding electricity production and consumption within the community. They also showed willingness to spend additional effort for the P2P electricity market and would not be deterred by slight additional costs or losses of comfort. Besides egalitarian generally positive attitude towards P2P electricity markets, they showed practical concerns and expressed worries about the electricity use behavior of other households. Moreover, the egalitarian households showed a greater focus on the community as a whole, while the conservative households were mostly focused on personal gain. This also led to greater expectations of other households with regard to their electricity consumption for

the egalitarian households, while the conservative households were less concerned with the behavior of others. Both types of households emphasized the need for a central governing authority that ensures rules and regulations are followed and that every participant can fulfill its electricity needs. Prosumption was not found to have a consistent impact across logics on households' attitudes towards P2P electricity markets. For the egalitarian households it appeared to further increase their consciousness regarding electricity production and consumption. Not prosuming appeared to lead to greater concerns regarding the power asymmetries between prosuming and consuming households which increased their dependence on prosuming households.

The effects of the forced association between households with conflicting logics created by P2P electricity markets are difficult to research using the current research design (see section 7.2). Nevertheless, all households stated to be relatively indifferent to the values of other households when engaging in a P2P electricity market. Moreover, all households stated that they thought it to be likely that social cohesion within a community could be increased by participating in a P2P electricity market together. Therefore, P2P electricity markets **could** help to bridge conflicting logics by increasing social cohesion. Still, a conclusive result cannot be said to have been found due to the reliance on assumptions and a hypothetical situation.

From a social perspective, the P2P electricity market design could become a viable alternative to the current Dutch electricity market design. Most households interviewed for this study (5/6) showed willingness to participate in P2P electricity markets if the financial, environmental, and social impacts of participating would be positive. Conservative households emphasize the importance of financial gains but do not disregard the environmental and social impacts, while egalitarian households emphasize the importance of environmental and social gains but do not disregard financial impact. To include both conservative and egalitarian households in the mainstreaming process of P2P electricity markets, the market design should allow for financial, environmental, and social impacts to be positive while also addressing practical concerns. This makes mainstreaming less likely as more conditions have to be met. Another, more effective approach could be to first focus on implementing P2P electricity markets in communities that show a high willingness to participate. According to my results, these communities would mostly consist of egalitarian households. Such communities perceive fewer barriers to participation and can serve as early adopters of the technology. Following this approach, fewer conditions have to be met to implement P2P electricity markets. After small-scale implementation, P2P electricity markets can be further developed to allow for more

positive impacts, thereby likely increasing the number of households that are willing to participate.

Based on the results of this study, to mainstream P2P electricity markets, my recommendation would be to initially focus on egalitarian households, develop the innovation to allow for more positive financial, environmental, and social impacts, and then broaden the scope to conservative households. Given the current state of RETs and storage technologies, the practical feasibility of self-sufficiency throughout the entire year is low. Therefore, I think that P2P electricity markets can be a viable alternative but not a replacement to the current system. It would be most effective when serving as complementary to the current system. This also leaves participation voluntary. Thus, to achieve positive financial, environmental, and social impacts, while also addressing practical issues, I recommend policymakers and the market:

- To initially focus on communities with a high willingness to participate in P2P electricity markets in the mainstreaming process. According to my results, these communities would consist mainly of egalitarian households.
- To research and use these communities to develop the innovation and create and show more benefits to participation to increase the attractiveness of participation for other (conservative) households.
- To implement P2P electricity markets as complementary to the current system to overcome practical barriers.

7.2 Limitations and further research

Several limitations of this study need to be addressed. The main limitation is the small number of participants (N = 6) as this limits generalizability. Moreover, the use of conservative and egalitarian logics to explain the attitudes of households towards P2P electricity markets is limited as attitudes are formed by other factors as well. To provide a comprehensive explanation of what forms an attitude towards an innovation more emphasis should be put on demographic characteristics, technological affinity, and other social variables. It would also be useful to interview more than one person in a household as attitudes within a household need not be uniform. The impacts P2P electricity markets can have on social cohesion are also inconclusive.

The theory of institutional logics proved to be relatively useful for the identification of households' specific values as well as being useful for explaining how households' attitudes towards P2P electricity markets are formed by those logics. Furthermore, using institutional logics allowed for gaining an in-depth understanding of the different types of households through the use of interpretive methods which were especially suitable for the exploratory, small-N research design. However, I do believe that I have not fully exploited the potential of using institutional logics for the in-depth investigation of households' attitudes towards P2P electricity markets. A broader focus on other cultural factors that shape identities and attitudes could align better with the constructivist orientation of the theory. I believe the theory of public deliberation can be very useful for researching the impacts participation in P2P electricity markets can have on the social cohesion within an electricity trading community. The research design of this study was inadequate to properly research the effects on social cohesion. Therefore, the theory of public deliberation was not particularly useful for this research but can be very relevant for further research on social cohesion impacts.

I advise further research to be focused on gaining a more in-depth and comprehensive understanding of what determines the attitudes of households towards P2P electricity markets as understanding this can significantly help decision-makers to effectively promote the mainstreaming of the innovation. This could be done in studies with a larger number of participants. Moreover, I believe that research on this topic should also focus more on pilot projects in the future. The ability to infer results from the observation of actual behavior adds a lot of value for niche innovations such as this. I also believe that the impact P2P electricity markets can have on social cohesion is an interesting and potentially useful topic to research. Through a research design using focus groups or pilots, the impacts on social cohesion could be more adequately studied, thereby achieving more conclusive results.

8. References

Ackermann, T., Andersson, G., & Söder, L. (2001). Distributed generation: a definition. *Electric Power Systems Research*, *57*(3), 195–204. https://doi.org/10.1016/S03787796(01)00101-8

Albadi, M. H. & El-Saadany, E. F. (2007). Demand Response in Electricity Market: An Overview. *in: IEEE PES GM, Montreal*, 1–5. https://doi.org/10.1109/PES.2007.385728

Alford, R. R. & Friedland, R. (1985). *Powers of theory: Capitalism, the state, and democracy*. Cambridge University Press.

Allcott, H. (2009). *Real Time Pricing and Electricity Markets* (Working Paper No. 7). Harvard University.

An, J., Lee, M., Yeom, S., & Hong, T. (2020). Determining the Peer-to-Peer electricity trading price and strategy for energy prosumers and consumers within a microgrid. *Applied Energy*, *261*, 114335. https://doi.org/10.1016/J.APENERGY.2019.114335

Andoni, M., Robu, V., Flynn, D., Abram, S., Geach, D., Jenkins, D., McCallum, P., & Peacock, A. (2019). Blockchain technology in the energy sector: A systematic review of challenges and opportunities. *Renewable and Sustainable Energy Reviews*, *100*, 143–174. https://doi.org/10.1016/j.rser.2018.10.014

Arneson, R. (2013). Egalitarianism. In Zalta, E., N. (Eds.), *The Stanford Encyclopedia of Philosophy*, Stanford University Press.

Barber B. (1984). *Strong Democracy*. Berkeley: University of California Press.

Bjarghov, S., Löschenbrand, M., Saif, A. U. N. I., Pedrero, R. A., Pfeiffer, C., Khadem, S. K., Rabelhofer, M., Revheim, F., & Farahmand, H. (2021). Developments and Challenges in Local Electricity Markets: A Comprehensive Review. In *IEEE Access*, *9*, 58910-58943 https://doi.org/10.1109/ACCESS.2021.3071830

Brint, S. (2001). Gemeinschaft Revisited: A Critique and Reconstruction of the Community Concept. *Sociological Theory*, *19*(1), 1-23. https://doi.org/10.1111/0735-2751.00125

Brown, D., Hall, S., & Davis, M. E. (2019). Prosumers in the post subsidy era: an exploration of new prosumer business models in the UK. *Energy Policy*, *135*, 110984. https://doi.org/10.1016/J.ENPOL.2019.110984

Burkhalter, S., Gastil, J., & Kelshaw, T. (2002). A conceptual definition and theoretical model of public deliberation in small face-to-face groups. *Communication theory*, *12*(4), 398-422. https://doi.org/10.1111/j.1468-2885.2002.tb00276.x

Capper, T., Gorbatcheva, A., Mustafa, M. A., Bahloul, M., Schwidtal, J. M., Chitchyan, R., Andoni, M., Robu, V., Montakhabi, M., Scott, I. J., Francis, C., Mbavarira, T., Espana, J. M., & Kiesling, L. (2022). Peer-to-peer, community self-consumption, and transactive energy: A systematic literature review of local energy market models. *Renewable and Sustainable Energy Reviews*, *162*, 112403. https://doi.org/10.1016/J.RSER.2022.112403

Chambers S. (1996). *Reasonable Democracy*. Ithaca, NY: Cornell University Press.

Denholm, P. & Margolis, R. M. (2007). Evaluating the limits of solar photovoltaics (PV) in traditional electric power systems. *Energy Policy*, *35*(5), 2852–2861. https://doi.org/10.1016/J.ENPOL.2006.10.014

Duckitt, J., & Sibley, C. G. (2009). A Dual-Process Motivational Model of Ideology, Politics, and Prejudice. *Psychological Inquiry*, *20*(2–3), 98–109. https://doi.org/10.1080/10478400903028540

Duckitt, J., & Sibley, C. G. (2010). Personality, ideology, prejudice, and politics: A dual-process motivational model. *Journal of Personality*, *78*(6), 1861-1894. https://doi:10.1111/j.1467-6494.2010.00672

Dutch New Energy Research (2022). *The National Dutch Solar Trend Report 2022.* Heerhugowaard, Dutch New Energy Research. https://en.solarsolutions.nl/trend-report/

Ellabban, O., Abu-Rub, H. & Blaabjerg, F. (2014). Renewable energy resources: Current status, future prospects and their enabling technology. *Renewable and Sustainable Energy Reviews, 39*, 748–764. https://doi.org/10.1016/J.RSER.2014.07.113

Ethics Committee University of Twente (n.d.). *Ethics Committee BMS / Domain Humanities & Social Sciences*. https://www.utwente.nl/en/bms/research/ethics/#procedurewebapplication

EU (2016, April 27). *General Data Protection Regulation*, EUR-Lex. https://eur-lex-europa-eu/legal-content/EN/TXT/?uri=celex:32016R0679

Fahrangi, H. (2010). The Path of the Smart Grid. *IEEE Power and Energy Magazine, 8*(1), 18-28. https://doi.org/10.1109/MPE.2009.934876

Fishkin J. (1995). *The Voice of the People.* New Haven, CT: Yale University Press.

Ford, R., Whitaker, J. & Stephenson, J. (2016). *Prosumer collectives: a review* (Project Report). Centre for Sustainability, University of Otago. http://hdl.handle.net/10523/6646

Friedland, R. & Alford, R. R. (1991). Bringing society back in: Symbols, practices, and institutional contradictions. In Powel, W. W. & DiMaggio, P. J. (Eds.), *The new institutionalism in organizational analysis*, 232-263. University of Chicago Press.

Gastil, J. (2000). *By popular demand: Revitalizing representative democracy through deliberative elections*. University of California Press.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy, 31*(8–9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8

Geels, F. W. (2005). *Technological transitions and system innovations: a co-evolutionary and socio-technical analysis.* Edward Elgar Publishing.

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, *36*(3), 399–417. https://doi.org/10.1016/J.RESPOL.2007.01.003

Georgarakis, E., Bauwens, T., Pronk, A. M., & AlSkaif, T. (2021). Keep it green, simple and socially fair: A choice experiment on prosumers' preferences for peer-to-peer electricity trading in the Netherlands. *Energy Policy*, *159*, 112615. https://doi.org/10.1016/J.ENPOL.2021.112615

Giotitsas, C., Pazaitis, A., & Kostakis, V. (2015). A peer-to-peer approach to energy production. *Technology in Society*, *42*, 28–38. https://doi.org/10.1016/J.TECHSOC.2015.02.002

Green, J., & Newman, P. (2017). Citizen utilities: The emerging power paradigm. *Energy Policy*, *105*, 283–293. https://doi.org/10.1016/J.ENPOL.2017.02.004

Gutmann A, Thompson D. (1996). *Democracy and Disagreement*. Cambridge, MA: Harvard University Press.

Habib Ullah, M. & Park, J. D. (2021). Peer-to-Peer Energy Trading in Transactive Markets Considering Physical Network Constraints. *IEEE TRANSACTIONS ON SMART GRID*, *12*(4). https://doi.org/10.1109/TSG.2021.3063960

Hahnel, U. J. J., Herberz, M., Pena-Bello, A., Parra, D., & Brosch, T. (2020). Becoming prosumer: Revealing trading preferences and decision-making strategies in peer-to-peer energy communities. *Energy Policy*, *137*, 111098. https://doi.org/10.1016/J.ENPOL.2019.111098

Hardy C., Harley., B., & Phillips, N. (2004). Discourse Analysis and Content Analysis: Two Solitudes? *Qualitative Methods, Spring 2004.* https://doi.org/10.5281/zenodo.998649

Hvelplund, F. (2006). Renewable energy and the need for local energy markets. *Energy*, *31*(13), 2293–2302. https://doi.org/10.1016/J.ENERGY.2006.01.016

IEA (2021), World Energy Outlook 2021, IEA, Paris https://www.iea.org/reports/world-energy-outlook-2021

Jost, J. T., Glaser, J., Kruglanski, A. W., & Sulloway, F. J. (2003). Political Conservatism as Motivated Social Cognition. In *Psychological Bulletin* (Vol. 129, Issue 3, pp. 339–375). https://doi.org/10.1037/0033-2909.129.3.339

Kemp, R., Schot, J. & Hoogma, R. (2007). Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. *Technology Analysis & Strategic Management*, *10*(2), 175-198. https://doi.org/10.1080/09537329808524310

Lee, M. D. P., & Lounsbury, M. (2015). Filtering institutional logics: Community logic variation and differential responses to the institutional complexity of toxic waste. *Organization Science*, *26*(3), 847–866. https://doi.org/10.1287/orsc.2014.0959

Long, C., Wu, J., Zhou, Y., & Jenkins, N. (2018). Peer-to-peer energy sharing through a two-stage aggregated battery control in a community Microgrid. *Applied Energy*, *226*, 261–276. https://doi.org/10.1016/J.APENERGY.2018.05.097

Lounsbury, M. (2007). A Tale of Two Cities: Competing Logics and Practice Variation in the Professionalizing of Mutual Funds. *Academy of Management Journal*, *50*(2), 289–307. https://doi.org/10.5465/amj.2007.24634436

Mendelberg, T. (2002). The deliberative citizen: Theory and evidence. *Political decision making, deliberation and participation*, 6(1), 151-193.

Mengelkamp, E., Staudt, P., Gärttner, J., Weinhardt, C., & Huber, J. (2018). Quantifying Factors for Participation in Local Electricity Markets; Quantifying Factors for Participation in Local Electricity Markets. In *2018 15th International Conference on the European Energy Market (EEM)*. https://doi.org/10.1109/EEM.2018.8469969

Morstyn, T., Farrell, N., Darby, S.J., & McCulloch, M.D. (2018). Using peer-to-peer energy trading platforms to incentivize prosumers to form federated power plants. *Nature Energy 3*, 94–101. https://doi.org/10.1038/s41560-017-0075-y.

Morstyn, T., Teytelboym, A., & Mcculloch, M. D. (2019). Designing Decentralized Markets for Distribution System Flexibility; Designing Decentralized Markets for Distribution System Flexibility. *IEEE Transactions on Power Systems*, *34*(3). https://doi.org/10.1109/TPWRS.2018.2886244

Panwar, N. L., Kaushik, S. C. & Kothari, S. (2011). Role of renewable energy sources in environmental protection: A review. *Renewable and Sustainable Energy Reviews*, *15*(3), 1513–1524. https://doi.org/10.1016/J.RSER.2010.11.037

Parag, Y., & Sovacool, B. K. (2016). Electricity market design for the prosumer era. *Nature Energy*, *1*(4), 16032. https://doi.org/10.1038/nenergy.2016.32

Peck M. E. & Wagman D. (2017). Energy trading for fun and profit buy your neighbor's rooftop solar power or sell your own-it'll all be on a blockchain. *IEEE Spectr.*,*54*(10), 56–61.
https://doi.org/10.1109/MSPEC.2017.8048842

Peng, D. & Poudineh, R. (2017). *Electricity market design for a decarbonised future: an integrated approach.* The Oxford Institute of Energy Studies, University of Oxford. https://doi.org/10.26889/9781784670948

Pumphrey, K., Walker, S. L., Andoni, M., & Robu, V. (2020). Green hope or red herring? Examining consumer perceptions of peer-to-peer energy trading in the United Kingdom. *Energy Research & Social Science*, *68*, 101603. https://doi.org/10.1016/J.ERSS.2020.101603

Reay, T., & Jones, C. (2016). Qualitatively capturing institutional logics. *Strategic Organization*, *14*(4), 441–454. https://doi.org/10.1177/1476127015589981

Reuter, E., & Loock, M. (2017). *Empowering local electricity markets: A survey study from Switzerland, Norway, Spain and Germany.* Institute for Economy and the Environment, University of St. Gallen, St. Gallen, Switzerland.

Rijksoverheid (n.d.). *Klimaat en energie*. Coalitieakkoord 'Omzien naar elkaar, vooruitkijken naar de toekomst'. https://www-rijksoverheid-nl/regering/coalitieakkoord-omzien-naar-elkaar-vooruitkijken-naar-de-toekomst/2.-duurzaam-land/klimaat-en-energie

Rip, A. & Kemp, R. (1998). Technological change. *Human choice and climate change*, *2*(2), 327-399.

Ruth, M. F. & Kroposki, B. (2014). Energy Systems Integration: An Evolving Energy Paradigm. *The Electricity Journal*, *27*(6), 36–47. https://doi.org/10.1016/J.TEJ.2014.06.001

Saragih, A., Saragih, M., & Hum, M. (2021). *Discourse Analysis*. Umsu press.

Schot, J. & Geels, F. W. (2008). Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda, and policy. *Technology Analysis and Strategic Management*, *20*(5), 537–554. https://doi.org/10.1080/09537320802292651

Siano, P. (2014). Demand response and smart grids—A survey. *Renewable and Sustainable Energy Reviews*, *30*, 461–478. https://doi.org/10.1016/J.RSER.2013.10.022

Sims, R., Mercado, P., Krewitt, W., Bhuyan, G., Flynn, D., Holttinen, H., Jannuzzi, G., Khennas, S., Liu, Y., Nilsson, L. J., Ogden, J., Ogimoto, K., O'Malley, M., Outhred, H., Ulleberg, Ø., van Hulle, F., (2011). Integration of Renewable Energy into Present and Future Energy Systems. In: Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Seyboth, K., Matschoss, P., Kadner, S., Zwickel, T., Eickemeier, P., Hansen, G., Schlömer, S., von Stechow, C., (Eds.), *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation.* Cambridge University Press, New York, pp. 609–706, retrieved from: (http://www.ipcc.ch/pdf/special-reports/srren/SRREN_Full_Report.pdf).

Smith, A. (2007). Technology Analysis & Strategic Management Translating Sustainabilities between Green Niches and Socio-Technical Regimes Translating Sustainabilities between Green Niches and Socio-Technical Regimes. *Technology Analysis & Strategic Management*, *19*(4), 427–450. https://doi.org/10.1080/09537320701403334

Smith, A., Voß, J. P. & Grin, J. (2010). Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research Policy*, *39*(4), 435–448. https://doi.org/10.1016/J.RESPOL.2010.01.023

Sousa, T., Soares, T., Pinson, P., Moret, F., Baroche, T., & Sorin, E. (2019). Peer-to-peer and community-based markets: A comprehensive review. *Renewable and Sustainable Energy Reviews*, *104*, 367–378. https://doi.org/10.1016/J.RSER.2019.01.036

Swan, M. (2015). *Blockchain: Blueprint for a new economy*. O'Reilly Media, Inc..

The GridWise Architecture Council (2015). *GridWise Transactive Energy Framework* (Report No. PNNL22946 Ver1.0)The GridWise Architecture Council, Tech. Rep. https://gridwiseac.org/pdfs/te_framework_report_pnnl-22946.pdf

The GridWise Architecture Council (n.d.). *Mission & Structure.* GRIDWISE AC. https://gridwiseac.org/

Thornton, P. H. & Ocasio, W. (1999). Institutional Logics and the Historical Contingency of Power in Organizations: Executive Succession in the Higher Education Publishing Industry, 1958-1990. *American Journal of Sociology*, *105*(3), 801-843.

Thornton, P. H., & Ocasio, W. (2008). Institutional logics. In Greenwood, R., Oliver C., Suddaby, R. & Sahlin-Anderson, K. (Eds.) *The Sage handbook of organizational institutionalism*, 99-128. SAGE PUBLICATIONS LTD.

Thornton, P. H., Ocasio, W. & Lounsbury, M. (2012). *The institutional logics perspective: A new approach to culture, structure and process.* Oxford University Press.

Verschae, R., Kato, T., & Matsuyama, T. (2016). Energy Management in Prosumer Communities: A Coordinated Approach. *Energies*, *9*(7), 562. https://doi.org/10.3390/en9070562

Weber, M. (1978). *Economy and society: An outline of interpretive sociology* (Vol. 2). University of California press.

Wilkinson, S., Hojckova, K., Eon, C., Morrison, G. M., & Sandén, B. (2020). Is peer-to-peer electricity trading empowering users? Evidence on motivations and roles in a prosumer business model trial in Australia. *Energy Research & Social Science*, *66*, 101500. https://doi.org/10.1016/J.ERSS.2020.101500

Wittmayer, J. M., Avelino, F., Pel, B. & Campos, I. (2021). Contributing to sustainable and just energy systems? The mainstreaming of renewable energy prosumerism within and across institutional logics. *Energy Policy*, *149*. https://doi.org/10.1016/J.ENPOL.2020.112053

9. Appendix

Appendix A: Initial survey

Consent

Completing this questionnaire is completely voluntary. You may stop filling in at any time by closing this window or program. If you have any questions regarding the questionnaire, do not hesitate to ask them to c.last@student.utwente.nl. Your privacy is protected in this questionnaire and the data is not shared with third parties. Your data will be used for a graduation research project into the trading of electricity on a local scale. The questions below are intended to outline a profile based on some demographic characteristics and opinions. The data will be deleted six months after the date or earlier at your request. By checking the option below, you give permission to participate in this research and to use your data.

- I understand

Demographic characteristics

Q1 - What is your gender?

- Male
- Female
- Other

Q2 - How old are you?

- Under 18
- 18-39
- 40-60
- 60+

Q3 - What is your highest completed education?

- No completed education
- Secondary school
- Vocational college degree
- Applied sciences degree
- University degree

- Doctorate

Q4 - What is your monthly income?

- Less than €2000
- €2000 – €3999
- €4000 – €5999
- More than €6000

Q5 - What type of accommodation do you live in?

- Rental house
- Rental appartement
- House ownership
- Appartement ownership

Q6 - Do you generate your own renewable electricity?

- Yes
- No

Values and opinions

Q7 - I am concerned about climate change.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q8 - I think economic growth is more important than sustainability.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q9 - I am open to change.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q10 - I think traditions and traditional values are important.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q11 - Self-interest is as important as group interest.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q12 - I think equal opportunities for everyone is important.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q13 - Supporting the underprivileged is important to me.

- Strongly disagree
- Disagree
- Neutral

- Agree
- Strongly agree

Q14 - I am very tolerant of people with a different worldview than me.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q15 - How would you categorize yourself with regard to your political ideology?

- 1 = extremely left – 10 = extremely right

Appendix B: Interview Questions

Questions on attitudes towards climate and electricity

- What are your thoughts on climate change?
- How familiar are you with the energy transition?
- What are your thoughts on the energy transition?
- How consciously are you engaged in your electricity use?

Questions on prosumption

- Do you generate your own electricity using solar panels or other RETs?
    - What was your motivation to do/to not do so?
- How has generating your own electricity impacted your electricity use or the way in which you use household appliances?
- Has generating your own electricity had any other impact on your life?

Explanation of topic

P2P electricity markets allow you to directly buy and sell electricity with households in your proximity. They are dependent on prosumers which are households that both produce and consume electricity. When a prosumer generates more electricity than it needs, it is able to trade it with households that need electricity instead of feeding it back to the grid (salderingsregeling). In such a system, you would be independent of your energy supplier. It creates a local market where locally generated electricity would be distributed within a community. You would change from a passive consumer and receiver of electricity to actively involved in your electricity use. Prices would be determined by negotiation between buyers and sellers, and trading would occur via an online platform.

Specific questions on P2P electricity markets

- Would you be willing to participate in such a market?
- What would be your main motivations to participate (or not) in P2P electricity markets?
- What are your main concerns regarding P2P electricity markets?
    - To what extent would you be willing to pay extra money for locally generated electricity?
    - To what extent would you be willing to spend additional effort on the active buying and selling of electricity?

- Do you think the P2P electricity market is a good alternative for the current system, and why/why not?
    - Does it offer more advantages than disadvantages compared to the current system?
- Would you want to trade with households of your choice and why/why not?
- How would participating in a P2P electricity market influence your electricity use patterns?
- To what extent would you be willing to give up comfort for the market to function well?
- Would you prefer a completely decentralized market or would you prefer a coordinator overseeing transactions or both?

Explanation of hypothetical situation

Imagine a hypothetical household which has values and worldviews completely opposite to yours. In a P2P electricity market it could be possible that a electricity trading community would be formed in which you would trade electricity with such a household. You would negotiate prices and actively buy and/or sell electricity from/to each other.

P2P electricity markets: social cohesion questions

- How comfortable would you feel in an electricity trading community with households such as this?
- Do you think being in an electricity trading community with such a household would make you more comfortable interacting with such a household?
- Do you think participating in a P2P electricity market would increase the social cohesion in a community?

Appendix C: Consent form

Consent Form for Master Thesis: Mainstreaming P2P Electricity Markets on the Community Level

YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information dated [DD/MM/YYYY], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	○	○
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	○	○
I understand that taking part in the study involves an audio-recording and transcription of the interview.	○	○
Use of the information in the study		
I understand that information I provide will be used for a master thesis	○	○
I understand that personal information collected about me that can identify me, such as [e.g. my name or where I live], will not be shared beyond the study team.	○	○
I agree that my information can be quoted in research outputs	○	○
I agree to be audio/video recorded. Yes/no	○	○

I give permission for the interview data that I provide to be archived in University of Twente Theses Repository so it can be used for future research and learning. ○ ○

Signatures

_____ _____ _____

Name of participant [printed]

and legal representative If applicable) Signature Date

For participants unable to sign their name, mark the box instead of sign

I have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

_____ _____ _____

Name of witness [printed] Signature Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____ _____ _____

Researcher name [printed] Signature Date

Study contact details for further information: Cas Last; c.last@student.utwente.nl

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee/domain Humanities & Social Sciences of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-hss@utwente.nl