The transition towards a sustainable way of living: an evaluation of the energy system at *De Ceuvel*

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Chapter 1: Introduction

Nowadays, global warming is almost universally recognized as a threat to various aspects of human life. This threat can occur on a local scale in the form of inconvenience, but also on a global scale when it is referred to as the threat of ultimate extinction (Rylatt, Gadsden, & Lomas, 2001). The production of energy from fossil fuels to serve different forms of human consumption is by far the most significant cause for global warming, due to the emission of greenhouse gases (Rylatt et al., 2001). Therefore, human kind needs to adjust to a sustainable way of living. Because urban areas are responsible for sixty percent of greenhouse gas emissions, cities have a high potential in reducing the threat of global warming significantly (Evola et al., 2016). One way of doing this is by replacing fossil fuels with non-polluting renewable energy sources. But how do energy systems of cities change? One way of developing a sustainable energy transition, is through grassroots experiments, in which experiments are situated in small scale places characterized by specific institutions (such as norms and values) to create alternative paths of development (Hansen & Coenen, 2015).

The work of several scholars seem to indicate that the energy system of cities can become more sustainable if the role of citizens in energy systems is empowered. For example, it is argued that the upscaling of project becomes easier when projects empower local communities because they become more socially acceptable and therefore have fewer problems obtaining planning permission than others (Walker, 2008). Moreover, it seems that people who can control the way energy is supplied and regulated in their energy system (for example in a community energy initiative) foster more positive attitudes towards renewable energy in general in comparison with people who do not have this control (Bauwens & Devine-Wright, 2018). Thus, it seems that the upscaling of a community led renewable energy system experiment could contribute to a more sustainable energy system and sustainable way of life in cities. By upscaling alternative energy systems, novel ideas and rules about how to live with energy can be added to or maybe even replace mainstream rules and routines (i.e. regimes). Regimes are defined as a shared sets of rules or routines that direct the behavior of actors on how to produce, consume, supply and regulate certain assets that are part of a specific socio-technical system (Schot & Kanger, 2018). On the other hand, the rules of a niche stimulate alternative behavior of people regarding these assets in comparison with

the behavior of the regime. In this thesis, the asset concerned is renewable energy and the people concerned are people who produce renewable energy (for example through solar panels on their rooftops).

The following example clarifies the difference between a regime and a niche rule: in the Netherlands people who own solar panels are obligated to sell their energy to big energy suppliers, but in a community in Amsterdam named *De Ceuvel* members can choose to trade their solar energy with other members. The latter is a niche rule that stimulates people to start trading renewable energy peer-to-peer instead of selling it to an energy supplier (a rule of the regime). Thus, this niche rule stimulates alternative behavior of people in an energy system that creates a more community controlled energy system. *De Ceuvel* experiments with peer-to-peer trading through a local energy system that is managed by blockchain technology. The technological structures of the energy system at *De Ceuvel* empower the community of *De Ceuvel* to take ownership of their own renewable energy produced and to trade their renewable energy with other members. A blockchain energy system creates connections between peers that enable them to trade energy with each other without the involvement of an energy supplier such as Eneco or Nuon. Thus, the technological structures of a blockchain based energy system can in potential produce new connections between people, give people more local control in the energy system and make people part of a community led energy system. As a consequence, it seems that the technological structures of blockchain create a system that contributes to the movement towards a sustainable way of life in cities. But do these technological structures develop new social structures concerning producing, supplying, consuming and regulating energy in real life as well?

In light of these findings, this thesis focuses on the development of alternative behavior of people concerning producing, consuming, supplying and regulating renewable energy in the energy system at *De Ceuvel*. As explained earlier, the ability to create alternative behavior in a small scale place is dependent on the specific institutions (such as norms and values) of this place (Hansen & Coenen, 2015). However, despite its high potential in creating alternative developments for energy systems, too much dependency on specific (local) institutions may limit the transferability of the niche rules to other places (Hansen & Coenen, 2015). Likewise, if an experiment is insufficiently protected by specific (local) institutions, then

the experiment is likely to lose its impact on developing alternative behavior: due to pressures exerted by regime rules, the development of the way things are done in an experiment (the rules established in this experiment) is more feasible for becoming too similar to regime rules. In other words, the 'alternative' way of doings things becomes too similar to the mainstream way of doing things. This inhibits the development of alternative behavior and, thus, the development of a transition towards a more sustainable way of living (Hansen & Coenen, 2015). Therefore, it is important to gain knowledge about the interrelatedness between the rules of niches and the rules of regimes and to what extent they are depended on specific institutions of the experiment.

In light of these findings, this thesis answers the following research question: what is the potential of niche rules in the energy system at *De Ceuvel* in contributing to the development of an alternative (more sustainable) way of living with energy in cities? The respective sub questions need to be answered to create the knowledge to analyze the potential of *De Ceuvel* to contribute to a sustainable way of living:

- To what extent stimulates the energy system at *De Ceuvel* alternative behavior of people regarding energy trading?
- To what extent is the energy system at *De Ceuvel* community led and how does this influence the energy system at *De Ceuvel*?
- To what extent is the energy system dependent on specific institutions of *De Ceuvel* and how does this influence the potential of upscaling the energy system at *De Ceuvel* to other places?

The conceptual framework of this thesis is rooted in the work of Geels (2002). His work is associated with the research field of strategic niche management (Raven, Bosch, & Weterings, 2010; Schot & Geels, 2008) and uses a multi-level perspective to gain understanding about the transition towards a more sustainable way of life. His framework consists of three levels, in which the niche level is embedded in the regime level, which is in turn embedded in the landscape level[1]. According to Geels (2002), niches could function as an incubation room for novelties to start a transition. However, the niche level is at the same time strongly influenced by the existing regime and landscape level. Thus, for a transition to occur, ongoing

[1] The landscape refers to external factors, such as oil prices, economic growth, wars, emigration, broad political coalitions, cultural and normative values and environmental problems.

processes at the levels of regime and landscape have to create a window of opportunity to let an experiment break out of the niche level.

Transition research has recently been criticized for neglecting the geographical context of the transition towards a sustainable way of living (Hansen & Coenen, 2015; Truffer, Murphy, & Raven, 2015). For example, transition research should address questions such as the following: why does the creation of novel rules occur in one place and not in another? And, what is the importance and role of relations at different spatial scales for transition processes? As such, this research tries to understand the energy system at *De Ceuvel* and how it came about at *De Ceuvel*. In accordance with the work of Truffer, Murphy and Raven (2015) three geographically concepts will be applied to the framework of Geels (2002) in order to analyze the development of the energy system at *De Ceuvel*.

This thesis conducts a critical case study to examine the potential of the novel rules in the energy system at *De Ceuvel* in contributing to the development of an alternative (more sustainable) way of living with energy. A critical case study enables the researcher to make generalizations based on the concerned case study. For example, most prosumers (peers that consume as well as produce energy) only want to supply energy to friends and family (Butenko, 2016). By conducting a case study on the energy system at *De Ceuvel*, the relationships between members of *De Ceuvel* can examined in depth. As such, it can be determined to what extent these relationship are relationships of friendship. In line with the above, the friendship between the members of *De Ceuvel* would create a critical characteristic for an energy system based on peer-to-peer trading. Therefore, it could be argued that if the people of *De Ceuvel* do not trade peer-to-peer, then most other places (for example neighborhoods or cities with more anonymous relationships) would probably not trade peer-to-peer either if the design of the energy system as one in *De Ceuvel* is kept the same. As a consequence, the upscaling of the energy system at *De Ceuvel* would not create new social structures concerning supply in the energy system of cities and one could argue that the (informal/formal) rules in the system at *De Ceuvel* needs to be adjusted in order to create new social structures in cities. However, because this is study of human affairs, the knowledge created in this thesis should be perceived as a contribution to the learning process of how to upscale the energy market of *De*

Ceuvel into for example neighborhoods. How the knowledge produced in a critical case study should be approached in social sciences is described more thoroughly in the methodology.

To summarize, next to understanding the local energy market and how it came about, the rules within the local energy system at *De Ceuvel* are analyzed in this thesis and to what extent the upscaling of this energy system can be perceived as the development towards a more sustainable way of living.

The structure of this paper is as follows: the theory concerning this thesis is explained in chapter 2. At first, information about the relationship between cities and bottom-up development is given and how this relates to local control. Also, the concepts of niche, regime and landscape level are operationalized. Furthermore, the three geographical concepts (social-spatial embedding, multi-scalar interconnectivity and power relations) are explained. In chapter 3, information about the potential impact of blockchain technology in the Dutch energy market is provided. In chapter 4, the methodology is described. In chapter 5, the energy market of *De Ceuvel* is explained in detail and the theoretical framework is applied to the space of *De Ceuvel*. Chapter 6 describes the conclusion concerning the main research question of this thesis. Finally, chapter 7 discusses some considerations regarding this thesis.

Chapter 2: Theoretical framework

This chapter describes the theoretical framework of this thesis. At first, it is explained why the coping of humans with the challenge of global warming is fundamentally a concern for the discipline of geography. Moreover, information about relationship between cities and bottom-up development is given and how this relates to local control and sustainability. Also, the concepts of niche, regime and landscape level are operationalized. Furthermore, the three geographical concepts (social-spatial embedding, multi-scalar interconnectivity and power relations) are explained.

2.1 Energy systems and geography

It is interesting to examine transition in geographical terms, because energy systems are constituted spatially: the components of the system are embedded in particular settings and the network of the system itself produces geographies of connection, dependency and control (Bridge, Bouzarovski, Bradshaw, & Eyre, 2013). This becomes clear by examining energy infrastructure, such as electricity distribution grids. For example, low-carbon energy can be generated through large, remote actors (e.g. offshore wind) and transmitted via a long-distance grid, or through decentralized generators on smaller scale in urban settings (e.g. solar panels on rooftops of houses) and distributed via local mini-grids. Thus, the components of a system create different connections, dependencies and relations of power between actors distributed across certain places. If the energy system at *De Ceuvel* is based on peer-to-peer energy supply, then the upscaling of such a system would probably change the spatial organization of the energy system and energy activities in the Netherlands more widely, because the Dutch traditional energy market is characterized by large centralized energy suppliers.

In other words, the coping of humans with the challenge of global warming is fundamentally a concern for the discipline of geography: it not only requires societies to commit on investing their resources to redesign infrastructure, buildings and functions of spaces, but also to make choices from a range of possible spatial solutions and levels of local (community) control.

2.2 Cities and transition

As addressed in the introduction, cities are responsible for 60 percent of the greenhouse gasses worldwide and can therefore play an important role in the transition towards a sustainable way of living. The energy system of a city can change via a bottom-up approach in which grassroot experiments are scaled up (Hansen & Coenen, 2015).

The idea of a bottom-up approach to start a transition in a city is rooted in the assumption that cities are places that connect people (Batty, 2012). Various processes take place in cities that mobilize people to produce and exchange goods and ideas, established by a multitude of networks that enable people to deliver materials and information to support these meet-ups. Because individuals are usually attracted to what already exists, the diffusion rate of goods and ideas seems to become higher when its network expands (Batty, 2012). This network of interconnections between people in cities makes cities complex spaces (Batty, 2012). This perspective empowers the local actors as it highlights the importance of local support in order to develop urban spaces and to increase the spreading of urban concepts, such as an organic neighborhood garden (Evola et al., 2016).

It is argued that projects with local control are more locally acceptable and have fewer problems obtaining planning permission than others (Walker, 2008). However, the degree of local control should be examined more carefully. Projects concerning implementing renewable energy are sometimes tagged with a community label, even when they are run by local authorities and by local entrepreneurs and organizations under standard institutional business models (Walker, 2008). In the Dutch situation this criticism is even more relevant because urban development is often not solely created by self-organizing communities (Boonstra & Boelens, 2011). In fact, the activities concerning participation of citizens in Dutch spatial planning have always been practiced within - and therefore also based on - government regimes (Boonstra & Boelens, 2011). As a result of this government centrality, the Dutch political system sets up the framework for the activities concerning spatial planning, which works through a decision hierarchy and structures of formal influence. Therefore, there is a lack of democratic distribution of authority and local people lack the power to influence spatial planning in the Netherlands (Boonstra & Boelens, 2011). In line of the above, this thesis handles the matter of local control in *De Ceuvel* as follows:

the level of local control is determined by analyzing to what extent the community of *De Ceuvel* is able to develop their energy system at *De Ceuvel* as they see fit.

As indicated by a recent study in Belgium (see Bauwens & Devine-Wright, 2018), the empowerment of citizens in spatial development projects and, as a response to this power, the extent to which they perceive this project as community-led, are important for the transition towards a sustainable way of live. Bauwens and Devine-Wright (2018) conducted a statistical analysis based on a quantitative dataset and found that members of community-based energy cooperatives have significantly more positive attitudes towards renewable energy in comparison to the attitude of non-members. As a consequence, these members are more supportive of the implementation of local wind turbines than non-members (Bauwens & Devine-Wright, 2018).

The work of Bauwens and Devine-Wright (2018) indicates that the characteristics of a cooperation concerning the way energy is supplied between members and regulated by members influence attitudes of people towards renewable energy. In general, energy cooperatives share strong community features and are controlled by members (Bauwens & Devine-Wright, 2018). In addition, the net surplus (the amount of energy the cooperation has left when it produces more energy than it consumes) is typically allocated pro rata among the members (Bauwens & Devine-Wright, 2018). Furthermore, the cooperative governance structure is democratic, involving democratic member control (the 'one person-one vote' rule) and voluntary and open membership (Bauwens & Devine-Wright, 2018). Thus, it seems that the transition from a fossil fuel based energy system in cities towards a renewable energy system can be stimulated through the development of community-led initiatives that experiment with sustainable energy systems. Not only are these spatial developments more socially accepted due to local control, they also seem to create more positive attitudes towards renewable energy.

In order to examine the relation between the energy system at *De Ceuvel* and the Dutch energy system and to what extent the energy system at *De Ceuvel* is defined by niche and regime rules, the framework of the multi-level perspective of Geels (2002) is used.

2.3 The multi-level perspective

As mentioned in the introduction, the conceptual framework is based on the multi-level perspective of Geels (2002) to analyze to what extent the development of the energy market of *De Ceuvel* can contribute to development towards a sustainable way of living. The multi-level perspective of Geels (2002) has been criticized by several geographers (Bridge et al., 2013; Hansen & Coenen, 2015; Truffer et al., 2015), because it assumes that niche, regime and landscape are spatially bounded. According to them, regimes are often perceived on a national level despite the fact that actors outside this geographical boundary also affect them. At the same time, niches are often examined at the local or regional level. A more holistic representation would be generated if the levels would be analyzed beyond the 'obvious' geographical boundary. Therefore, the following subheadings describe the niche, regime and landscape level without referring to a geographical boundary.

Moreover, the multi-level perspective should take into account that an actor can simultaneously be part of incremental development (thus stimulating the 'normal' path development; the rules of the game) and radical development (thus stimulating an alternative path development; the introduction of new rules in the game), because incumbents (actors that follow the rules of the game for a long time) can also create experiments which might lead to the introduction of new rules (Schot & Kanger, 2018). This makes it not always clear to what extent an actor influences the development of old rules or new rules; it might stimulate both kinds of rules. Thus, the understanding of the development of alternative paths demands more than a dialectical system explanation of actors that belong to the niche versus actors that belong to the regime. Therefore, this thesis will describe the niche and the regime level by focusing on the development of rules instead of actors.

To summarize, this thesis perceives the development of new rules as a co-construction of organizations and institutions that are scattered over different locations and that can be supporting as well as discouraging the development of novel behavior in an energy system at the same time. The next paragraphs describe how the niche, regime and landscape level are operationalized in this thesis.

2.3.1 Regime

Regimes are defined as shared semi-coherent sets of rules or routines directing the behavior of actors on how to produce, consume, supply and regulate certain assets that are part of a specific socio-technical system (Schot & Kanger, 2018). These rules are embedded in a network consisting of various groups of elements within the system. In the case of the electricity system this includes the infrastructure (the electricity grid), energy producers and suppliers, regulation and policies, market and user practices and culture and symbolic meaning (Schot & Kanger, 2018). These rules shape innovative activities towards a specific trajectory of incremental innovation (for example, engineering efforts aimed at increased fuel efficiency). An example of such a trajectory in the energy system of the Netherlands is that over time the electricity system of the Netherlands became more centralized: series of isolated islands of power have increasingly been replaced by integrated national and continental scale grid systems. In other words, the innovative efforts aimed at the development and maintenance of the central electricity grids have become the specific trajectory of incremental innovation over time in energy systems (Bridge et al., 2013).

Thus, a regime is the alignment of rules that constraints and promotes certain actions, also known as the rules of the game, leading to regular pattern of practice (the self-evident way of doing things). Rules can be defined on a magnitude ranging from implicit to explicit, informal to formal, unsanctioned to sanctioned and are subject to differing interpretations (Schot & Kanger, 2018).

2.3.2 Niche

A niche rule is a fundamentally different rule than a regime rule: a niche rule creates different rules of the game and stimulates an alternative way of doings things (alternative behavior) (Schot & Kanger, 2018). As explained earlier, a niche is embedded in a regime. Often the creation of a niche rule is embedded within specific circumstances, because the focal technology in which the niche rule is rooted in is immature and the end state of the technology is unstable. For this reason, the development of niche rules often needs to be protected from pressures exerted by the rules of the regime (Schot & Kanger, 2018). Thus, niche rules develop in parallel with regime rules. Therefore, this thesis defines a niche rule as parallel with a regime rule; if a rule stimulates novel behavior of people in the energy system in comparison with the normal behavior of people in traditional energy systems, then it is defined as a niche rule. Moreover, this

operationalization of a niche rule takes into account the interrelatedness between regime and niche rules. Indeed, often the creation of a niche rule is embedded within specific circumstances, because the focal technology in which the niche rule is rooted in is immature and the end state of the technology is unstable. As such, the development of niche rules often needs to be protected from pressures exerted by the rules of the regime (Schot & Kanger, 2018).

2.3.3 Landscape

The landscape level consists of external factors that shape the niches and the regimes. These factors involve trends such as globalization, urbanization, individualization, mass consumption and climate change, but also events such as wars, natural disasters, and economic crises (Schot & Kanger, 2018). These trends form an external context that cannot be influenced by actors on the short run. The following example illustrates the influence of trends on stimulating a certain trajectory of development. The trends of individualization and mass consumption enable more people to buy a gasoline fuel-based car. As such, these trends play an important role in increasing the contribution of automobility on greenhouse gas emission because other forms of mobility, such as car sharing alternatives, are ignored. As a consequence, the individualizing trend (which was reinforced by the trend of mass consumption) led to the abandonment of many alternatives of development, such as collective mobility, energy and housing (Schot & Kanger, 2018).

Thus, the individualization and mass consumption trend enforced the development of fulfilling necessities of life, such as mobility, energy and housing on an individual scale instead of a, for example community scale. In the example of the gasoline car this lead to a more unsustainable way of living.

This subchapter showed that the emergence of niche rules in a geographical place could not be understood solely by referring to its local context or to certain actors; the emergence of niche rules is too complicated for such a small perspective. In this thesis, the behavior of people in the energy system at *De Ceuvel* is perceived as alternative when differs from the behavior of people in the Dutch energy system, instead of justifying it as alternative behavior by referring to a certain actor or geographical scale. In this thesis, the multi-level perspective is especially used to analyze to what extent behavior can be perceived as alternative and the geographical concepts of multi-scalar interconnectivity, social-spatial

embeddedness and power relations are used to analyze why alternative behavior emerges in a certain place. The following paragraphs describe why these concepts matter for justifying the emergence of niche rules in a certain space.

2.4 Geographical concepts

In this thesis, space is defined in accordance with the perspective of relational geography on space. Relational geography emphasizes a perspective that sees space as a social construct, in which space is constructed through social interactions between actors. Therefore, flows (capital, knowledge and people) and relations within and between spaces influence the development of a space (Hansen & Coenen, 2015). Therefore, in this thesis the alternative development is connected to a certain space (instead of a small scale place). The concepts of multi-scalar interconnectivity, social-spatial embeddedness and power relations describe the characteristics of a certain space and can be used to explain why niche rules emerge in a place accordingly: these concepts emphasize that space is constructed through social interactions between actors (it is a social construct); they emphasize that flows (capital, knowledge and people) and relations within and between places and people influence the development of a space (Hansen & Coenen, 2015).

2.4.1 Multi-scalar interconnectivity

Location has an absolute characteristic (latitude and longitude) and a relative one, describing the 'relational proximity' of one element in the system to another. While absolute location is fixed and unchanging, relative location can be highly dynamic (Bridge et al., 2013). A change in relational proximity could increase or decrease the frequency and intensity of interactions within and between places (Bridge et al., 2013). The (dynamic) concept of location indicates that energy systems have a specific network that interlinks elements across certain locations. These elements can be described as technological components of a certain energy system but also the actors involved in the development of a certain energy system.

As explained earlier (see subchapter *Energy systems and geography*), the components of a system create different connections between places. Thus, the components of a system and in what places these are embedded, increase or decrease the frequency and intensity of interaction within and between places. In

other words, the components of a system establish relations between places and thus create interconnectivity between places.

The destabilization of a regime and the development of the niche, are influenced by actors, such as firms, investors, users, social movements, cities and various government agencies located across space. For example, the success of the development of a new rule at a certain place can be explained by the ability of the (local) network of actors to learn from the experiments conducted elsewhere or to use their outcomes (e.g. new technologies, organizational innovations, institutional lessons) and its ability to convert this knowledge to the specific situation of the concerned experiment (Schot & Kanger, 2018). Thus, the concept of multi-scalar interconnectivity does not assume that novel rules are created solely on a local scale; it directs attention to the possibility that the development of new rules does not only take place at a local level but is influenced by other places as well; i.e. by a network between places. This network might be established by the technological components of an energy system but also by actors who are interested in the development of an certain energy system. Furthermore, in order to provide a more holistic understanding of the development of new rules, this thesis introduces the notion of social-spatial embeddedness and power relations.

2.4.2 Social-spatial embeddedness

The concept of social spatial-embeddedness emphasizes an understanding of why a rule is interpreted in a certain way. For geographers it is clear that experiments such as *De Ceuvel* are per definition socio-spatially embedded, because they take place in a certain space. In contrast, transition sciences tend to focus on the forces that are located at the scale of a nation state in order to address transitions of sustainability (Truffer et al., 2015). To take the role of a space in the emergence of novel rules into account, this thesis uses the concept of social-spatial embeddedness.

Alternative values and norms can create environments for the development of unconventional behavior, for example an alternative lifestyle. Therefore a milieu of a place can be more or less amenable for the promotion of the sustainability transition. I.e. an environment may consists of conditions that are less or more suitable due to the development of specific institutions in a space (e.g. specific cultures, values and

norms). These conditions enable or restrain rules to promote new technologies, develop new lifestyles or to try out new policies in support of sustainability transitions (Truffer et al., 2015).

However, Truffer et al. (2015) do not specify which conditions create a lifestyle that is more suitable for transition and which conditions restrains the development of such a lifestyle in a certain place. While the authors do not specify these conditions, the study of Bauwens and Devine-Wright (2018) describes conditions that create favorable attitudes to renewable energy systems more in detail. He highlights the importance of community identity on the formation of attitudes toward renewable resources. His findings indicate that the relationships between people of energy systems that resemble the relationship within energy cooperatives have higher positive attitudes than people who belong to an energy system without this resemblance. The main characteristics of an energy cooperative is that energy cooperatives share strong community features and are controlled by members (Bauwens & Devine-Wright, 2018).

Moreover, Bauwens and Devine-Wright (2018) found out that members that joined a community initiative for wind power later on are more driven by material incentives attached to electricity supply, have lower environmental concerns and identify less strongly with the community than early members of the community. The difference is, according to them, related to the extent to which a member feels part of a community of place. Bauwens and Devine-Wright (2018) define a community of place as followed: “A community of place implies a set of social relationships embedded in a particular geographical context.” (p. 613). Early generations of members tend to form a community of place more easily than later members. This suggests that members who feel part of a community of place have even more favorable attitudes towards renewable energy sources than members who do not feel part of this.

This concept is interesting for the analysis of the development of *De Ceuvel*, because the components of the energy system at *De Ceuvel* seem to be embedded in a small place and according to Seyfang & Smith (2007), local solutions to global warming tend to adjust to the local situation and the interest and values of the communities involved. Moreover, this concept seems to be of importance, because if the rules of a local energy system are too much dependent on its specific situation (for example the norms and values of the community involved) then it is more difficult to expand this system to other places (for example

communities with other norms and values) (Hansen & Coenen, 2015). For example, if a member of *De Ceuvel* trades his or her renewable energy peer-to-peer because he or she perceives renewable energy as a community asset (In other words, when peer-to-peer trading is established by the norm that renewable energy is a community asset), then an individual that does not perceive his or her generated energy as a community asset would likely not trade their energy peer-to-peer in an energy system such as *De Ceuvel*. In other words, when the energy system at *De Ceuvel* is established at a bigger scale (for example in a neighborhood or city), then it might be that the energy system at *De Ceuvel* (which is supported by the energy supply of peer-to-peer trading) will not function properly because the residents do not perceive their produced renewable energy as a community asset. Thus, the more the niche rules within an energy system are based on the specific institutions of the experiment, the more difficult it is to fit in such an energy system with the institutions at other places. Likewise, if an experiment is insufficiently protected by specific (local) institutions, then the experiment is likely to lose its impact on developing alternative behavior: due to pressures exerted by regime rules, the development of the way things are done in an experiment (the rules established in this experiment) is more likely to become too similar to regime rules. In other words, the 'alternative' way of doing things becomes too similar to the mainstream way of doing things. This inhibits the development of alternative behavior and, thus, the development of a transition towards a more sustainable way of living (Hansen & Coenen, 2015).

2.4.3 Power relations

The concept of power relations describes why the development of certain rules is encouraged or discouraged in a certain energy system.

Many social actors who have relatively clear ideas about where they want (or do not want) the development to go, will consciously try to influence the process of development (Meadowcroft, 2009). For example, a common view about the transition of the energy system could be characterized as the shift from a fossil fuel based energy system to a non-fossil fuel based energy system or the movement from an insecure energy system to a secure energy system, or a change from a centralized energy system to a decentralized energy system. Whether or not certain actors will be less satisfied with certain outcomes than others depends on the power relations in the network of actors.

Different stakeholders have different interests and different power resources to influence the debates concerning the development of an experiment. Therefore, the development of an experiment is the product of social processes and the outcomes of conflict and negotiation among different stakeholders. Thus, power relations between actors are creating a selective pressure that will create a common view about a certain development; this pressure will guide a development that represents the ideas of those in power.

To summarize, the geographical concepts of multi-scalar interconnectivity, social-spatial embeddedness and power relations describe why niche rules emerge in a certain place. Firstly, the concept of multi-scalar interconnectivity directs attention to the possibility that the development of social rules does not only take place at a local level but is influenced by a network of people and components of an energy system across places as well. Secondly, the concept of social-spatial embeddedness describes the specific cultures, values, norms and capital stocks that make a place more or less suitable for the promotion of certain social rules. Thirdly, the concept of power relations refers to the relations between actors that create a selective pressure on the development of the social rules in a place. As such, the selective pressure guides a development of social rules that represents the ideas of those in power. In order to understand the potential of blockchain technology to create alternative behavior in an energy system in the Netherlands, the next chapter describes the difference between the technological structures of a blockchain based energy system and the Dutch energy system and to what extent they could enable new social structures concerning producing, consuming and regulating energy.

Chapter 3: The effect of blockchain on the Dutch energy market

This chapter describes the potential impact of blockchain technology in the Dutch energy market. For example, the potential of the technical structures of the technology of blockchain to enable the development of new social structures in energy markets. First, the technology of blockchain is described. Secondly, information about the Dutch energy market and the role of citizens concerning producing,

consuming, supplying and regulating energy is given. Finally, the potential impact of blockchain on the Dutch energy system is analyzed.

3.1 Blockchain technology

Blockchain technology is a decentralized database that stores a registry of assets and transactions across a peer-to-peer network. It is a public registry of who owns what and who trades what. For example, the blockchain stores the history of ownership and location of digital assets. The transactions between assets are secured through cryptography and over time that transaction history gets locked in blocks of data that are linked together. This public registry is replicated on every computer in the network and is constantly being updated so it can track the changes (of for example, ownership) over time. In other words, the blockchain is a public registry that stores transactions in a network and replicates this to all the nodes in the network (every individual with a computer that is connected with the blockchain). Since blockchain enables individuals to track how assets got to them, the blockchain provides transparency. Moreover, blockchain allows people to write binding contracts between individuals (digital code) that guarantee that these contracts are executed without a third party arbitrator. Thus, blockchain creates an immutable enforceable record.

The blockchain technology is expected to change the way transactions are conducted in society. One could argue that blockchain will change the rules of the game (the routines), because the problem of uncertainty concerning trading is solved differently. Before blockchain, societies needed to trust intermediaries in order to do transactions in many types of businesses. For instance, individuals trust their savings to a bank and in return for interest accumulation the bank loans these savings to other individuals at a higher interest rate. The energy sector has a similar market structure: energy producers sell their energy to suppliers, who in turn resell the energy to consumers. In these examples both producers and consumers trust the intermediary (i.e. the bank or energy suppliers have good reputations) but in order for the transaction to happen, it is not necessary that the consumer and producer trust each other. Blockchain is able to provide cryptographic trust, because its technological design enables anonymous parties to transact without the possibility of cheating. The following paragraphs describe how cryptographic trust could change the way business is conducted.

First of all, intermediaries will no longer be necessary beyond the technical platform provision, because blockchain can replace the role of the confidant intermediary. Blockchain would not create similar platforms such as Airbnb or Uber whereby virtual organizations deliver platforms for individuals to transact with each other. These organizations are monopolizing platform delivery and impose intermediation costs, but through blockchain technology such monopolizations become impossible. The platform that blockchain technology creates is a decentralized network where in every transaction has to be verified by every node; no node has centralized power. Thus, blockchain is a decentralized database that managed markets with the same effectiveness (e.g. trust) of intermediated organizations without creating a central authority and without intermediated costs.

Secondly, blockchain is expected to change the way business is regulated. Until recently regulators were required to ensure that business would operate within legal frameworks (for instance, regulators who oversee fair pricing, proper fund handling or correct record keeping for land ownership). However, blockchain provides transaction record transparency and its technology design imposes rules defined within contracts upon all transactions. Therefore, legal compliance becomes a prerequisite in order for a transaction to happen. Thus, ideally, if the blockchain design imposes legal rules then traditional regulators are not necessary in order to oversee whether a transaction is legal afterwards.

Thirdly, blockchain changes the role of individuals within society. Society today in developed countries is seen as a consumer society, whereby individuals are generally passive consumers (Butenko, 2016). However, as explained in the next paragraphs, the use of blockchain encourages prosumers into active supplier roles.

Thus, the technical structures of blockchain-based transactions seem to enable the development of new social structures concerning the way energy is produced, regulated and supplied in energy systems. In theory, blockchain enables the development of non-conventional rules of the game, because the role of producers and suppliers can be taken over by the network of peers. Furthermore, the technological design can oversee if the transaction is legal. The next paragraphs describe how blockchain technology

could affect the energy market in the Netherlands. Specifically, how a blockchain-based market constrains or encourages certain roles for peers and energy suppliers in the energy system of the Netherlands today.

3.2 The Dutch energy market

There are a lot of different forms of traditional energy markets and blockchain-based energy markets. Because the energy system at *De Ceuvel* is focused on peer-to-peer transaction of renewable energy, this chapter will focus on the behavior of peers in the traditional energy market of the Netherlands. By describing the role of peers within the traditional energy market and at the blockchain market of *De Ceuvel* it can be analyzed to what extent the blockchain market of *De Ceuvel* creates new rules.

Peers that consume as well as produce energy are known as 'prosumers'. In their role as energy consumers, most prosumers have a preference towards energy that is cheap, sustainable and self- or locally-produced (Butenko, 2016). As such prosumers want to produce renewable energy. Also, prosumers increasingly want to behave as a supplier because they want to complement other peers of renewable energy in need and consume energy of other peers if needed. Therefore, the ambition of prosumers is to engage in the production and supply of renewable energy. The next paragraphs describe what role the prosumers have in the traditional energy system of the Netherlands today.

Many prosumers in the Netherlands still fulfil the role of traditional energy consumer to some extent, because most of the time they are not able to be self-sufficient and still have to rely on traditional energy suppliers. I.e. Their energy consumption is often fed by the national grid (Butenko, 2016) and one could argue that they still have a traditional role in the energy market because of it.

In the Netherlands prosumers can only 'sell' their energy to large energy suppliers on such terms that they cannot be perceived as a trader or supplier. This is illustrated by the following example from the Netherlands. When a prosumer has solar panels that generate 1000 kilowatt in one year but in the same year consumes 3000 kilowatt, the prosumer receives annual accounts for 2000 kilowatt from its energy supplier (in Dutch this is known as the *salderingsregeling*). In this example the prosumer is essentially not selling the energy to its energy supplier but is receiving more of a compensation to limit the costs of his or her electricity bill. Moreover, the prosumer cannot choose to whom he or she will sell its renewable

energy but can only 'sell' it to his or her energy supplier. Therefore, the prosumer is more of a subordinate supplier for the traditional energy supplier; the prosumer relies on the energy supplier that collects his or her renewable energy.

On account of this *salderingsregeling*, the energy supplier has to buy the energy from a prosumer at the same price that he or she is offering the prosumer for his energy. However, if the solar panels of the prosumer generate more energy than the prosumer consumes in one year, than the energy supplier can buy out the energy at a price of his choice. For example, when a prosumer has solar panels that generate 4000 kilowatt in one year but in the same year consumes 2000 kilowatt, the energy supplier only has to buy 2000 kilowatt at the same price he is offering the prosumer (the supplier can buy the other 2000 kilowatt from the prosumer for a cheaper price). Therefore, it is recommended that prosumers install only as many solar panels needed for own consumption. Thus, the *salderingsregeling* discourages prosumers to act as a supplier for other peers. However, in 2020 the *salderingsregeling* will be abolished and prosumers will receive less for their generated energy from the energy supplier.

It is difficult for prosumers to trade peer-to-peer under the current Dutch regulatory system. The current formal rules of the electricity system in the Netherlands are adapted towards traditional large energy suppliers operating on the national grid and do not take into account the ability of prosumers to generate and supply energy on a peer-to-peer scale (Butenko, 2016). If individual prosumers want to fulfil the role of energy supplier to other peers, they need to apply for a license from the Dutch national regulator. Obtaining this license is often not possible, because individual prosumers need to demonstrate that they possess the required organizational, financial and technical characteristics in order to prove that they are able to function as a traditional energy supplier. For example, according to Dutch law, energy suppliers are obligated to supply energy to every citizen that wants to be a client of the concerned energy supplier. This is an obstacle for the individual prosumer who only wants to supply to their neighbors or families. Moreover, prosumers cannot always guarantee supply to other consumers.

There are some exceptions which enable peer-to-peer trading of energy. For example, it is possible to supply a neighbor of energy if both parties are the owner of the solar PV system (Akerboom & Scholten,

2014). Moreover, if actors belong to the same legal entity (i.e. people who own shares of a company or people who are a member of an association, foundation or cooperative), the solar PV system of that legal entity can supply these actors of energy (Akerboom & Scholten, 2014). However, the question arises whether household consumers are willing to undertake activities necessary to enable peer-to-peer trading of energy, especially when they are already connected to the national grid.

Thus, the current rules of the Dutch regulatory framework create conditions that discourage people to act as an energy supplier on a local (and national) energy market, because prosumers are dependent on their traditional energy supplier in several ways. When prosumers do not generate enough energy for their own consumption they have to buy the energy of their energy supplier and when they consume less than they produce, prosumers have to 'sell' their energy to their energy supplier. Metaphorically speaking, a situation is created in which people who harvest apples from their own garden can only sell these to a certain supermarket at a fixed price. Through formal rules prosumers are forced to act passively in the current energy system since they can only interact with their current energy supplier; they cannot choose to trade with other actors. This explains why most of the electricity produced by solar PV systems of household end-users that is not consumed by them is sold to large energy suppliers (Akerboom & Scholten, 2014).

The development of a local community energy market is restrained by limitations on participation in the energy management of the Dutch government (Adil & Ko, 2016). In 2007, Kemp, Rotmans, and Loorbach (2007) assessed the state of the Dutch energy government and concluded that the way the energy policy in the Netherlands is managed was not the open, reflexive process it was supposed to be at that time: "The policy was developed through a 'business-as-usual model, instead through an inspiring societal agenda developed through bottom-up consultations" (Meadowcroft, 2009, p. 334).

According to this view, the way the energy policy was managed had only incremental (instead of radical) impact on the dominant rules of conducting and regulating energy markets, because outsiders were barely involved in the development of policy.

The EU also influences the role of the prosumer in the energy system of the Netherlands, but this is not necessarily stimulating the prosumer to become an active player in the system. On the one hand, the EU contributes to labelling prosumer energy as a desirable and a positive development as it contributes to reaching both sustainability, and security of supply goals of the European energy policy (Butenko, 2016). This view encourages the Netherlands to increase the local sustainability energy production six fold by 2020 (Butenko, 2016). But, on the other hand the Europeanization trend is a main political driver of central energy policy in Europe (Meadowcroft, 2009). Thus, while the EU is stimulating the development of local renewable energy systems, it is not stimulating the development of a decentral energy system. In other words, if a blockchain-based energy market is perceived as the change from a on a carbon-based resources market to a non-carbon based market, then the influence of the EU encourages the transition. But if the blockchain-based energy market is perceived as a threat to traditional energy policy in the Netherlands, then the influence of the EU can be perceived as discouraging. However, it seems that blockchain technology could contribute to both forms of transition.

To summarize, the rules of the Dutch energy market create a modest role for peers in the energy market. These rules stimulate peers to be consumers and producers of renewable energy, but transactions on a peer-to-peer scale are discouraged. In other words, peers are stimulated to fulfil the role of producers for their own energy consumption. They are discouraged to become a supplier of another ones' energy consumption. This seems to be related to the fact that policy of energy markets is stimulating (local) renewable energy but at the same time is focused on retaining the traditional roles that maintain the central organization of the energy market in the Netherlands today.

3.3 Blockchain and the Dutch energy market

The development of blockchain energy markets enables a peer-to-peer trading system in which the producer is able to market energy to others, because the units of generated electricity are recorded inside a blockchain (a digital decentralized network). Therefore, blockchain enables peers to take ownership of their product and preferences, rather than relying on the traditional energy supplier as an intermediary. In general, the role of peers in a blockchain energy market is extended compared to the traditional energy market, because it includes the role of supplier; peers can trade the renewable energy that they own with

whomever they want to. Moreover, the blockchain energy market is based on decentralized energy production; peers who are generating energy through, for example, solar panels are providing the market with energy.

As explained in the theoretical framework (subchapter Niche), the immaturity of novel technologies creates disadvantages in comparison with the technologies that support the way of doings things in the 'normal' energy system. For this reason, the development of niche rules often needs to be protected from pressures exerted by the rules of the regime (Schot & Kanger, 2018). The next paragraph describes the technological immaturity of blockchain and describes briefly the pressures exerted by the technological maturity of the Dutch energy system.

The technological immaturity of the technology supporting blockchain markets seems to create disadvantages that limit the development of such a market. For example, the social apprehension towards new technologies is high (Mengelkamp, Notheisen, Beer, Dauer, & Weinhardt, 2018). Also, despite the fact that a blockchain-based market is not dependent on intermediated organizations that manage the market (in comparison with the Dutch energy market), it is still dependent on intermediated organizations to set-up the market; the creation of such a market is dependent on organizations that have the knowledge to set-up a system based on these technologies (Mengelkamp et al., 2018). Because the usage of blockchain technology in energy markets was first addressed in 2014 at a congress about energy trading (Mengelkamp et al., 2018), the knowledge about energy systems supported by blockchain technology is likely not diffused as much as the knowledge behind the Dutch energy system. However, the technological aspects of blockchain based energy market do also have some benefits in comparison with the Dutch energy systems. For example, according to Walker (2008), a decentralized electricity system (that could be establish by blockchain technology) avoids some of the issues that are related to a central energy system (such as the Dutch energy system) in order to create a sustainable electricity system. For example, in order to deploy renewables in the central electricity system, expensive upgrades and extensions of the network (such as grid reinforcement) are required. Decentralized energy systems can defer these expensive upgrades. However, balancing the energy production and consumption over the central distribution grid, often ensures operational stability of local energy systems. Thus, a connection to

the large-scale power grid is most of the time established. As a consequence, most 'local' energy systems are therefore still connected with the national energy system (Mengelkamp et al., 2018).

This chapter described the role of actors within the traditional energy market and described how the blockchain technology can empower peers in the energy market. It seems arguable that actors perceive the development of the blockchain-based markets differently. For example, actors who benefit from an active role of prosumers in the energy market will stimulate this development but actors who benefit from a centralized organization will discourage it. Because the technical structures of blockchain based transactions seem to enable the development of new social structures, it is interesting to analyze to what extent these social structures are developed at the energy market of *De Ceuvel.*

Chapter 4: Methodology

This chapter describes the methodology. At first, it is described what analyzes are used to answer the questions regarding this thesis. The second subchapter focusses on the methodology in depth. Finally, information about the data gathering in this thesis is given.

4.1 Analyses

This research describes the energy system at *De Ceuvel* and to what extent the rules of this system contribute to the development of an alternative (more sustainable) way of living. In order to understand the influence of the space of *De Ceuvel*, the analysis is focused on to what extent the realization of the energy system at *De Ceuvel* is corresponding with the ideas of the initiator about an ideal energy system before *De Ceuvel* became in the line of sight of the initiator. For example, if the behavior (behavior in respect to energy trading, such as producing, supplying or consuming energy) of the members in *De Ceuvel* contradicts with the behavior that the initiator had in mind, then it is analyzed to what extent this behavior can be explained by the space of *De Ceuvel*. Thus, in order to compare the ideal energy system of the initiator with the actual energy system at *De Ceuvel*, two analysis are needed: one that focusses on the behavior of members that the initiator had in mind and one about the actual behavior of members in the energy system at *De Ceuvel*.

At first, this thesis describes the ideas the initiator had about an ideal energy system before *De Ceuvel* was taken into account and what the initiator had in mind about how people would behave in respect to energy trading in this energy system. In this stage of the project it was not clear to what place these ideas were prescribed to (these were just ideas about an ideal energy market). Because the geographical concepts can only be applied by referring to a space, this (ideal) behavior is only perceived by the multi-level perspective analysis. In this thesis, a rule is defined as a niche rule if the rule stimulates alternative behavior of people in comparison with the 'normal' behavior of people in the Dutch energy system. Therefore, in order to understand to what extent the ideas that the initiator had about an energy system before *De Ceuvel* was taken into account prescribe niche rules, it is analyzed to what extent these ideas prescribe alternative behavior of people in comparison with the behavior of people in the Dutch energy system. Moreover, the emergence of niche rules is, according to the operationalization of the multi-level perspective in this thesis, influenced by the long-term trends in the landscape level. Therefore, this thesis will analyze how certain trends influence the chances of the niche rules that are prescribed by the initiator to develop his ideal energy system.

Secondly, this thesis describes how the energy system at *De Ceuvel* came about by referring to the concepts of multi-scalar interconnectivity, social-spatial embeddedness and power relations. In other words, the influence of the space of *De Ceuvel* on the development of the energy system at *De Ceuvel* is taken into account by connecting the geographical concepts of multi-scalar interconnectivity, social-spatial embeddedness and power relations with the space of *De Ceuvel*. By comparing the behavior of people in the current state of development with the behavior that the initiator had in mind before *De Ceuvel* was taken into account, the influence of the space of *De Ceuvel* on the development of the energy system at *De Ceuvel* is analyzed.

4.2 Critical case study

A critical case study can be used to analyze to what extent the knowledge created in an experiment of one place (in one case), can be used for the development of such experiments at other places. The function of conducting a single case study in social science is often described as a way to explore subjects. However, as proved by critical case studies, this is a misunderstanding. Indeed, this type of cases provide the

possibility to formulate a generalization to other situations based on the critical characteristic of the concerned case (Flyjberg, 2006). For example, when a medicine clinic wants to know whether people working with organic solvents suffered brain damage, the clinic can choose a workplace that fulfils all the safety regulations to investigate this relation. When the results show that this is a causality even in the safest workplace, then it is likely that the same problem would exists in the workplaces were the safety regulations for organic solvents are less carefully fulfilled. By researching a critical case, one can save both time and money in researching a given problem because a following generalization can be made: if it is not valid for this case, then it is not valid for any (or only few) cases.

This thesis conducts a critical case study to examine the potential of the novel rules in the energy system at *De Ceuvel* to contribute to the development of an alternative (more sustainable) way of living with energy. A critical case study enables the researcher to make generalizations based on the concerned case study. For example, most prosumers only want to supply energy to friends and family (Butenko, 2016). As such, through conducting a case study on the energy system at *De Ceuvel*, the relationships between members of *De Ceuvel* can be examined in depth. As a result, it can be determined to what extent these relationship are relationships of friendship. In line with the above, these relationships of friendship between the members of *De Ceuvel* would create a critical characteristic for an energy system based on peer-to-peer trading. Therefore, it could be argued that if the people of *De Ceuvel* do not trade peer-to-peer, then most other places (for example neighborhoods or cities with more anonymous relationships) would probably not trade peer-to-peer either if the design of the energy system as one in *De Ceuvel* is kept the same. As a consequence, the upscaling of the energy system at *De Ceuvel* would not create new social structures concerning energy supply in the energy system of cities and one could argue that the system at *De Ceuvel* needs some adjustments in order to create new social structures in cities. However, because this is a study of human affairs, the knowledge created in this thesis should be perceived as a contribution to the learning process of how to upscale the energy market of *De Ceuvel* into for example neighborhoods. How the knowledge produced in a critical case study should be approached in social science is described more thoroughly in following paragraphs.

Thus, while the multi-level perspectives focusses on the question 'when can behavior be perceived as alternative behavior?' and the geographical concepts on why alternative behavior occurs in a certain place (in this thesis space), a critical case study builds further upon the knowledge of these answers. In this thesis, the aim of conducting a critical case study is to analyze to what extent the niche rules at *De Ceuvel* create alternative behavior at *De Ceuvel* and can be added to - or maybe even replace - the mainstream rules and routines in the Dutch traditional energy system in general.

The question of 'how does a workplace influences organic solvents to cause brain damage?' seems less complex then the question of 'how does the space of *De Ceuvel* influences the development of niche rules (for example peer-to-peer trading) in its energy system which lead to a more sustainable energy system?'. The main difference between the latter and the former problem is that the effect of peer-to-peer trading is part of human behavior; the researcher cannot do a targeted research such as the medical clinic did on organic solvents. The influences on the toxicity of solvents are more static and clear (for example PH value) than the influences on human behavior in a certain space (for example, values, norms, social relationships, feeling of community, power). Thus, through the aspect of human affairs in social sciences it is important to clarify the deeper causes behind a given effect and its consequences (Flyvbjerg, 2006). A case study provides this knowledge, because it describes the context of a case in depth.

In the study of human affairs, there appears to exist only context dependent knowledge, which, thus, presently rules out the possibility of epistemic theoretical construction (Flyvbjerg, 2006, p. 221). Therefore, the goal of the critical case study of *De Ceuvel* is that people can learn from the knowledge created. That this kind of knowledge is also of value becomes clear in the work of Eysenck (as cited in Flyvbjerg, 2006): "sometimes we simply have to keep our eyes open and look carefully at individual cases—not in the hope of proving anything, but rather in the hope of learning something!". Or as Flyvbjerg (2006) himself explains: "Predictive theories and universals cannot be found in the study of human affairs. Concrete, context-dependent knowledge is, therefore, more valuable than the vain search for predictive theories and universals." (p. 224). Thus, the aim of conducting a critical case study is not to construct context-independent theories, but to construct context-dependent knowledge in order to learn from the development of the energy system at *De Ceuvel.*

4.3 Data gathering

The initiator of the energy system at *De Ceuvel* was interviewed several times in order to understand the emergence of the local energy market of *De Ceuvel* in depth (the interviews took twelve hours in total). The aim of these interviews was to understand the motivations and interest of the initiator and to what extent the initiator could operate these into the development of the local energy system at *De Ceuvel*. If the initiator had to adapt his ideas about an ideal electricity market, then it is interesting to analyze to what extent this was due to place specificity of De *Ceuvel*. Moreover, a meeting between the initiator, the municipality of Groningen (the municipality is interested in having a similar energy market as the one at *De Ceuvel*) and other stakeholders was attended and analyzed. The aim of this meeting was to analyze to what extent the knowledge created at *De Ceuvel* could help the development of peer-to-peer energy transactions in Groningen. Through the analysis of the potential of developing an energy market similar to the one of *De Ceuvel* in Groningen, knowledge is generated about to what extent the energy market of *De Ceuvel* can be upscaled. Furthermore, information about the development of the local energy market of *De Ceuvel* was gathered from desk research and was, if possible, cross-validated during the interviews.

Moreover, it was analyzed to what extent the information from a master thesis (Drosner, 2015) (Drosner conducted a case study about the relatedness between culture and sustainability at *De Ceuvel* in 2015) could be used to describe the values and norms of the community of *De Ceuvel.* Finally, information about the traditional energy market and that of a blockchain based market was complemented by scientific literature.

To summarize, the knowledge created by this approach is used to analyze to what extent the development of the local energy market at *De Ceuvel* can contribute to a sustainable way of living. Thus, next to understanding the local energy market and how it came about, the rules within the local energy market of *De Ceuvel* are analyzed and to what extent they are related to the development of new rules that contribute to a more sustainable way of living. Comparing the rules of the energy system at *De Ceuvel* with the rules of the Dutch energy system creates this knowledge. By conducting a critical case study several (social) factors are described that can influence the development of a local energy system such as *De Ceuvel*. This methodology will create context-depended knowledge to answer the main

question of this research: what is the potential of the niche rules in the energy system at *De Ceuvel* in contributing to the development of an alternative (more sustainable) way of living with energy in cities?

Chapter 5: Results

This chapter explains the energy system at *De Ceuvel* in detail and applies the theoretical framework to the space of *De Ceuvel*. The first section of this chapter describes the genesis of the energy system at *De Ceuvel*. In this stage of development the space of *De Ceuvel* was not taken into account. This subchapter describes the ideas the initiator had about an ideal energy system and to what extent his ideas about how people should behave in this energy system can be perceived as an alternative form of behavior in comparison with their behavior in the traditional energy system of the Netherlands. The second section of this chapter describes how the energy system at *De Ceuvel* came about by connecting the geographical concepts of multi-scalar interconnectivity, social-spatial embeddedness and power relations with the space of *De Ceuvel*. By comparing the behavior of people in the current state of development with the behavior that the initiator had in mind before *De Ceuvel* was taken into account, the influence of the space of *De Ceuvel* on the development of the energy system at *De Ceuvel* is analyzed. The third section describes the (social) factors that influence the development of an energy system such as *De Ceuvel.*

5.1 The genesis of an new energy system

The next paragraphs describe the ideal energy system of the initiator of *De Ceuvel* and to what extent his ideas about how people should behave in this energy system can be perceived as an alternative form of behavior in comparison with their behavior in the traditional energy system of the Netherlands. Referring to the multi-level perspective does this.

5.1.1 The ideal energy system of Jos Blom

Jos Blom is the initiator of the local energy market in *De Ceuvel* and works at Alliander, a distribution system operator (DSO) in the Netherlands. A DSO is the operating manager of energy distribution networks and is among other things responsible for maintaining energy grids.

Bloms was inspired by the financial crisis to combine the financial and energy sector through the asset of renewable energy to provide alternative developments for both. His initial motivation was to create a

medium of exchange (a coin) that had value in itself. He wanted to establish a medium that was not created out of nowhere or by one profit driven actor but was representing something that existed and could be created by as many people as possible. He wanted to create a coin that was based on the value of renewable energy and named the coin Jouliette. Thus, when you do not consume as much renewable energy that you produce, you create Jouliette. Because the value of the Jouliette is based on renewable energy, speculation becomes impossible. The Jouliette is in proportion to renewable energy and one Jouliette represents one hundred watt-hour. Not only wanted Blom to avoid speculation via this coin, he also wanted to enable as many as people to create this coin instead of a central bank. To implement this aspect of his idea in an energy system he thought that the renewable energy should be generated via solar panels because this enables everyone who owns solar panels to create Jouliettes. Another aspect of his ideal energy market stems from his believe that people feel good about themselves when they give something of value away to someone else, for example someone from their community or neighborhood. He believes that these social benefits should be the incentive to start trading peer-to-peer. Moreover, he believes that people in the energy system should perceive benefits for a local community as beneficial for themselves.

In 2015, blockchain was introduced and it became possible to experiment with a decentralized energy market where people could trade energy on a peer two-peer scale in real life. The blockchain technology enabled the Jouliette to function as a sort of a certificate for owning renewable energy that could be transferred between individuals across the blockchain network without the involvement of a centralized third party. In other words, trough blockchain, it was easy to trace changes of ownership of renewable energy and enabled the producer of Jouliettes to give the Jouliette away to someone else. For example, in theory a tenant who has Jouliettes is able to pay a cleaner in Jouliettes. Moreover, blockchain enabled people to track renewable energy. For example, they would be enabled to see who was receiving their renewable energy. Thus, blockchain technology created a decentralized platform for peers to trade via Jouliettes.

5.1.2 Multi-level perspective

The development of the ideas of Blom in the Dutch energy system prescribes a change of the behavior of people in the Dutch energy system in several ways.

In the ideal energy system of Blom people would be enabled to supply each other of energy. This differs with the regime rules of the Dutch energy system, because regime rules require a prosumer to 'sell' their energy to an energy supplier. Thus, to enable peer-to-peer trading (and as such, alternative behavior) prosumers would have to be enabled to supply another resident of energy without the involvement of the energy supplier (for example through including formal niche rules in the space of the energy system).

Furthermore, the ideal energy system of Blom prescribes that prosumers would trade peer-to-peer because they receive social benefits in return. He insists that prosumers would be willing to give away renewable energy for free to another prosumer (for example a neighbor) because they become happier as result. This differs with the behavior of people in the Dutch energy system because prosumers receive a financial compensation in return for their produced energy. Thus, in order to stimulate alternative peer-to-peer behavior in the Dutch energy system (peer-to-peer trading for the sake of social benefits), niche rules need to be embedded in the space of the energy system that value social benefits over financial benefits. Consider certain norms (informal rules), for example. Moreover, he wants people to be under the impression that benefits for the community will lead to benefits for the individual. This is different with the behavior of people in the Dutch energy system, because prosumers are currently receiving a compensation for their renewable energy on an individual- and not on a community level. In order to develop this belief and as such alternative behavior of people in the Dutch energy system, informal niche rules need to be introduced in the energy system.

Alternative behavior of people in the financial sector

Next to changing the Dutch energy system, the development of the ideas of Blom about an energy system would impact the financial sector as well. He wants to create a coin that is based on the value of renewable energy (the Jouliette) that enables peers to trade (for example someone could pay a cleaner with Jouliettes). This would change the behavior of peers in the financial sector, because the energy system of Blom enables peers to create a medium of exchange instead of a centralized bank.

As explained in the conceptual framework, trends in the landscape level influence the chance of developing alternative behavior. The need for energy to be fulfilled by a community-based energy system is influenced by the trend of individualization. For example, the trend of individualization represses the belief that incentives to do peer-to-peer trading can be developed by referring to community- instead of individual benefits. At the same time, collective happiness and the well being of people increasingly receive attention as an indicator for welfare. For example, in Bhutan welfare and progresses to increase welfare are determined by the gross national happiness index (Adler, 2009). The trend that collective happiness matters for the welfare of places increases the belief that collective happiness can be an incentive to start peer-to-peer trading. Furthermore, according to Blom, the financial crisis made people distrust the financial sector and more open to alternative mediums of exchange (such as the Jouliette). The next subchapter describes to what extent the ideas of Blom became reality in the energy system at *De Ceuvel*.

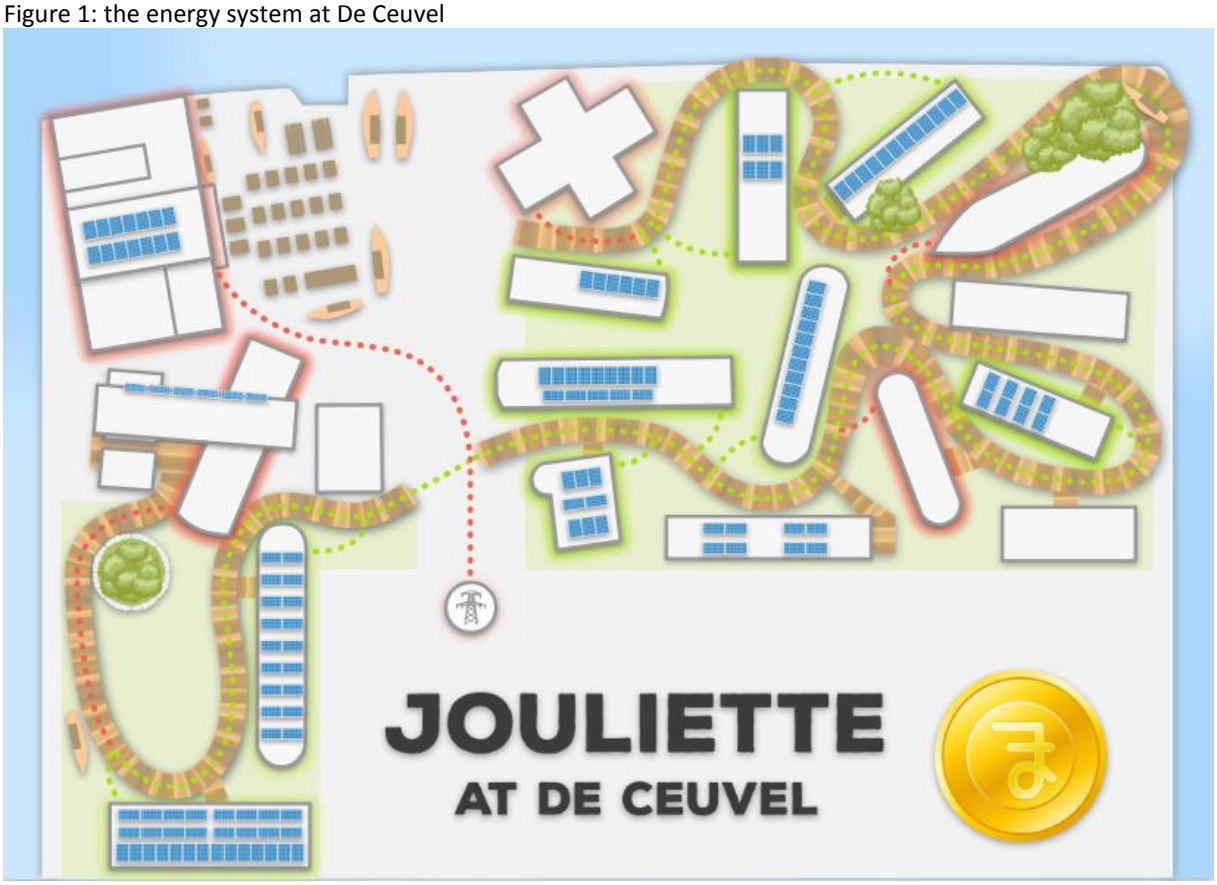
5.2 The energy system at *De Ceuvel*

This subchapter describes the location and the space of *De Ceuvel.* At first, the location is described and illustrated by some figures. Also, (the location of) the components of the energy system at *De Ceuvel* are described. Thereafter, the influence of the space of *De Ceuvel* on the development of the energy system at *De Ceuvel* is analyzed by connecting the geographical concepts of multi-scalar interconnectivity, social-spatial embeddedness and power relations with the space of *De Ceuvel*.

5.2.1 The location of the energy system at De Ceuvel

The next paragraphs describe the location of *De Ceuvel* by referring to some figures. The following figure is a representation of the energy system at *De Ceuvel*.

Figure 1: the energy system at De Ceuvel



(Alliander and Spectral, 2017. Retrieved from https://jouliette.net/map.html)

The blockchain based energy system at *De Ceuvel* is in use since September 2017. The energy is produced by solar panels and is distributed through a private micro-grid. This micro-grid connects the buildings at *De Ceuvel* with each other. The micro-grid is connected with the central energy grid. The green dotted lines represent the feed-in of renewable energy in the energy system, while red dotted lines represent that the building is consuming energy. As seen in this figure, the energy system at *De Ceuvel* is consuming energy from the central electricity grid. Moreover, the blue areas represent water. As seen in figure two, *De Ceuvel* is built on a former ship wharf.

Figure 2: De Ceuvel is build on a former ship wharf

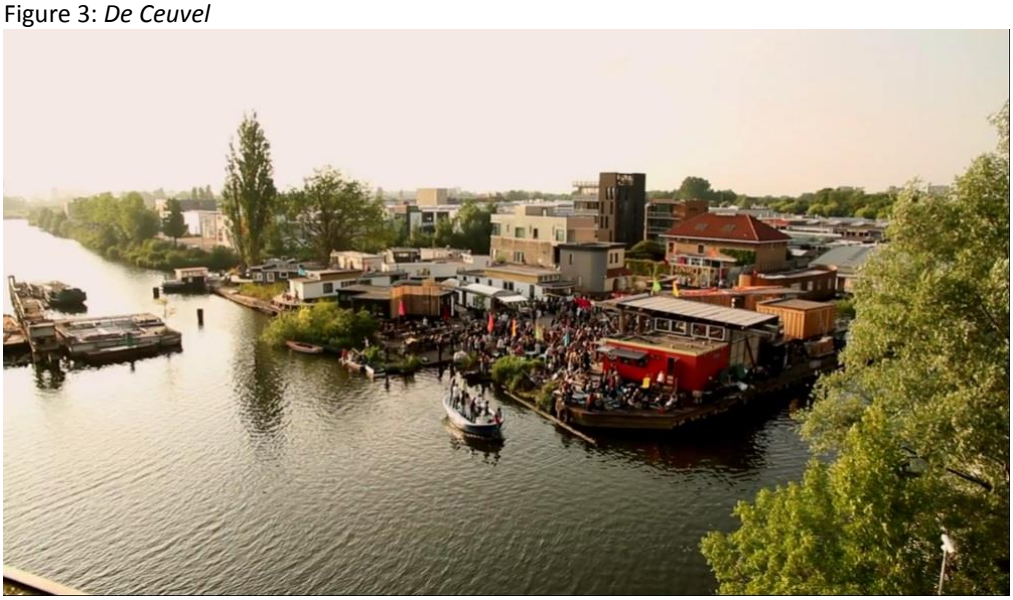
(Space and Matters. Retrieved from https://archello.com/project/de-ceuvel).

This shipyard polluted the ground on which *De Ceuvel* is located. The community is cleaning the ground of toxic chemicals by planting plants in the ground that can absorb these chemicals. The polluted land was (for ten years) granted to *De Ceuvel,* because they won a competition that was launched by the government (Drosner, 2015). According to Drosner (2015) the government established this competition for two reasons. Firstly, the urban re-development plans for Amsterdam Noord were put on hold due to the financial crisis. As a result, land remained untilled, as was the case with the former ship wharf Ceuvel Volharding. Secondly, this particular piece of land was further excluded from the local government's ground exploitation program for the area, because it is heavily polluted. Hence, there was no expected revenue for ten years. *De Ceuvel* opened her doors for visitors in 2014.

The relevant actors concerning the energy system at *De Ceuvel* are Alliander, Spectral and the community of *De Ceuvel*. The municipality of Amsterdam was not involved. Alliander is a distribution system operator (DSO) in the Netherlands and is responsible for maintaining the central electricity grid. Spectral is a start-up and consultancy agency in the Netherlands. Spectral implemented the blockchain technology in the energy system at *De Ceuvel*. In order to create an energy system that was managed by blockchain

technology, Alliander hired Spectral to develop the hardware and software aspects of the blockchain technology. The members of *De Ceuvel* belong to entity of the association of *De Ceuvel (De Ceuvel* is an associations of owners. In Dutch this is called a *vereniging van eigenaren*). *De Ceuvel* functions as a workplace for its members (not as a place of residence). The members of *De Ceuvel* are creative entrepreneurs or artists, because *De Ceuvel* is a breeding ground for art. One of the members is the local café (*café De Ceuvel*). This café attracts a lot of students and young professionals. The following figures show an impression of the ambiance of *De Ceuvel.*

Figure 3: *De Ceuvel*



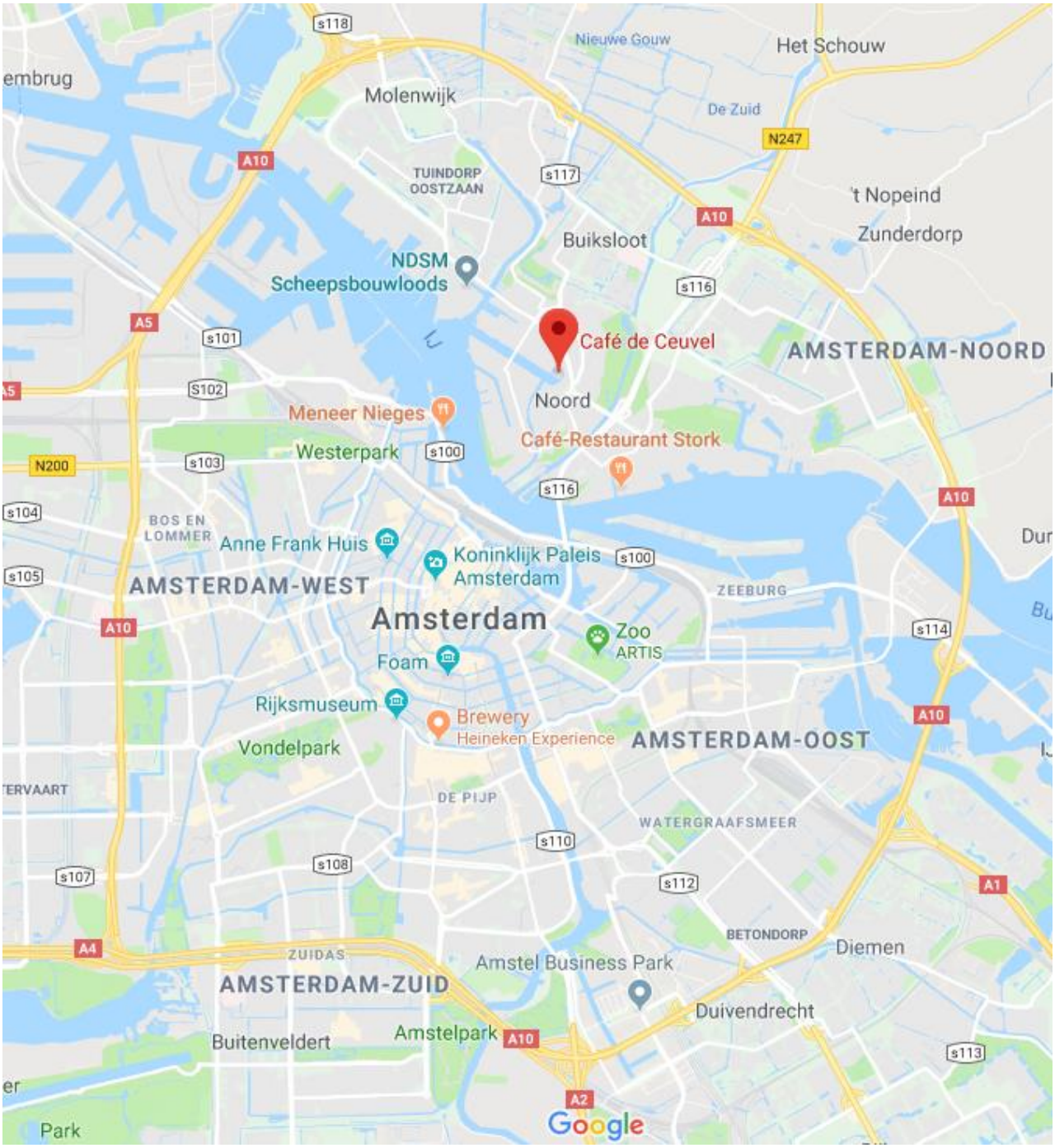
*(*We The City. Retrieved from http://www.wethecity.nl/PROJECT-DE-CEUVEL).

Figure 4: Café *De Ceuvel*

(Metronieuws, 2015. Retrieved from: https://www.metronieuws.nl/nieuws/amsterdam/2015/07/club-capital-cafe-de-ceuvel)

The next figure shows the location of *De Ceuvel*: Amsterdam, The Netherlands.

Figure 5: the location of De Ceuvel



(Google Maps, 2018)

In this thesis, the collectively of the actors involved in the energy system at *De Ceuvel* is based on defining the rules in the energy system at *De Ceuvel* and how people should produce, supply and consume energy at *De Ceuvel*. In other words, how the members should life with energy. In order to analyze how the

behavior if its members came about, the concepts of multi-scalar interconnectivity, social-spatial embeddedness and power relations are related to the development of *De Ceuvel*.

5.2.2 Multi-scalar interconnectivity

The energy system at *De Ceuvel* is currently an inspiration for the development of energy systems similar to that of *De Ceuvel* in other places. For example, members of *De Ceuvel* lead people around and tell about the energy system by referring to it as 'the blockchain project'. Moreover, Alliander, Spectral and the board of *De Ceuvel* are often approached by municipalities, congresses and universities to inform them about the project, but also by Dutch cultural organizations that function as a platform for innovative initiatives. For example, Pakhuis de Zwijger organized a congress titled Digital energy (https://dezwijger.nl/programma/digitale-energie) about the energy system at *De Ceuvel* in Amsterdam. Blom sees these meetings as a means to create the necessary attention needed for the further development of the energy system at *De Ceuvel*. He perceives these meetings as a performance: 'Tomorrow night I have to perform", (Blom, 2018). The aim of these meetings was according to Blom to upscale the project by making more people familiar and enthusiastic about the project of *De Ceuvel*.

De Ceuvel receives a lot of international attention but recently a municipality of a city in the Netherlands (the city of Groningen) arranged a meeting with the project of *De Ceuvel*. The municipality invited Spectral and Alliander to discuss how they can set-up a similar system as the one at *De Ceuvel*. The municipality has already designated two potential locations for the system (two neighborhoods in Groningen) and wants to learn from the findings of *De Ceuvel*. However, during this meeting the discussion about the establishment of a similar energy system at *De Ceuvel* was focused on learning from the financial and technological aspects of the energy system at *De Ceuvel*. For example about how blockchain was managing the system, what technological components were needed for a blockchain managed system and its costs. Thus, the aim of the municipality to retrieve knowledge from the project of *De Ceuvel* is especially focused on the financial and technological aspects and seems to neglect the potential of learning from the social aspects of the energy system at *De Ceuvel*. In other words, the social aspects of the energy system at *De Ceuvel* are not included in the learning process for the experiments concerning blockchain managed energy systems in Groningen. This might has to do with the fact that the members of

De Ceuvel were not present during the discussion nor any residents of the designated neighborhoods in Groningen. This seems to be at odds with the symbolic meaning of such an energy system for the municipality of Groningen; they want to represent the energy in these systems as the energy of Groningen.

During the interviews Blom did not mention any connections between the experiment at *De Ceuvel* and other experiments concerning blockchain managed peer-to-peer trading. According to Blom this is due to the fact that the energy system at *De Ceuvel* is pioneering as a social experiment. He even describes the famous energy system in Brooklyn as an advertisement for stakeholders to invest in energy systems based on blockchain technology; he thinks the concept was hyped and does not perceive it as an experiment were *De Ceuvel* can learn from. "As such, you do not hear anything from it anymore", Blom (2018).

Thus, it seems that the network established by the energy system at *De Ceuvel* is focused on the technological and digital aspects of the system. The social aspects about how to establish a community-led energy system receive less attention. Moreover, the connection within this network is mainly based on the energy system at *De Ceuvel* as an experiment to learn from, instead of *De Ceuvel* learning from other places.

However, other places still have some kind of influence on the establishment of the energy system at *De Ceuvel*. As Blom addresses, his job is to safeguard the long-term diffusion of the system by ensuring that the energy system at *De Ceuvel* is not adjusted too much to the desires of *De Ceuvel*. He is worried that if the energy system becomes too much adjusted towards the wishes of the community that the he will not be able to connect the energy system at *De Ceuvel* with other places (perhaps with other desires). For example, he wants to safeguard that the energy system of Groningen can be connected to the energy system at *De Ceuvel.* Therefore, he wants to create a balance between the particular wishes of communities in places. Thus this (potential) interconnectivity seems to influence the development of the energy system at *De Ceuvel*. In the near future Groningen will establish an energy market similar to that of *De Ceuvel*. It would be interesting to compare these systems and to what extent they have to adjust to the wishes of the communities involved in order to be connected.

While the (inter)national popularity of its technological design (a blockchain managed energy system) create mainly connectivity between the energy system at *De Ceuvel* and other places, the embeddedness of the components of the energy system at *De Ceuvel* also influence the interconnectivity between places. Despite the potential of blockchain to create a worldwide energy system, the connectivity between the energy system at *De Ceuvel* and other places is inhibited because energy trading between people is only allowed to take place between people that hire a workplace at *De Ceuvel*. This has to do with the fact that peer-to-peer energy trading is not allowed through the public energy grid in the Netherlands. As such, peer-to-peer trading is only allowed through the private micro-grid of *De Ceuvel*. This technological structure inhibits the establishment of interconnectivity concerning energy trading between people outside the community and the members of *De Ceuvel.* Therefore, it inhibits interconnectivity between *De Ceuvel* and other places.

Even though energy trading between people can only take place on the private micro-grid of *De Ceuvel*, the energy system at *De Ceuvel* is still connected to the central energy grid. This connection is necessary, because the local energy system at *De Ceuvel* often does not provide *De Ceuvel* of enough energy and because *De Ceuvel* cannot store energy. Therefore, if the microgrid was disconnected with the central energy grid, then there would be most likely an imbalance of energy and, as a consequence also no electricity at *De Ceuvel*. The connection between the micro-grid at *De Ceuvel* and the central electricity grid creates connectivity between *De Ceuvel* and other places because the members still have the opportunity to 'sell' energy to their joint energy supplier Greenchoice.

To summarize, the knowledge created at *De Ceuvel* is diffused to other places and create connections between places. But, this connection is mainly based on the energy system at *De Ceuvel* as an experiment to learn from, instead of *De Ceuvel* learning from other places. As a consequence, the learning processes of people concerning energy trading at other places do not inspire the way the energy trading is established at *De Ceuvel*. Thus, the knowledge exchange with *De Ceuvel* and other places establishes connectivity but not interconnectivity. This form of connectivity is in particular focused on the technological aspects of the energy system at *De Ceuvel*. In other words, the attention of outsiders to learn from the energy system at *De Ceuvel* seems to be focussed on the technological aspects of

blockchain. However, the long-term goal of Blom to upscale the energy system at *De Ceuvel* could influence the energy system at *De Ceuvel*. Moreover, the technological components of the energy system at *De Ceuvel*, such as the connection between the micro-grid of *De Ceuvel* and the central electricity grid create interconnectivity between *De Ceuvel* and other places. In line with the above, the concept of multi-scalar interconnectivity shows that the rules and behavior of people in the energy system at *De Ceuvel* is not only influenced by the place of *De Ceuvel* but also by other places. However, it seems that the energy system at *De Ceuvel* is more influenced by the space of *De Ceuvel* itself. Despite the one-sided knowledge exchange between *De Ceuvel* and other places, the energy system at *De Ceuvel* seems still affected by other places. For example, due to the long-term ambition of Blom to protect the upscaling potential of the energy system or due to the way the technological components of the energy system at *De Ceuvel* are embedded in the Dutch energy system.

5.2.3 Social-spatial embeddedness

The place *De Ceuvel* is functioning as a breeding ground for creative and cultural entrepreneurs, such as artists. The community brands itself as a cultural urban hub that connects technology, sustainability and art on their website (https://deceuvel.nl/en/). It wants to function as a symbol for the transition towards a more sustainable lifestyle. For example, they have a cultural program that tries to inspire individuals to become involved in the movement towards a more sustainable life. As such, it seems that the values of the community are stimulating a sustainable way of living and the members of *De Ceuvel* are encouraged to create a sustainable lifestyle together. Another thesis describes a similar view:

> *De Ceuvel is a sustainable, closed-loop incubator that hosts a thriving community of creative and social enterprises. By recycling houseboats, cleaning the soil with plants, and using low-cost clean technologies to improve the sustainability of the development, the former shipyard is an example of creative, circular, urban community.* (Rigter, 2016, p. 58).

However, the case study of (Drosner, 2015) describes the aspect of *De Ceuvel* as a cultural breeding ground as a top-down implementation. According to her, it is perceived as a ‘must’ arising from the regulations for breeding places set by the government.

Moreover, according to Blom, the feeling of community is currently not that strong. First, it is explained how people become a member of *De Ceuvel*. Thereafter, two factors that influence on the feeling of community are described.

Only a small group of members are part of *De Ceuvel* for longer time; most people are a member of *De Ceuvel* on occasion. The diversity in spending time at *De Ceuvel* is influenced by the membership of *De Ceuvel.* Indeed, entrepreneurs become a member of the energy system at *De Ceuvel* when they rent a building from the board of *De Ceuvel.* As such, every tenant, no matter for how long, receives Jouliettes (renewable energy) in a personal digital wallet. Therefore, members can only become part of *De Ceuvel* if they are an artist (*De Ceuvel* is a creative breeding ground for art). In accordance with the work of Bauwens and Devine-Wright (2018) this leads to less open membership. As a consequence, the energy system at *De Ceuvel* is less similar to energy cooperation. This seems to inhibit the potential of *De Ceuvel* to contribute to a community-led transition towards a more sustainable way of life in cities.

Firstly, Blom described that most members do not spend an equal amount of time at *De Ceuvel* or are part of the energy system at *De Ceuvel* for the same time: some entrepreneurs rent a workplace for several years but some only for a day or so. A member, for example a writer, who is only one day at *De Ceuvel* for inspiration, is likely to have less social relations with the community than a member who is more often at *De Ceuvel.* As a consequence, the writer is less likely to perceive the community of *De Ceuvel* as a community place.

Secondly, Blom described that the feeling of community was stronger at the start of the development of *De Ceuvel*, because the cultivation of *De Ceuvel* was a common project and unified the members. The current phase of *De Ceuvel* has more different projects on a smaller scale instead of one unifying project. The connection of most members with the community of *De Ceuvel* is therefore not that strong as the connection of the small group at *De Ceuvel* that were part of *De Ceuvel* from the start. As a consequence, the small group of entrepreneurs that were a member of *De Ceuvel* from the start tends to perceive the community of *De Ceuvel* more as a community of place in comparison with most members. Thus, it seems that a small group of members of *De Ceuvel* form a community of place, while most members of *De*

Ceuvel are not part of it. In accordance with the work of, Bauwens and Devine-Wright (2018) most member of the community at *De Ceuvel* would be more driven by material incentives attached to electricity supply, have lower environmental concerns and identify less strongly with the community.

The work of Drosner (2015) seems to validate this analysis. In 2015, all interviewees saw positive developments in terms of a community feeling. Some tenants described the creation of *De Ceuvel* as a do-it-yourself-project in which a community was creating through a common effort. For example, during this period tenants had to invest in setting up their own boats. In her research, one tenant who was involved in setting up *De Ceuvel* states the following: "A lot was asked from these parties [the tenants], because we had so little money. We depended a lot on voluntary work." (Drosner, 2015, p. 53). Thus, during the cultivation of *De Ceuvel* members had more social interaction with each other at *De Ceuvel,* because the cultivation was an unifying project. Moreover, this voluntary work can, in accordance with the work of Bauwens and Devine-Wright (2018), be perceived as a characteristic of management through a democratic cooperative structure.

However, the rules concerning energy allocation in the energy system at *De Ceuvel* seems to unify the members. For example, the members are participating in meetings to discuss the further development of the experiment. Furthermore, the community of *De Ceuvel* has decided that the community owns many solar panels at *De Ceuvel*. Therefore, the total amount of renewable energy generated by these solar panels is evenly distributed to all the buildings that are at that time in use. Thus, even if a member only rents the workplace for a week and another member rents the workplace for a year, the members receive an equal amount of energy at the time they both rent a workplace. Therefore, the energy produced at *De Ceuvel* is allocated pro rata among the members (it is in proportion to the time a member rents a workplace). In accordance with the work of Bauwens and Devine-Wright (2018), this might create a more unified community and as a consequence, a more community led energy system.

5.2.4 Power relations

The role of Alliander in the traditional energy system is reluctant in steering the behavior of people; it ought to have a neutral role in the policy of the energy system in the Netherlands and should only enable people to make choices. Moreover, Alliander hired Spectral to set up the technological design of the

blockchain in the energy system at *De Ceuvel* and because it is a consultancy agency it is expected to work for Alliander. Thus, the relations between Alliander, Spectral and *De Ceuvel* are empowering the community of *De Ceuvel* and stimulate the community to have the local control on the development of the energy system at *De Ceuvel*. The power relations between these stakeholders created the common view that the rules concerning energy trading should be established by the self-defining rules of the community. The power relations at *De Ceuvel* seem to create a centralized role of the community concerning the development of the energy system at *De Ceuvel*. As suggested by the work of Bauwens and Devine-Wright (2018), the development of community led energy systems seem to stimulate the transition from a fossil fuel based energy system in cities towards a renewable energy system. Not only are these kinds of development more socially accepted due to local control, they also seem to create more positive attitudes towards renewable energy.

In contrast with the role of the municipality of Amsterdam in the development of the energy system at *De Ceuvel,* the municipality of Groningen seems to have a centralized role in the development of the - inspired by the energy system at *De Ceuvel* - energy systems in Groningen. The development of the energy systems in Groningen is initiated and managed by the municipality of Groningen. For example, none of residents in the designated neighborhoods were invited to participate in the meeting. Moreover, the municipality does not want to reveal the idea of creating these energy systems to the public before the alderman approved. During the meeting it also appeared that the development of these energy system has a political purpose, because they perceive the development as a potential advertisement for their ability as authorities to create typical renewable energy systems of Groningen. Thus, while the community of *De Ceuvel* has a centralized role in the development of its local energy system, the communities in the neighborhoods of Groningen will probably (at most) participate in the local energy system of the municipality of Groningen. Therefore, the way the development of the energy system of Groningen is controlled seems to have, in accordance with the work of Bauwens and Devine-Wright (2018), an higher risk of inhibiting the potential benefits of community led energy systems.

The next paragraphs compare the behavior of people in the current state of development with the behavior that the initiator had in mind before *De Ceuvel* was taken into account. Through this approach

the influence of the space of *De Ceuvel* on the development of the energy system at *De Ceuvel* is analyzed.

5.3. Niche rules at *De Ceuvel*

This subchapter compares the (niche) rules at *De Ceuvel* with the (niche) rules in the ideal energy system of Blom.

The energy system at *De Ceuvel* is a social experiment because the energy system enables the members of *De Ceuvel* to give away renewable energy to another. For example, if a member does not consume the amount of renewable energy he or she is granted (the individual has 20 Jouliettes of renewable energy left), he or she could give it (the 20 Jouliettes) to another member of the community of *De Ceuvel*. Thus, why and under what conditions would a member of *De Ceuvel* give the energy away (thus without a compensation) to another member?

As explained earlier, Blom wants prosumers to be triggered to start trading peer-to-peer through the incentive of receiving social benefits in return. According to him, prosumers would be willing to give away renewable energy for free to another prosumer (for example a neighbor) because they become happier as result. Moreover, he wants people to be under the impression that benefits for the community will lead to benefits for the individual.

There are tensions between these values that the initiator wants to foster vs. the values of the spatial institutions of the community. This is reflected by the fact that members often choose to 'sell' energy to Greenchoice (the joint energy supplier of *De Ceuvel*) via *de salderingsregeling* instead of trading it peer-to-peer. Moreover, during a meeting of the energy system at *De Ceuvel* it became clear that the members of *De Ceuvel* want to have a compensation for their renewable energy. Therefore, they wanted to add another option next to giving renewable energy away for free: If individuals do not consume all the renewable energy they produce and choose to trade their energy with another, they should be able to receive something valuable in return if wanted. Thus, despite the fact that the solar panels are a community asset of *De Ceuvel*, the renewable energy is not perceived as a community asset since the members are not willing to share the renewable energy with other members for free.

Furthermore, Blom described that the members are unaware of the possibility that if the community is doing well, the individual will also benefit. During a meeting Blom wanted to pinpoint this believe of social benefits over financial benefits, but he could not convince the community of this because the meeting was from the start focused on deciding what kind of financial compensation somebody should receive when trading renewable energy peer-to-peer. Therefore, a deeper reflection regarding how to make such informal rules explicit (e.g. peers should give away renewable energy for free because it will improve the community and therefore the situation of tenants as well) and whether and how to include them in the negotiates of spaces for experimentation seem to be important to create a better understanding on how to create (sustainable) new rules in communities.

According to Blom, during this meeting it became clear that the community was focused on the financial benefits of the individual, instead of the social (and financial) benefits for the community. It seems that the individual benefits concerning renewable energy trading are more valued than the benefits for the community despite the fact that almost all solar panels located on *De Ceuvel* are a community asset. These values seem to be explain (partly) why the members choose almost without exception to sell the remainder of renewable energy to *Greenchoice* instead of giving it away to other peers.

Recently, another digital coin (*Ceuveltje*) was introduced in the energy system at *De Ceuvel*. If a member provides the local café of energy, then the member receives an amount of *Ceuveltje*. The coin *Ceuveltje* compensates the member because the tenant can use the *Ceuveltje* to buy products at the café. This creates an incentive to trade peer-to-peer, because peers can trade *Jouliette* in exchange for Ceuveltje. This incentive is not only created through trading with the local café, but also with each other, because the *Ceuveltje* is, just as the *Jouliette*, transferable to other members as well.

Whether the members find the compensation receiving form spending *Ceuveltje* in the local café attractive enough to start trading peer-to-peer is arguable, because it does not seem to resolve the former barrier to start trading peer-to-peer. The difference between the compensation of *Greenchoice* and the *Ceuveltje* is that the latter can only be invested in the local economy of *De Ceuvel*, while the former is not bounded by the local economy in which you can only buy products from the local café. Thus,

if a member still feels that the benefits of the individual (obtaining indirectly money from *Greenchoice* to spend on assets that are not bounded by a geographical space) out seek the benefits of the community (spending renewable energy in the local economy by trading *Jouliette* for *Ceuveltje*), than he or she is likely to choose the compensation of *Greenchoice* over the compensation of *Ceuveltje*. This seems to be explain why most members still do not use *Ceuveltje*; most members still trade with Greenchoice instead of trading peer-to-peer. Blom suggest that it is just a matter of time and habituation, because the coin have only been in use since May 2018. Moreover, the compensation of *Greenchoice* becomes less attractive because members will receive less compensation from energy suppliers starting from 2020 (the current form of *salderingsregeling* will be abolished by 2020).

Chapter 6: Conclusion

This chapter answers the research questions regarding this thesis. Firstly, the research question 'to what extent stimulates the energy system at De Ceuvel alternative behavior of people regarding energy trading?' is answered. Secondly, the research question 'to what extent is the energy system at De Ceuvel community led and how does this influence the energy system at De Ceuvel?' is answered. Thirdly, the research question 'to what extent is the energy system dependent on specific institutions of De Ceuvel and how does this influence the potential of upscaling the energy system at De Ceuvel to other places?' is answered. The main question 'what is the potential of niche rules in the energy system at *De Ceuvel* in contributing to the development of an alternative (more sustainable) way of living with energy in cities?' is answered in the discussion.

6.1 De Ceuvel and alternative behavior

This subchapter answers the following research question: to what extent stimulates the energy system at De Ceuvel alternative behavior of people regarding energy trading?

In comparison with the role of citizens in the Dutch energy system, the energy system at *De Ceuvel* has niche rules that stimulate alternative behavior. The members at *De Ceuvel* are stimulated to trade peer-to-peer and become active in their role as supplier, because the private micro-grid at *De Ceuvel* makes this form of trading legal and, thus, this rule should be perceived as a formal niche rule. However, the

routines of behavior in the energy system of *De Ceuvel* are mainstream and, therefore, these routines should be perceived a regime routine. Indeed, the main form of energy trading conducted in the energy system at *De Ceuvel* is selling energy to the joint supplier (*Greenchoice*). Moreover, if a member would provide another member of energy (and thus would conduct peer-to-peer energy trading), then he or she can demand a financial compensation in return. This stimulates behavior similar to the behavior in the Dutch energy system: peers should sell their energy instead of giving it away. Therefore, the conclusion of this sub-question is as follows: in theory, the energy system at *De Ceuvel* does stimulate alternative behavior, but in reality it does not.

The next subchapters explain how the behavior at *De Ceuvel* came about.

6.2 De Ceuvel and community led behavior

This subchapter answers the following research question: to what extent is the energy system at *De Ceuvel* community led and how does this influence the energy system at De Ceuvel?

The community of *De Ceuvel* has a centralized role concerning the development of the energy system at *De Ceuvel*. During a meeting, the power relations between Alliander, Spectral and the community at *De Ceuvel* created a selective pressure that in turn created a common view about a certain development: there should be an option of peer-to-peer energy trading that creates financial benefits for the member who is trading his or her share of energy.

In other words, the relations between Alliander, Spectral and *De Ceuvel* are empowering the community of *De Ceuvel* and stimulate the community to have the local control on the development of the energy system at *De Ceuvel*. The selective pressure established by the power relates between the stakeholders created the common view that the rules concerning energy trading should be developed by the self-defining rules of the community, because a pressure guides a development that represents the ideas of those in power. In relation to this case study, the community controlled the development of the energy system at *De Ceuvel*.

In conclusion, the energy system at *De Ceuvel* is community led and created the rule in the energy system at *De Ceuvel* that a member, who trades his energy with another member, can demand a financial compensation from the other member in return.

6.3 De Ceuvel and specific intuitions

This subchapter answers the following research question: to what extent is the energy system dependent on specific institutions of *De Ceuvel* and how does this influence the potential of upscaling the energy system at *De Ceuvel* to other places?

The transactions in energy system at *De Ceuvel*, in other words the (digital) flow of energy between members, is tracked by the digital coin Jouliette and is of use in every place. However, the digital coin Ceuveltje can only be used to buy products at *De Ceuvel*. The latter makes the system more place-specific. The Ceuveltje was introduced at *De Ceuvel,* because the members wanted to have a financial/material

incentive for conducting peer-to-peer trading. This material incentive seems to be created due to the lack of community of place at *De Ceuvel.* In accordance with the work of Bauwens and Devine-Wright (2018) most members of the community at *De Ceuvel* seem to be driven by material incentives. However, if they also have lower environmental concerns in comparison with the small group of members of *De Ceuvel* is not clear.

Chapter 7: Discussion

This chapter answers the main question regarding this research: what is the potential of niche rules in the energy system at *De Ceuvel* in contributing to the development of an alternative (more sustainable) way of living with energy in cities? Moreover, it describes the validations and considerations regarding this answer.

The energy system at *De Ceuvel* receives al lot of (inter)national attention. This attention is mainly focused on the technological and financial aspects of the energy system at *De Ceuvel*. Consider the blockchain technology, for example. The social factors that influence the energy system at *De Ceuvel* receive less attention. However, as this research shows, peer-to-peer trading is inhibited in the energy system at *De Ceuvel*, because the community that is driven by financial incentives leads the energy system. The transactions conducting are mainly between a member and the joint energy supplier. Therefore, the energy system at *De Ceuvel* is still dependent on the Dutch energy system and not as alternative as it seems in the first case. Thus, while the energy system at *De Ceuvel* is community led, it is not a community-based energy system. The underlying causes for this behavior are the effect of the social aspects of the energy system at *De Ceuvel*. Earlier research showed that most prosumers (peers that consume as well as produce energy) only want to supply energy to friends and family (Butenko, 2016). It seems that the lack of social interactions between members in the community of *De Ceuvel* inhibit the development of relationship of friendship. Still, it seems arguable that there are more social interactions between the communities of *De Ceuvel* than in most neighborhoods in urban areas. Therefore, most other places in cities would probably not trade peer-to-peer either if the rules in the energy system as the one in *De Ceuvel* were kept the same. As a consequence, it seems that the upscaling of the energy system

at *De Ceuvel* will not create new social structures concerning supply in the energy system of cities and one could argue that the (informal/formal) rules in the system at *De Ceuvel* needs to be adjusted in order to create new social structures in cities. This conclusion contributes to a better understanding of energy transitions, because it provided insights on the underlying causes of the conclusions of the work of Bauwens and Devine-Wright (2018). They indicated by conducting a survey study that a community-based energy system creates more positive attitudes towards renewable energy, but did not research the underlying social aspects of peer-to-peer energy trading. However, there are some considerations regarding this thesis, because the members of *De Ceuvel* were not interviewed in depth. Therefore, the in-depth knowledge is mainly constructed through the experiences of the initiator. As a consequence, this research is mainly a one-sided story. Hence, the recommendation for further research is as follows: the members of *De Ceuvel* should be interviewed. *De Ceuvel* is a very interesting case, because it has the potential to create a community-based energy system. Upscaling community-based energy systems radically change the Dutch energy system concerning the rules and routines of producing, consuming, supplying and regulating energy. However, too understand the potential impact of community-based energy systems on creating more positive attitudes of its actors towards renewable energy, the value of members of a community-based energy system should be investigated more in depth. This knowledge can be created by conducting qualitative interviewing with the members of the community of *De Ceuvel*. Research such as this thesis are relevant today, because it is expected that by 2050 almost half of all European households could be involved in producing renewable energy and about 37% of which would come through involvement in an energy community (Kampman, Blommerde, & Afman, 2016).

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Appendix

Interviews with Jos Blom

Founding father and motivation

Het idee van Jouliette is ontstaan in 2009, toen banken aan het omvallen waren. Eigenlijk is het idee gebaseerd op: laten we een fysieke eenheid aan geld koppelen en stabiliteit creëren in plaats van speculatie de overhand gaat nemen. Want bij een ruilmiddel is stabiliteit cruciaal en worden sommige mensen rijken, maar heel veel mensen worden er vaak slechter van. Volgende stap is; je hebt ooit goud gehad dat is losgelaten omdat geld moet overeenstemmen met een economie in een land, maar tegenwoordig wordt het geaccepteerd dat er meerdere betaalmiddelen in een land toegepast kunnen worden. In het begin heette het ook Greenmiles, als afgeleiden van de Airmiles zeg maar. Volgende stap is inderdaad die duurzame energie. Daar is het standaard idee begonnen. Als je duurzame energie over hebt en je deelt dat met andere, krijg je een tegoedbon die je later weer in kunt leveren voor een kilowattuur duurzame energie. Zo simpel was het basisidee in eerste instantie. Het idee heeft jarenlang gesudderd tot de blockchain technologie om de hoek kwam kijken en er in een keer een IT-technologie was die dat heel

makkelijk toepasbaar ging maken. In de tussentijd is in 200… ik heb er trouwens een presentatie over die kan ik misschien als handvat pakken, want die kan ik naar je toesturen. Dat heet het afsluitdocument en binnen Alliander zijn we ons zeg maar aan het reorganiseren en ons weer aan het bezinnen in welke verschillende innovaties we in moeten zetten. En het ontwikkelen van dit soort concepten past niet in de rol die Alliander toegewezen heeft gekregen door de ontwikkeling in de wetten, regelgeving in de kamer. Wetgeving Vet. Eerst hadden we een lijst bij netbeheerders wat we niet mochten doen, nou is er een lijst van activiteiten die we alleen maar mogen doen. Dus dat is veel beperkter. Dat is afgelopen jaren zijn wel heel actief geweest in het verkennen van nieuwe rollen van netbeheerders in het energiedomein, maar is er een rol voor collectieve infrastructuur die nodig is om energietransitie te kunnen versnellen. En daar wordt nu een beetje voorzichtiger mee omgegaan. Dus ik ben nu in de interne organisatie nieuwe fondsen aan het werven. Daar gebruik ik dit nieuwe document voor. Dit is nog in ontwikkeling. En eigenlijk si het doel dus. Dat is eigenlijk het doel (zie PowerPoint). Startpunt financiële crisis wat ik net zei he. En eigenlijk is het doel om speculatie te voorkomen en duurzame energie te stimuleren. Die twee komen in een keer bij elkaar. En dan de blockchain technologie komt om de hoek kijken in 2015. Dan kan je op een eenvoudige manier de administratie invoeren en transacties plegen. Voor iedereen toegankelijk. Het is een open systeem, want als netbeheerder is het uitgangspunt als we een infrastructuur ontwikkelen moet iedereen daar gebruik van kunnen maken. Inclusieve. I.p.v. Exclusieve. Je moet geen lid worden van een club, maar iedereen mag eraan meedoen. En de schepper van duurzame energie bepaald met wie die die energie deelt, want ik heb nu in eerste instantie was alleen de creator van energie krijgt een muntje toegeworpen maar op het moment dat je een rekeneenheid, of een betaalmiddel hebt, dan kun je hem ook weer weggeven aan iemand anders. Die vervolgens die energie weer kan kopen. Dus los van dat je hemzelf terug kunt pakken, die kilowattuur die je op het net gezet hebt, kun je hem ook weer overdraagbaar maken aan andere. Dan maak je er weer een ruilmiddel van i.p.v. een rekeneenheid. Blockchain maakt het makkelijk. In 2015 ben ik bij banken langsgegaan, IT-bedrijven, energiebedrijven, buurtvertegenwoordigers. Ik heb een sessie gehouden in Pakhuis de Zwijger met een man van 40/50. Brainstormsessie: hoe gaan we hier mee verder. Eerst is het een goed idee? Of moeten we er mee verder gaan en wat moeten we wel of niet doen. En over het algemeen was de reactie ja door goed idee. Alleen

ik wou geen software ontwikkelen want er was geen partij die die wou beginnen; geen partij wou beginnen omdat er geen systeem was. Dus de Kip en ei situatie zat ik een beetje in. 2016 kwam ook nog de Financiële crisis er overheen van wie schept het geld en waar ligt de verantwoordelijkheid ervan. Dus maatschappelijke verontwaardiging rondom dat fenomeen wel toen. En uh, dus, rondom het geldsysteem is wel steeds meer onder een vergrootglas terecht gekomen. Want Banken kunnen gewoon vanuit het niks geld creëren als iemand geld wil lenen. Waarom is dat recht alleen bij banken neergelegd. Waarom kan niet iedereen dat doen bijwijzen van spreken. Degene die mij gestimuleerd hebben zijn ook Jan Jonker moet je een keer op googlen. Jan Jonker is Professor sociologie op de Radboud universiteit. Die heeft een Ander geld onder die titel heeft die aan de kaak gesteld dat inderdaad het geldsysteem gekaapt is door commerciële partijen die er zoveel mogelijk winst uit proberen te halen. Met als gevolg dat geldsysteem minder betrouwbaar wordt omdat er speculatief mee omgegaan wordt. Dat moet je eigenlijk zien te meiden. Nog steeds de regels en richtlijnen waar banken waar banken aan onderworpen …. Het is het eigenlijk niet handig om het geldsysteem aan commerciële partijen over te laten. Weet ik veel, Beheer van wegen, vaarwegen of dijken bouwen. Moet je dat aan commerciële partijen over laten? Of moet je dat overheidswegen laten organiseren? Hele geldsysteem is vercommercialiseerd en de vraag is of dat wel zo slim is.

Wij hebben ook nog in 2016 kilowatsapp ontwikkeld. Het concept vormgegeven in een appje om iets simpels zoiets als dit te creëren. Binnen drie dagen. Alleen het concept hoor. Tessa heeft stroom over die wil dat aan haar oma geven en dus diegene die geeft heeft een voorkeur, diegene die ontvangt moet het accepteren en vervolgens kan de transactie plaatsvinden. Dus je hebt de fysieke energiestromen die gaan hun eigen gang en je hebt de verekeningsstromen die een andere route kennen. Wat stroom die Tessa over heeft, komt niet echt aan bij oma, omdat die stroom uit de centrale uit de hoek komt. In de Afrekenwereld heb je gewoon een afwijking van de fysieke wereld. Dus net zoals jij duurzame energie koopt bij een leverancier, fysiek komt die stroom … woon je in Utrecht? Dan komt die misschien van de WKKs die daar staan die de warmtestad, die het net verwarmen, en die stroom ook op het net zetten. Dus je fysieke stroom komt ergens anders vandaan dan de…. Maar het is maar hoe je het plaatje, het plaatje

van de elektriciteitsstroom is best wel complex en daar is een vereenvoudigde weergave in de afrekeningswereld van gemaakt om het hanteerbaar te maken.

Eigenlijk was het stabiliteit creëren in de een ruilmiddel. Dat was het oorspronkelijke idee. Gebaseerd op duurzame energie om dat dat wereldwijd toepasbaar is.

Involvement of Alliander

Vanaf begin af aan was Alliander betrokken is ontstaan bij een workshop. Ja het heeft tijdlang op een grote tekening in ruimte gehangen waar in het midden stond zon grote munt. Waar een Energieteken op stond ofzo. De naam Jouliette was pas later ontstaan.

Project establishment

Er was nog niet eens een project. Zo'n idee suddert een tijdje. Op een gegeven moment spar ik met allerlei mensen daarover. Er zijn heel veel mensen die zijn geïnteresseerd en die vinden het leuk. Op een gegeven moment dan heb je een groepje en daar ga je er mee beginnen. Iedereen praten, netwerk groter maken rondom het fenomeen. Dan worden mensen enthousiast en dan krijg je intern wat meer mensen. Op een gegeven moment ga je budget vragen om iets te laten bouwen. Dus een soort gelijk groeiproces.

Financial capital

Budget aanvragen was helemaal niet moeilijk, dat komt omdat we bij strategie redelijk autonoom zijn in het kunnen toewijzen van een bepaalde hoeveelheid budget waar je zelf de regie over kunt voeren. Dus een paar ton per jaar. Kon ik redelijk makkelijk, nou nee, heb ik zeg maar als budget waar ik niet zo veel verantwoordelijkheid voor hoef af te leggen omdat het allemaal verkenningen zijn van korte en lange termijn ontwikkelingen die je moeilijk kunt rationaliseren waarom je daar geld op gaat zetten. Verkennend onderzoek. Dus als je eerst je omgeving moet verklaren waarom je geld ergens gaat uitgeven dan moet er altijd een return investment komen en al dat soort verantwoording afleggen kost veel tijd en over het algemeen veel meer geld dan alleen dat ding bouwen. Jouliette de Ceuvel heeft alles bij elkaar 1 ton ofzo gekost. Nou ja, als het allemaal had moeten aanvragen alsof we een infrastructuur zouden aanleggen dan was ik een miljoen kwijt geweest.

Technologies concerning De Ceuvel

Ceuvel: technologie op het bestaande energiesysteem gezet? Traden mogelijk gemaakt

Zonnepanelen waren er al. Traden van energie proberen we niet handel, maar het uitruilen van energie, het weggegeven van energie wilde we onderzoeken. Mensen worden gelukkiger als ze dingen voor een groep doen als ze zichzelf proberen te verrijken. Dat is een van de filosofieën die er achter zat. Zit! Nog steeds. Is een belangrijk aspect voor mij. Los van de IT-technologie, we noemen het ook een sociaal experiment. Hoe voelen ze dat om weg te geven. Wat bleek op de Ceuvel, ze wouden er wel iets voor terug hebben voor de energie die ze aan iemand anders weggaven. Dus we doen iets voor de groep, landen daar slecht zeg maar. Ja het is een soort maatschappelijk fenomeen. Iedereen voor zich. In het voor me, is toch een belangrijker thema.

Trends

Ja individualisering, klopt. Of de groep in de Ceuvel is niet hecht genoeg. Je hebt wel een groep in De Ceuvel die redelijk hecht is. Maar dat zijn allemaal mensen die boten huren waar een doorloop in is. Dus er zit een groep mensen die ook betrokken zijn bij de Ceuvel die zich minder betrokken voelen bij het totaal van de groep.

Nee de Ceuvel bestaat 4/5 jaar en je hebt zon harde kern die dat opgebouwd heeft en daar zit. En je hebt allemaal mensen die die ruimtes huren; Er woont niemand en er zijn mensen die dan die boten huren voor een dag of 2 dagen in de week. Een kunstenaar die daar inspiratie wil opdoen of startup die kantoorruimte zoekt om gezamenlijk te kunnen zitten ergens. Die groep die er zeg maar los aan hangt is best wel groot. Die minder voor de totale groep iets over heeft. En over het algemeen zijn het mensen die weinig centen te makken hebben in de creatieve hoek. Dubbeltje omdraaien voordat ze hem uitgeven. Dan is dingen weggeven voor hun gevoel onhandig.

Ceuveltje

2017 Pakhuis de Zwijger, ruim jaar geleden. Conclusie ga er mee door. Dat was een openbare bijeenkomst. Toen is dit dus gebouwd (website). De Jouliette is ontstaan uit de naam Joule. Jouliette

schrijven. Gebaseerd op gedeelde duurzame energie. Hij wordt geminde op het moment dat je een slimmer meter meet dat je energie deelt met de community. Een stuk IT gekoppeld die gelijk Jouliette mind. De blockbox wordt dat genoemd: zeg maar De meter en de blockchain technologie wordt daarin aan elkaar gekoppeld. De waarde van de Jouliette kan je nog over soebatten, wat je op het net zet. Je kunt hem salderen; dan gaat het gewoon door het net terug en dan is die 18 cent waard. Bij de Ceuvel wat minder, Omdat ze een grotere aansluiting hebben dus ze betalen minder per kilowattuur. Inkoopwaarde van energie pakken, dat is maar 4 cent. Je kunt de groencertificaat waarde pakken (2 tot zoveel cent waard). CO2 certificaat nog.

Nog een pakhuis de zwijger avond gehouden in januari. Wat ik vaak als Kapstok gebruik is dit model. Als je naar energiesystemen kijkt heb je drie invalshoeken. 1. Fysieke wereld, zonnepanelen die stroom maken. 2. IT-wereld, slimme meters, de blockchain. 3. Afspraken wereld. Mensen; wat wij vinden, wat vinden wij belangrijk en wat is iets waard. Op alle drie die vlakken moet je georganiseerd hebben, wil je iets kunnen laten draaien. Jouliette is eigenlijk ontstaan op het snijvlak van fysiek naar digitaal worden die munten ervan geminded en eindigen in een wallet van booteigenaren daarvan. Die kunnen nu bij de kroeg waarde creëren door een biertje, broodje of koffie te kopen. En de vraag is, gaat dat nog het energieverbruik veranderen. Op de community; gaan mensen meer stroom delen of vinden ze het niet zo belangrijk. Dus hoe daarmee omgegaan wordt zeg maar.

Jouliette

Uitgangspunt voor de Jouliette en wallet per boot creëren is dat elke boot zijn eigen zonnepanelen heeft en dat wat die deelt waarde creëert. Echter binnen de Ceuvel is afgesproken dat de zonnepanelen van iedereen zijn. Dus iedereen die huurt, heeft recht op zoveel stroom uit zijn panelen. Dus we hebben nu de fysieke entiteit die meet gedetailleerd wat de boot deelt op het net. In de praktijk krijgen alle boothuurders gelijke porties Jouliette toegewezen wat afhankelijk is van de totale productie. Omdat ze hebben afgesproken dat iedereen daar gebruik van mag maken. Én Jouliette in een wallet van hun boot betekend dat ze minder hoeven te betalen voor de energierekening die later komt. De stroom die community creëert wordt verdeeld over iedereen in gelijke porties en de Jouliette kun je vervolgens weer

omruilen in Ceuveltje om daar mee op de kroeg, en die Ceuveltje worden eigenlijk uitgegeven door het restaurant, die heeft die Ceuveltje geminde uit niks. Als een soort kortingsbonnen; als jij een korting bon hebt dan krijg jij minder te betalen en met die Jouliette kun je dus die Ceuveltje creëren om daar mee te betalen in de kroeg. Dat is een complexe constructie die we bedacht hebben, omdat wij als netbeheerder… Heeft te maken met onze rol als netbeheerder. Wij moeten geen cryptocurrencies gaan ontwikkelen vanuit Alliander perspectief want dan is dat ver buiten de rol die wij als netbeheerder hebben. Dus wij moeten wel energiestromen zichtbaar maken in de digitale wereld; en eigenlijk moeten we in de digitale wereld mogelijk maken dat mensen daar transacties mee doen en dus dat laatste is nu niet mogelijk in het huidige afspraken stelstel van de energierecht wat er nu is. En nu ga ik iets toevoegen zeg maar…

Energierecht conflicteert met consumentenrecht zodat dat in NL afgesproken is. Als ik stroom over hebt, dan moet ik dat aan mijn leverancier verkopen.

Dutch energy system

Stel: je hebt een tuin en appelboom en je plukt er een appel van af en je wilt die weggeven dat kan dan niet; je moet hem aan AH verkopen. De enige plek waar jij appels kwijt kan. En ik wil mijn appels niet aan AH verkopen hoewel AH wel de verkoopprijs ervoor betaald. Ik verdien er goed mee. Maar daar gaat het mij niet om. Ik wil appels aan mijn moeder geven of aan mijn buren. Het sociale aspect is belangrijker dan het financiële gewin is zeg maar het uitgangspunt van het idee. Maar dus Energierecht wrikt met consumentenrecht. En consumentenrecht is langer en dominanter. Want energierecht is pas 20 jaar geleden bedacht met de partijen toen aan de macht waren met IT die toen bestond zeg maar. Dus de reguleringsmethodiek die rondom energie ontstaat, begint te wringen met allerlei andere juridische systemen. En de Universiteit van Tilburg is daar druk mee bezig om daar zeg maar…. Een van de sprekers van die avond, Margo Eders is daar mee bezig. Zij promoveert op dat thema. Saskia Lavrijzen, zij is de professor die dat knellend karakter tussen energierecht en consumentenrecht aan de kaak stelt en daar ook adviseert op regeringsniveau wat daarmee moet gebeuren. Dus er gebeurt wel het nodige. Dus dit is nu… en eigenlijk als je nu teruggaat naar welke rol zou Alliander erin kunnen spelen… Wij ondersteunen

klanten bij het maken van hun keuzes; dat is onze strategie. Die Jouliette die bepaald met wie jij je stroom deelt… je investeert in nieuwe open netten. Dus we maken naast fysieke wereld is het aanwezig zijn in digitale wereld van energiestroom is een belangrijk onderdeel. Want wij moeten markten… een van de rollen van de netbeheerder is dat de energiestromen worden gemeten om de markt zijn werk te laten doen. En dat is de rol van de netbeheerder om dat zichtbaar te maken: Wij moeten slimme meters ophangen om die energiestromen in kaart te brengen, En vervolgens kan de leverancier op grond daarvan een rekening sturen. Dus het vertalen van de fysieke energiestroom naar de digitale wereld is nog de rol van de netbeheerder die je nu op een hele andere manier invult met blockchain technologie dan dat we dat klassiek deden. Vroeger was het; je had een meter, gaat de meter opnemen, schrijft het op en die brengt het hier in de computeren. Nou dat is nu door de slimme meter die dat naar ons toezendt ergens in de cloud en dan hang je er een blockchain technologie aan die de klant gelijk in de leed zet om mee te doen wat die zelf wil. Moderne technologie maakt dat weggetje steeds korter en veel efficiënter en daardoor veel goedkoper. Dat is een van die ideeën.

Actors

Dit zijn de betrokken partijen. Alliander (wij) zijn er mee begonnen zeg maar. Spectral is degene die de blockbox gemaakt heeft. De sensor en de digitale vertaling naar de blockchain technologie en ook de multichain blockchain technologie gebouwd heeft om daar gebruik van te maken. Maar dat is gewoon een bouwpakket die je makkelijk kan inrichten

De Ceuvel is de plek waar het experiment (de locatie) plaatsvindt.

PricewaterHouse hebben we de app meegemaakt samen met hun startup wineup.

University of Delft

TuDelf TBM doet nu ook onderzoek naar de sociale aspecten op de Ceuvel. Wat voor een impact dat heeft. Wat jij ook een beetje doet.

Pakhuis de Zwijger zeg maar om er Reurink aan te geven; het publiek debat aan te gaan.

Intern organisatie zoek ik… ik werk bij de afdeling strategie. Wij zijn in reorganisatie dus van de 18 man gaan we terug naar 8 man ofzo. We gaan ons herbezinnen op innovatieportfolio. Of Jouliette nog ondersteunt gaat worden door Alliander is nog maar de vraag. Dus ik ben nu aan het zoeken binnen onze organisatie of er nog directieleden zijn die dit project willen ondersteunden om vervolgfase te onderzoeken.

Klanten markt. Je doet het voor klanten is er eentje

We hebben nog een programma marktfacilitering. Dat betekent dat wij marktpartijen ondersteunen in digitale informatie.

Je hebt de afdeling regulering. Die de wet en regelgeving bekijkt of we binnen de lijntjes kleuren

Innovatieprojecten.

IT tak die research development bezig is.

Tak met business development bezig is.

Je hebt nog data gedreven netbeheer.

Er zijn allerlei partijen bezig.

En dit is de laatste.

Dit is de toekomst.

Blockchain

We willen Peer2peer transacties doen. Nou kan je lokaal stroom uitwisselen. Jouliette kan je weggeven aan iemand anders of je kan Jouliettes omwisselen naar de Ceuveltjes en dan geef je ze aan de kroeg en diegene die ze heeft betaald minder voor zijn stroomrekening. Wat je eigenlijk doet is peer2peer transactie tussen verschillende partijen op energiegebied. Dat bestaat nu in de Ceuvel. De truc is nou: kunnen we dit ook door het publieke net doen. En als je dat door het publieke net doet, dan heb je een leverancier nodig in principe. Dat is het afspraakstelsel wat nu bestaat op het publieke net. Als ik aan jou stroom wil weggeven moet ik de van de bron formule toepassen dat jij bij mij aanklikt en dat jij mijn

stroom koopt en dat jij mij geld geeft zeg maar. Dus dan is de leverancier de partij die je… Je moet allebei bij van de Bron moet zitten willen we onderling stroom kunnen uitwisselen. Terwijl die tussenpartij eigenlijk niet nodig is, die wil je vermijden: het Heeft geen toegevoegde waarde. Dus kunnen wij dit organiseren zonder een leverancier. Dat gaat nu vrij moeilijk. En eigenlijk als alliander willen we niet met 1 leverancier iets doen, want dan gaan we die bevoordelen. Als we iets creëren voor de markt dan moeten alle leveranciers daar gebruik van kunnen maken; Als een soort voorwaarde. Dus meerdere leveranciers moeten er gebruik van kunnen maken. Dat wordt nog de uitdaging. De blockchain technologie die we nu gebruiken voldoet absoluut niet aan onze eisen, want je kunt nog wel een IT-technologie toepassen maar de open change die we nou gebruiken zitten partijen achter die de software kunnen aanpassen zonder dat we er invloed op uit kunnen oefenen. En dat gebeurt met elke blockchain technologie. Daar zit een community achter die dingen kan doen en als ze een keer de boel aangepast hebben en zij hebben daar een soort van grote stemrecht in, dan kan het zo zijn dat er dingen gebeuren dat er dingen gebeuren waardoor wij onze transacties niet meer kunnen doen. Bij de bitcoin-blockchain technologie houdt de community een wereldwijde community in, in de praktijk zijn het er een stuk of 6/7 dominante IT'ers die als een soort goeroes beschouwd worden die door hebben hoe het werkt. Als dat groepje besluit we moeten sneller gaan maken of de tijdframe korter maken of we gaan splitsing maken tussen nieuwe en oude muntjes. Omdat het te duur is of te veel energie kostte. De huidige Marktprincipes. Dan kan er zo een nieuwe munt zijn die misschien wel duurzamer is, maar waardoor je sommige dingen niet meer kan doen. Dus het vraagstuk is, wil je iets wijzigen in de software; software is een levend organisme, dat moet je continue aanpassen omdat dat dat… er zitten altijd fouten in en De omgeving verandert ook continue. Dus het moet zich continue aanpassen aan de nieuwe omgeving. Dus elk programma moet je continue beheren, onderhouden en nieuwe releases maken. Net zoals je een keer updates voor je app krijgt als een soort levend organisme. Eigenlijk is iedereen die gebruikt maak van blockchain technologie die moet inspraak krijgen over alle veranderingen die plaatsvinden. Een soort Democratiebeginsel over hoe je wijzigingen accepteert. Hoe je dat dan weer moet organiseren is de weer een sub vraagstuk. Het sociaal experiment op de Ceuvel, leer je heel veel in dit soort over dingen die wringen maar waar we nog geen oplossing voor hebben. Maar het vraagstuk kan ik wel beschrijven, de oplossing heb ik nog niet helemaal.

Hoe je dat moet organiseren, lijkt een beetje op Linux. Was een concurrent voor Microsoft (operating system) en zo'n constructie zou je ook op blockchaintechnologie moeten betrekken. Linux googled met open source. Heel veel blockchain ontwikkelaars doen alsof ze open zijn en alles publiceren. Maar ondertussen worden alle veranderingen niet op een democratische manier toegepast. Moet allerlei constructie verzinnen dat je variaties op een blockchain ontwikkeld die je dan moet kunnen veemarkten. Mensen mogen er best wel geld mee verdienen. En daar zijn allerlei organisatievormen voor om dat te organiseren en de Linux vorm lijkt wel een voor de hand liggende oplossing.

Spectral heeft niet de blockchain ontwikkeld. Alle blockchain technologieën zijn gewoon bouwpakketten. Spectral heeft een bouwpakket gekregen; je klikt een website open, pakt die toolbox eruit en je moet een fee betalen van 100 euro per maand ofzo en je maakt er gebruik van. Want de meeste technologieën worden gewoon gepubliceerd en worden voor iedereen toegankelijk gemaakt. Het verdienmodel wat erachter zit moeten die bedrijven nog ontdekken. Net zoals toen google begon 20 jaar geleden begon met zoekmachine. 15 jaar gelden. Niet-wetende waar ze hun geld mee verdienen. Omdat het toen nog niet was. Achteraf bleek het dus traffic genereren en aandacht creëren dat dat het grote verdienmodel was.. Dus heel veel partijen stellen het gratis ter beschikbaar en dan in de toekomst gaan ze daar wel hekjes om heen zetten om er geld uit te halen. Als die hekjes neerzetten van bij elke transactie moet je een dubbeltje betalen welke transactie Jouliette die maar 1 cent waard is, dan ben je de Sjaak dan kun je er wel mee stoppen.

Een ander die belangrijk is dat ik Tokens wil introduceren, Jouliettes, die niet aan speculaties onderhevig zijn. Bijna iedereen die cryptocurrencies maakt, die doet dat om snel rijk te worden. ICO innitial coin offerings. Iemand heeft een goed idee, maakt er een muntje van. En dan ga je Mensen die geïnteresseerd zijn in jouw idee die geef je al muntjes uit. En wie weet wordt het heel veel waard. Jij krijgt duizend muntjes die niks waard zijn, maar door speculatie krijgen ze dat wel. Dus iedereen steekt geld in gebakken lucht. Heel veel Partijen zijn hier heel snel rijk mee geworden en jaarlijks wordt hier gewoon miljarden mee opgehaald... ICO's zoals dat heet. Of miljarden.. Honderden miljoenen. ICO's coins offering neemt flink toe, helft daarvan is na 1 jaar niks mee waard omdat het gebakken lucht ideeën zijn waar niks van de

grond komt. En Ik probeer juist speculatie te voorkomen, dus ik ga geen Jouliette uitgeven uit het niets. Nee; je kunt ze alleen maar creëren als je duurzame energie op het net zet. Punt. Haha.

Ander idee is… Elke cryptocurrencie heeft hardware en software nodig. Die hardware zou dus geleverd moeten worden door partijen die meedoen. Het kan zo zijn dat die blockbox, het kleine stukje IT-component, een onderdeel is van een grotere groep die je aan elkaar koppelt waardoor je genoeg rekencapaciteit krijgt om het hele systeem te ondersteunen. Dus iedereen moet 100 euro bijdragen. Jouliette systeem aan jouw computertje die eraan zit is een onderdeel van het groter geheel.

Als particulier zou je dus 100 euro moeten bijdragen om die component te koppelen aan je smart meter. En dan kun je Jouliette gaan minen met zonnestroom die je aan het netwerk geeft aan andere partijen. Je hebt ook nog stroom nodig om die bitcoin te laten draaien. Bitcoin kost nu evenveel stroom als di Evan heel Oostenrijk vanwege de consensusmechanismes die erachter zitten. Nouja hier moet de hardware in ieder geval draaien. De stroom die door de computer wordt gebruikt moet ook geleverd worden aan het net. Dus iedereen draagt bij met zijn duurzame energie om het energiesysteem te onderhouden. Naast hardware heb je dus ook nog energie nodig.

Dus je hebt Logica nodig, waar iedereen instemming over heeft. Het mag niet speculatief zijn. Hardware moet iedereen aan bijdragen; is community based en de energie is community based. Als een soort principes die ik probeert te introduceren.

Future

Dit zit er nog niet in hoor… Al hoewel, bij de Ceuvel worden de computers wel gedraaid door de lokale energie. Maar er staan nog 2 services om het concensusmechanisme te laten draaien of 2 rekeningeenheden. En hij zit ook nog vast aan het centrale net.

Je kunt het met duurzame energie doen, maar je kunt nog meerdere waarde gebieden ontsluiten. Eentje is settlements. De hele energiesector is een afsprakenstelsel ontwikkeld; de stroom die je op het net zet, moet er ook afgehaald worden. En alle partijen die het inkopen en verkopen moet in balans zijn. Dat heet settlement. Ik zet voor 100 euro iets op het net, iemand haalt het voor 80 eraf. En Dit is 100

kilowattuur is hier opgezet en daar is 100 afgehaald. Dus je hebt allerlei stromen in stroom en geldmechanismes die in evenwicht moeten zijn na zoveel tijd. En Er zit een heel complex spel achter van programmaverantwoordelijken leveranciers netbeheerders Tennet die daar het afsprakenstelsel op gemaakt hebben om per kwartier balans te houden in het systeem. En de kosten van de onbalans wordt doorgerekend aan degene die de overlast veroorzaken. Dus er zit een heel spel al achter wat settlement heet. Wat nu heel complex is, maar je op een veel simpelere manier kunt toepassen. En als je daar meer van af wil weten, dan moet je misschien een keer settlement energiesector een keer googlen ofzo. Dan krijg je daar het verhaal over. Belangrijke rol daarin is programmaverantwoordelijke. Dat is zeg maar de titel in Nederland voor partijen die verantwoordelijk zijn voor balanshandhaving in het net.

Je kunt een groen certificaat administratie zuiver meevoeren. Nu Jij als consument en e zet zonnestroom op het net, dan daar krijg jij geen groencertificaat voor maar die steekt de leverancier in zijn zak. Ik weet niet eens of ze het überhaupt doen, misschien is de administratie wel duurder dan wat het oplevert.

Je kunt wat ze op de Ceuvel ook doen is alle energiestromen inzichtelijk maken, dus je weet wat de productie en afname is overal. Dus die maak je ook inzichtelijk. Dus het inzicht maken van energiestromen kan laagdrempelig. Je kunt het energiesysteem daarmee ondersteunen. Dus wij moeten… frequentie handhaven, spanningsvaliditeit op orde brengen. Dus de kwaliteit van het energie leveren kun je beter maken. Last but not least: je kunt Jouliette koppelen aan meerdere energiedragers. Dus waarom ook niet aan groen gas, wat mensen op het net zetten of Duurzame warmte of andere vormen van duurzame energie die je ook vertaald naar Jouliette. Dat is nog ver weg, maar waarom niet. Ceuvel willen ze bijvoorbeeld vergisting neerzetten en moeten ze nou Jouliette uitkeren van mensen die kilo’s biomassa in die vergisten gooien. Kan dat? Terwijl je nog niet zeker weet hoeveel kub gas eruit komt. Of als er veel vocht in zit, dan krijgen ze misschien te veel Jouliette. Hoe weeg je die biomassa? Moet je die biomassa moet je de biomassa meten of eerst het vocht eruit halen. En stroom is makkelijk.

Samenwerkingspartners zijn op toeval gekozen. Spectral hiervoor 1 keer een klus gedaan. We waren bezig met toekomstige energiesystemen; hoe ga je dat vormgeven. Wat kom je tegen. 3 maanden met hun

zitten kletsen. Zij hebben ontwerp gemaakt plaatjes hoe dat er uit zou kunnen zien. Daar kwam Jouliette ook naar voren. En zij zaten op de Ceuvel en vonden dat zo een goed idee.

Zo zijn ze aan de locatie gekomen. Ook om op te treden in Pakhuis de Zwijger. Continue publicatie zoeken of publiek zoeken. Zorg dat je zichtbaar bent. En vertellen dat je een plek zoekt waar mensen aan de slag willen, dat je software bouwers zoekt. Het is met heel veel mensen praten en je netwerk heel groot maken. En ergens komt dat vanzelf ergens boven water

Nee, niet dezelfde visie op energiesysteem. Spectral anders. Wil ook duurzame energie ontwikkelen maar meer lokale scalasystemen om energiestromen inzichtelijk te maken. Willen ook verduurzamen. Ze hebben wel dezelfde waardes als Alliander alleen zij vullen dat op een andere manier in. Zij zijn een startup. En wij zijn een…. Zo'n traject is heel lastig planmatig aan te vliegen van tevoren. Dat is het leuke van nieuwe ontwikkelingen. Netwerkgewijs moet je het ontwikkelen. Met veel mensen praten. Degene die het idee zien zitten praat je wat vaker mee. Gegeven moment contract vormen. Soms gaan mensen gewoon meemaken omdat ze het een leuk plan vinden, soms hebben ze geld nodig om te ontwikkelen.

Ceuvel? Mensen in de Ceuvel stonden ervoor open. Spectral heeft daar ook een boot. Zij zijn daar kind in huis. Er was daardoor meer vertrouwen om dat dan te gaan doen. Schoonschip is het volgende traject wat plaatsvindt. Het idee daar toepassen is ook een optie, maar dan ga je via het publieke net. Dat is nog wel spannend hoe we dat moeten gaan organisme. Gemeente Groningen wil ook met het idee aan de slag gaan. De truc is: Je moet het zo organiseren dat iedereen op dezelfde manier Jouliette genereert om daar in ieder geval eenduidigheid over te krijgen want op het moment dat je variaties krijgt is die uitwisseling onmogelijk. Het idee van Jouliette wordt over geblogd, in het parool energie kranten blogs Ceuvel publiceert. Zichtbaar te zijn, creëer je aandacht en daar komen vanzelf partners uit tevoorschijn.

Postcoderoos. Afsprakenwereld. Door Wetten en regels worden nu Jouliette niet geaccepteerd. Estland Tenant. Digitale eenheid als eenheid waarmee je uit kan wisselen. Dan gaan er meerdere partijen van maken. Privenetten zijn er niet zoveel. De truc is juist om alles over het publieke net te laten doen.

Community die anders reageert dan verwacht.