ENERGY RELATIONS

The evolution of our relationship with power

ENERGY RELATIONS:
The evolution of our relationship with power

lena de rouw / strategic product design

master thesis graduation report / TU Delft

“Energy cannot be created or destroyed; it can only be changed from one form to another.”

Albert Einstein

colofon

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preface

As my time in Delft comes to an end after seven years of studying, I reflect on the fascinating subject of energy. My interest began to grow during my minor, was nurtured by the solar boat team, and has remained a consistent theme throughout my master's program. Energy is often perceived as technical and mundane, yet it permeates every aspect of our lives. Through this thesis, my goal is to shed light on the less explored aspects of energy and provide a better understanding of how it influences our daily lives.

I would like to express my heartfelt gratitude to the LIFE project for granting me this opportunity to work on this project. I want to extend a special thank you to Hans-Roeland, whose enthusiasm, persistence, and ability to reach out beyond my Delft bubble have been invaluable.

Next, I would like to thank my coach, Abhi, for his passion for the topic and his extensive knowledge. Your commitment to continuous learning and your insightful perspectives have greatly enriched my understanding. Marina, my chair, I extend my sincere appreciation for your eye for details, genuine interest, and unwavering support, even during challenging times. Your belief in me has meant the world.

I owe a special thanks to my incredible mother, who has been my rock and provided unwavering mental support throughout this entire process. To my sisters, Lies and Jet, thank you for the countless phone calls during my bike rides. Then, I would like to express my gratitude to my roommates and close friends, Noor and Ruby, for the countless coffees, quick or longer dinners and for always being there.

To all my study friends who have been my pillars of strength and offered guidance during moments of doubt—Femke, the Hannahs, Chris, Mats, and Sanne—I am deeply grateful for your advice and support. Lastly, I want to acknowledge my friends who may not always be near Delft or Rotterdam but have remained close to my heart, Una, Nora, and Luigi. Thank you for your uncondtional support and valuable outside perspective.

I hope that after reading this thesis, you will no longer simply pass by a transformer box, but instead acknowledge how this seemingly strange object shapes our everyday lives. Enjoy!


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abstract

The urgent need to transition away from fossil fuels due to their contribution to climate change and environmental degradation has become increasingly evident. The global emissions must be reduced to zero within the next few decades to avoid severe consequences. The recent invasion of Ukraine has further highlighted the importance of clean and affordable energy technologies to address economic, climate, social, and security priorities.

While the energy transition is often approached from a technical standpoint, this thesis recognizes the significance of social dimensions in shaping behaviors, attitudes, and governance structures. By adopting a cultural perspective of energy consumption behavior, the study aims to provide a holistic understanding of the transition process.

This thesis investigates the shift from a passive to a proactive energy relationship, taking into account the influence of changing context factors. It begins by framing energy relations through extensive literature research and research methods, resulting in the development of an energy relation framework. This framework emphasizes the role of individual autonomy and integration in shaping energy relationships. Historical research and trend analysis are conducted to examine the evolution of energy relations and identify potential future scenarios.

Building upon the understanding of energy relations, the thesis proposes the design of an intervention that enables individuals to experience a proactive energy relationship. The Forekast is based on a redesign of a transformer box into an interactive intervention that increases energy awareness and highlights the interconnectedness of energy, weather conditions, and consumption patterns.

The effectiveness and desirability of the intervention are evaluated through tests conducted at Energie Lab Zuid-Oost and a street test in ArenApoort. The evaluation assesses the impact of the intervention on residents' engagement, knowledge-sharing, and adoption of sustainable energy practices. The thesis concludes by discussing the implications and value of fostering a proactive energy relationship, contributing to the acceleration of the overall energy transition.

In conclusion, this thesis sheds light on the relational aspects of energy in the context of the energy transition. By examining the shift from a passive to a proactive energy relationship and proposing an intervention that serves as a catalyst for dialogue, knowledge-sharing, and empowering residents to actively engage in sustainable energy practices.

Keywords: energy relationship, context factors, intervention design, proactive approach, energy transition.


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index

index

introduction

The burning of fossil fuels has long been a critical driver of global economic growth but has also contributed significantly to climate change and environmental degradation. As the scientific evidence of the impact of greenhouse gas emissions on the planet has become clearer the need to transition away from fossil fuels has become increasingly urgent. Analysis by the Intergovernmental Panel on Climate Change (IPCC) clearly shows that global emissions need to be reduced to zero within the next few decades to avoid a dangerous increase in global temperatures.

The invasion of Ukraine has impacted energy markets and policies. While the environmental case for clean energy was strong, the economic arguments for cost-competitive and affordable clean technologies have become more attractive. The need for energy security has also become more urgent. As a result, the energy transition has taken center stage in political discussions as the economic, climate, social, and security priorities all align to tackle the challenges of our energy dependency.

The Dutch electricity network is with 99,995% reliability one of the most reliable energy systems of the World (NOS, 2022). The energy system is efficient and centralised. Yet it is not visible, the cables are buried underground and the transformer boxes are camouflaged or hidden in cute houses. Without any prior planning and knowledge of where the energy comes from, we can regulate the temperature in our house. Unlike other consumer goods such as music or clothing, energy is treated as a commodity where the majority of people are not concerned about its origin or production methods (Keith, 2022, n.p). This results in having a passive relation with energy (more on energy relations in chapter 2).

Our relationship with energy has always been one of dependency. We rely on energy to power our homes, our transportation, and our industries. Our reliance on energy has increased as our devices become smarter and the power grid more complex. Everything in our lives, from our homes to our workplaces, runs on electricity.

This energy crisis is a reminder of the fragility and unsustainibility of the current energy system. It has no doubt that we need to change towards more sustainable sources. But this doesn't go without a challenge. Historically, we have always moved towards an energy source with a higher power density. However, renewables have a lower power density than fossil fuels, resulting in higher land use requirement. Additionally, renewable energy sources, such as wind and solar, are subject to weather patterns, which can result in fluctuations in energy supply. Currently, our energy system is too dependent on the fact that with a high demand for energy, an additional gas or coal power plant can be used. However, with a high supply of sustainable energy, it is difficult to match the demand for it; we already see shortages coming up in 2025 (Tennet Monitoring Leveringszekerheid (2025-2030), 2022).

The key to better utilizing sustainable energy sources is promoting "gelijktijdigheid", consuming sustainable energy as it is produced. Using energy when it's available and using less energy when it's not. Our energy dependence has a paradoxical effect; we rely on it for almost every aspect of our lives, yet the transition towards renewable energy sources requires a different way of interacting with it.

Ultimately shifting the perception of energy as something we can control towards energy as a limited natural resource that we have to take care of. This requires moving away from a passive relationship with energy towards a pro-active one.

Figure 1: (The Weather Project • Artwork • Studio Olafur Eliasson, n.d.)

LIFE context

Amsterdam Zuidoost strives to be energy neutral by the year 2040 (Nawaz et al., 2021). The developments in Amsterdam Southeast were seen as opportunities to combine sustainability ambitions with poverty reduction and social improvement, for that reason Energy Lab Zuidoost was initiated (AMS institute, 2021). Energy Lab Zuidoost focuses on several scalable pilots and experiments in Amsterdam Zuidoost, which are carried out together with various companies, public organizations, and residents. One of these projects is the LIFE project.

The Local Inclusive Future Energy (LIFE) project is an interdisciplinary collaboration between the Municipality of Amsterdam, Spectral, Stichting WOON!, CoForce, Liander, and the AMS Institute, aimed at developing a district-scale energy management platform in Amsterdam Southeast. The platform is designed to enable residents to trade or donate sustainable energy with their neighbors and should be accessible to large companies, small business owners and residents in Venserpolder. The project aims to research and experiment with various challenges and possible solutions that arise around an energy transition. While a significant portion of the project is focused on the technical aspects, one of its work packages is centered on inclusion. This involves identifying methods to engage residents in the platform's design process and its use, which is critical to its widespread adoption. This is where my thesis comes into play.

Energy as something relational

The energy transition is often viewed as a technical issue because it involves the adoption of new technologies and infrastructure to reduce carbon emissions and increase energy efficiency. Many of the proposed solutions to the challenges posed by climate change, such as renewable energy technologies, smart grids, and energy storage, are technical in nature. However, Social issues form the roots of many wicked problems, yet often go unseen and unaddressed by traditional problem-solving approaches (Irwin, 2018). This narrow focus on the technical aspects of the energy transition neglects the social dimensions of the issue, such as the need for changes in behavior, attitudes, and governance structures.

A cultural perspective of energy consumption behaviour allows for a holistic understanding of how behaviours are embedded within the physical and social contexts of everyday life(Stephenson et al., 2015).

The ***aim of this project*** is to investigate how context factors --the wide range of conditions external to the individual that are significant determinants of behaviour- that change over time influence the relationship that we have with energy, in order ***to move from a passive relationship towards a pro-active one,*** and create a fitting intervention which should allow residents in venserpolder to experience this pro-active relationship with energy. The underlying assumption of this project is that by fostering a pro-active relationship with energy, the adaption of this energy transition will be accelerated.

project approach

The project approach is based on the steps in the systemic design toolkit. These consist of 7 steps.I divided these into four categories: 1. Energy relations: Framing, Listening and understanding energy relations 2. The evolution of energy relations: Defining a desired future and exploring the possibility space, 3. A pro-active future energy relationship: Designing the intervention model and 4. Integration of this new energy relationship: fostering the transition.

Phase 1: Energy relations:

This phase first frames the definition of an energy relationship based on literature research. Hereafter I started listening to the system in order to find which contextual factors shape our energy relationship, this based on a mix of research methods from desk research, visiting events, organising a co-creation workshop and doing street research. The third step was understanding energy relations, which by having a deeper analysis of the context factors, two key overarching context factors emerged: individual autonomy and integration in the context. This is communicated in the form of an energy relation framework.

Phase 2: The evolution of energy relations:

The second phase involves examining the evolution of energy relations in accordance with the framework. By understanding the past and present energy landscape, we can better prepare for the future. Hereafter, trends are identified that could possibly influence our relationship in the future. The historical research was mainly based on desk research, while the trends were also fueled by the many events attended. The findings will be presented in a timeline format, highlighting significant events and shifts in energy attitudes over time. Additionally, this phase explores possible future energy relation scenarios in Venserpolder in order to define a desired future energy relationship allowing to explore the possibility space.

Phase 3: A pro-active future energy relationship:

The third phase is characterized by designing an intervention that allows for experiencing a future pro-active energy relationship. The aim of this project is to challenge the current relationship that we have with energy and propose a different one. Additionally, the chapter outlines the design goal, metaphor and interaction qualities of the intervention.

Phase 4: Integration of the new energy relation

This chapter focuses on the integration of the intervention designed to facilitate a new relationship with energy in the Venserpolder neighborhood. The chapter evaluates the desirability of this new relationship through a street test in ArenApoort and a test at Energie Lab Zuid-Oost. By analyzing their feedback and responses, the chapter explores the effectiveness of the intervention and its potential impact on the community.

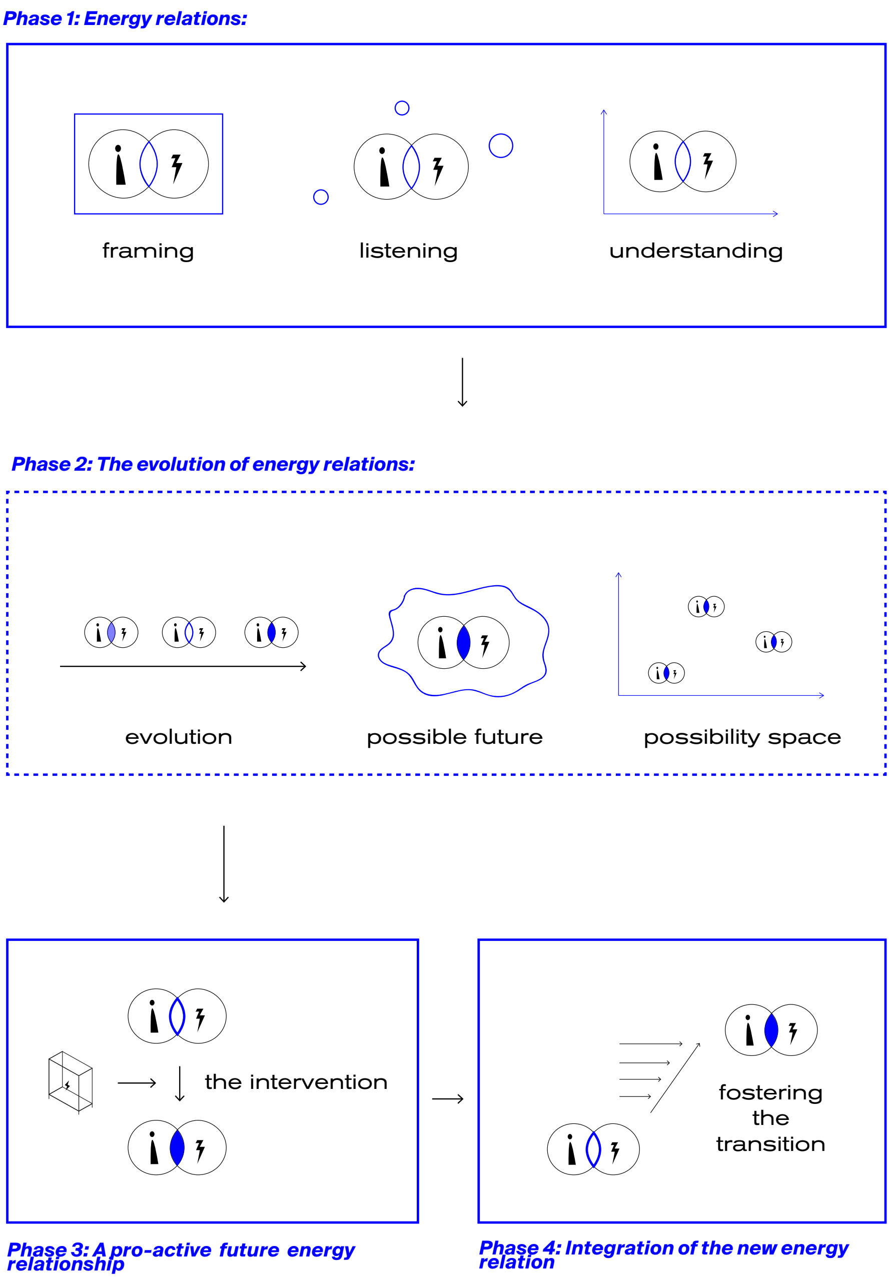


Figure 2: Overview project approach.

methodology

To tackle the complexity of the problem at hand, a mix of methods is necessary. First, I will explain the different methods that are used. Hereafter I will describe the approach and structure of the thesis.

Systemic Design

The field of design is evolving and has been categorized into four orders of design as coined by Buchanan (1992). Van der Bijl-Brouwer and Malcolm (2020) suggest that design has shifted from a purely object-oriented practice to one that aims to address more abstract, complex societal issues. This shift has given rise to systemic design, which combines the principles of systems thinking with design methodologies. Systemic design, in the context of systems and an evolutionary design approach, is the process of identifying the connections between different elements to gain a better understanding of the system as a whole and to identify 'leverage points' to influence and steer the system in an intended new direction (Meadows, 2008). In line with the relational view of infrastructure proposed by Star and Ruhleder (1996), infrastructure should be understood as a complex web of relationships and connections between people, technologies, and organizations.

Similarly, the LIFE project with its many stakeholders and connectedness to the current energy infrastructure is regarded as a complex system, which calls for a systemic approach. The systemic design toolkit, which includes framing the system, listening to the system, understanding the system, defining the desired future, exploring the possibility spaces, designing the intervention model, and fostering the transition, has been used as a tool to approach the complexity of the LIFE project.

The importance of a systemic approach lies in the realization that energy and its infrastructure are complex, interrelational, and require a holistic approach, not aiming for a solution but searching for balance (Meadows, 2008). In designing the next generation of energy relations, designers play a crucial role in connecting past, present, and future while being sensitive to the characteristics, qualities, and meanings assigned to energy and its infrastructure.

Interactive Design

Design for interaction prioritizes creating engaging experiences for users through their interactions with products, services, and environments. This approach requires understanding users' needs and behaviors, making existing and new interactions tangible, and developing an interaction vision as a point of reference throughout the design process. Through iterative design and testing, design for interaction aims to create products and services that meet functional needs while also evoking positive emotional responses and establishing lasting connections with users (Exploring Interactions manual, 2022).

While systemic design considers the relationships that shape a system holistically, interaction design is concerned with the relationship between users and products or services. To reimagine our relationship with energy, it is essential to incorporate interaction design principles, which emphasize creating engaging and meaningful experiences for users. By prioritizing users' needs and behaviors, interaction design can help shape our interactions with energy in a way that is intuitive, efficient, and emotionally resonant.

Speculative design

In Speculative Everything (2013), Dunne and Raby present, speculative design as an approach that uses fictional scenarios and prototypes to explore the potential implications and consequences of current and future technologies, social trends, and policy decisions. It is a way to imagine and show what could be possible, to spark conversations and debates about the future, and to provoke reflection on the values and assumptions that underpin our current design practices. The idea behind speculative design is to intentionally disconnect from current challenges and collectively speculate about what might be. By placing the eventual proposition in a future context, space is created to detach from certain limitations and shortcomings and focus on questioning whether this potential scenario would be preferable. Speculative design distinguishes four different potential futures: the 'probable,' 'preferable,' 'plausible,' and 'possible' future, decreasing in likelihood. One way that speculative design is executed is through the use of props. Props are artifacts or objects that are designed to help imagine and visualize a fictional world or scenario. They can range from simple sketches and drawings to fully functional prototypes. Props are used to immerse the audience in the scenario and to make it feel more tangible and real (Dunne & Raby, 2013, p. 89).

Speculative design is relevant to energy relations because it offers a way to engage stakeholders in conversations about the future of energy. After years of science communications focused on the doom and gloom of climate change, it is time to reframe the conversation by giving people something desirable to run toward, rather than something frightful to run away from (Williams, 2019).

Open-ended learning towards energy relations

Open-ended learning is not a single method, but rather a category of method utilization and application. I engaged in open-ended learning by examining certain areas of research interest in detail, driven by my own curiosity and desire to gain holistic knowledge within a situated context. To facilitate this, I utilized a variety of methods, including creating a photo series, hosting energy dinners, attending workshops and hackathons, visiting museum and creating an energy playlist. These methods allowed for an immersive and experiential learning process that was engaging and enjoyable, and ultimately helped me to gain a deeper understanding of the topics at hand. Even though what I learned was shaped by my own personal views and ideas, I still gained some great insights that helped me better understand energy-related issues.

01. energy relations

This chapter explores the concept of energy relations, including what they are, what contextual factors influence them, and how to analyze them. To begin, the chapter frames the definition of energy relations based on literature research. Then, it discusses the process of listening to the system to identify contextual factors that shape energy relations, using a mix of research methods such as desk research, event visits, and interviews. Finally, the chapter delves into understanding energy relations by analyzing the contextual factors, which revealed two key overarching factors: individual autonomy and integration in the context. The findings are presented in the form of an energy relations framework.

01.01. energy relations

Figure 3: DALL-E generated image - prompt “human interaction with electricity

energy relations

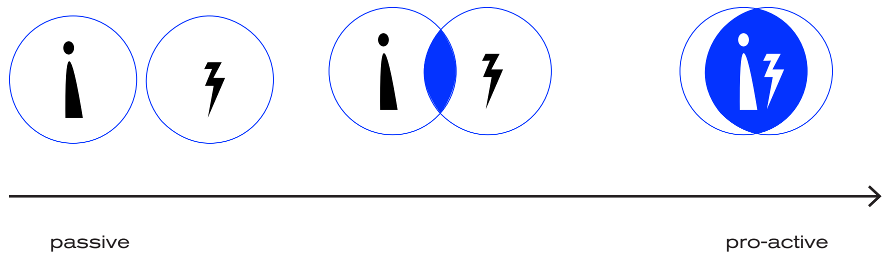
As stated in the approach, the research will be presented along the steps of the systemic design toolkit. The first step includes the setting of boundaries of the system in space and time and the identification of the hypothetical parts and relationships (van Ael et al., n.d.).

The energy transition is often viewed as a technical issue because it involves the adoption of new technologies and infrastructure to reduce carbon emissions and increase energy efficiency. This narrow focus on the technical aspects of the energy transition neglects the social dimensions of the issue, such as the need for changes in behavior, attitudes, and governance structures.

Our relationship with energy is not just a matter of personal preference. It is also influenced by social, economic, and political factors that shape how energy is produced, distributed, and consumed (Solarscapes, 2022). For example, government policies and regulations can impact the availability and affordability of different energy sources, while societal norms and cultural values can affect how people view and use different types of energy (Stephenson et al., 2015). In my thesis I define external factors based on the definition of context by Wilson and Dowlatabadi: The wide range of conditions external to the individual that are significant determinants of our relationship with energy.

When asking residents about how important energy to them is my street research (more can be found in chapter 1.2: contemporary energy relations), I observed that individuals often do not explicitly consider the energy source itself, but rather view it as a means to facilitate specific activities, such as charging an electric bike or styling one's hair. This phenomenon is reinforced by the notion put forth by David Keith, a professor of Applied Physics at Harvard University, who argues that energy is a commodity business. Unlike goods such as clothing or music, where specific attributes matter to specific people, most people do not care where their gasoline or electricity comes from, as long as it meets basic quality standards. It is a low involvement product. Involvement has been defined as "a state of motivation, arousal or interest" (Rothschild, 1984). When we are involved, we pay attention, perceive importance and behave in a different manner than when we are not involved (Zaichkowsky, 1984).

The study by Soyoung Yoo, Jiyong Eom, and Ingoo Han examined the relationship between a household's level of "home energy involvement" and their energy consumption and purchases. Higher levels of energy involvement were associated with lower energy consumption and higher probabilities of purchasing energy-efficient appliances. This is in line with the underlying assumption of this project that by fostering a pro-active relationship with energy, the adaption of this energy transition will be accelerated.



In my thesis, I define an energy relations as: the various ways in which individual households interact with energy as a resource. This includes how energy is used, consumed, and managed in daily life. I identify two categories of relationships: a proactive or passive relationship with energy.

A pro-active relationship with energy involves being mindful of its source, and consciously monitoring and regulating its usage. While it may require sacrificing convenience, it's important to note that such a relationship also brings qualitative benefits such as joy, playfulness, empowerment, togetherness, comfort, and a sense of self-sufficiency (Solar Biennale, 2022).

In a way, having an active relationship with energy is similar to the way we approach our bodies and food, paying attention to our energy levels and being conscious of what we consume. While it may be tempting to seek quantitative solutions such as taking an energy pill, it cannot replace the experience of having dinner with friends.

On the other hand ***a passive relationship*** with energy entails an approach that is less involved, whereby individuals do not actively monitor or control their energy consumption. In such cases, individuals may be unaware of energy and simply take for granted their immediate access to it. They do not contemplate the origin of the energy, the amount being utilized, or its scarcity. A passive relationship with energy offers the benefit of using energy with minimal effort and thought, making life more convenient. However, this convenience comes at the cost of little to no control over energy consumption.

The relationships we have with energy are shaped by the personal choices one makes, but by also by context factors. In the next chapter we will try to investigate which context factors - the wide range of conditions external to the individual that are significant determinants of behaviour - influence the relationship that we have with energy.

Energy relations: the various ways in which individual households interact with energy as a resource. This includes how energy is used, consumed, and managed in daily life. I identify two categories of relationships: a proactive or passive relationship with energy.

01.02.
contemporary energy relations

This chapter aims to delve deeper into the contextual factors that influence our energy relationships. The chapter is divided into two sections: Part 1 presents a general overview of the Dutch energy system and current public attitudes toward energy, while Part 2 focuses on energy relations within the LIFE context

Figure 4: Energy poverty (Salehi, 2021)

contemporary energy relations

After defining the definition of what an energy relation is, the next step of the Systemic Design Toolkit is to listen to the system. In practice, this means to 'listen' to the experiences of the people, and to discover how the identified interactions lead to the system's current behaviour. The energy system is complex and consists of many stakeholders. It doesn't stop at the Dutch border and is wired in a global net of energy trading dynamics. The timing of my research was very oppurtune, the energy transition is on top of the global agenda and many resources, events and people were talking about it at the time of doing research.

In order to get a better understanding of the contemporary energy relations I used a mix of research methods. It included desk research in the form of news articles, documentaries, podcasts, and youtube videos. Next to that, I attended multiple events (Solar biennalle, energy hackathon, energy poverty theather play Snikheek, IABR i'ts about time, Donut economy day and the Energy show), that helped me to get a better understanding of how the current energy system is working, additionally I also interviewed two experts working at Drift transition studio who did a project on energy poverty.

The Dutch energy system

The Dutch electricity network is a complex system that involves various stakeholders, including national and regional grid operators, energy suppliers, and government regulations (Netbeheer Nederland, 2019). Although households in the Netherlands have multiple ways to manage their energy bills, such as selecting an energy supplier or investing in renewable sources, the complexity and opaqueness of the energy market, as well as the invisibility of energy sources and infrastructure, limit their influence over the market's inner workings (Temmink, 2023a). Power plants and wind turbines are often located far away from urban areas, and infrastructure is often designed to blend in or hidden from view, making it challenging for individuals to comprehend the impact of their energy consumption on the environment and wider energy system (Oudes, 2023).

The invisibility of energy sources and infrastructure, coupled with the complex and opaque nature of the energy market, can contribute to a passive relationship with energy consumption among individual households.

Current attitude towards energy

The current attitude towards energy in the Netherlands is characterized by a sense of worry and concern. The ongoing energy crisis has led to soaring energy prices, resulting in energy poverty for a significant number of households, especially those with low income. The energy transition is exacerbating inequality, as low-income households often cannot afford costly energy-saving measures, such as solar panels or heat pumps, while higher-income households benefit from lower energy bills. A recent survey by the Dutch Association for Sustainable Energy (NVDE) found that 46% of respondents had significant worries about the energy crisis, 84% had personal worries over energy bills, and 45% of respondents identified a lack of government policy as a significant factor contributing to their worries over the energy crisis. The lack of transparency in the energy market and concerns over profit margins, combined with high levels of concern over the energy crisis, energy poverty, and inequality, have resulted in a decline in trust towards energy companies.

As a result, there is now a greater emphasis on the need for transparency and more control in the energy market. This shows signs of a need for having a more active relationship with energy.

The complex and opaque nature of the energy market can result in a passive relationship with energy, but the current energy crisis is bringing the issue of energy to the forefront of public concern and potentially leading to a shift towards a more active relationship.

Figure 5: Theaterplay about the dynamics in the current energy system (Parels voor de Zwijnen, 2022)

EVA a playing in the theather play Snikheet: I'm talking about people who don't have money. Making your home more sustainable is something only the rich can afford. Where do I get the money for a heat pump or solar panels? You don't have to worry about rising gas prices, you have the luxury of being off the gas. I live in a rental house where nothing has been done for 40 years. It's drafty and windy on all sides.

LIFE context

The LIFE project, with all its different stakeholders and interests, reveals the challenges that occur when trying to accelerate this transition in a just way. You could even argue that the problems on a national level are magnified in the area of Amsterdam Zuid-Oost. This chapter aims to identify the factors that influence the energy relation specific to the local context, with a focus on the perspective of the residents. To get a better understanding of the local context and their relation towards energy, I conducted street interviews and an interview with a resident in Zuid-Oost, a Bijlmer resident who runs his own company which addresses energy transition challenges with youngsters in the Bijlmer. Together with the design team working on the LIFE project, we organized a co-creation workshop to explore the potential role of the LIFE Social Platform in the local energy system. Based on this research and the research conducted by former students working on the LIFE project, three primary challenges regarding establishing an active relationship with energy were identified: limited agency, limited knowledge, and limited time; additionally, five design conditions for the local context were identified.

Context of LIFE

The LIFE is situated in Venserpolder. Around 20% of households in Venserpolder (686 residents) have a low income, which is defined as being lower than €9.249. This is a high percentage compared to the rest of the Netherlands, where it is only 8%. Additionally, 10% of households in Venserpolder receive social assistance benefits, which is more than twice the national average of 4% (CBS, 2021). These figures are evident in the debt counseling activities in the area. Venserpolder is classified as an 'ontwikkelbuurt' (development area), which resulted in a great amount ofresearchers and projects focusing on improving the neighborhood. Due to participation fatigue of the residents, I was cautious in interviewing residents therefore the primary focus was on street research, where the residents could choose if they wanted to engage or not.

Figure 6: Venserpolder topview (Parool, 2009)

Figure 7: Venserpolder oktober 2022

Figure 8: Question asked at street research: How important is energy for you?

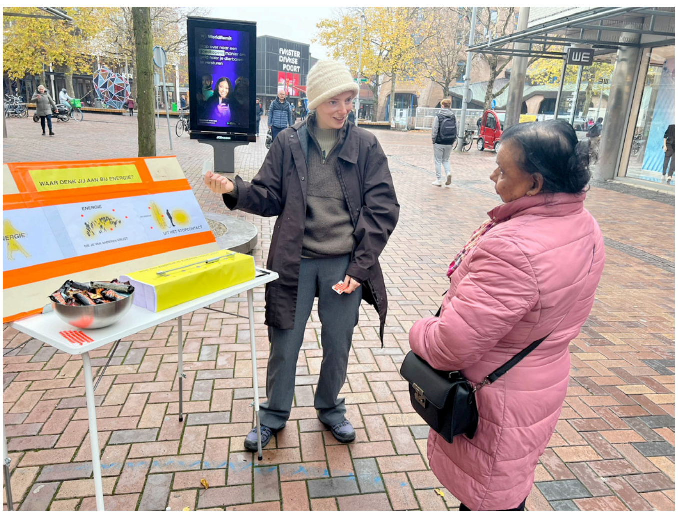


Figure 9: Streetinterviews, Venserpolder november 2022 (Vicky Toellner)

research method

In order to get a better understanding of the relationship of the residents towards energy, and also to get a broader understanding of the dynamics within the LIFE platform I used a mix of qualitative methods including a co-creation session, street test, and semi-structured interviews. Also, observation and pictures were taken in the neighborhood. The findings were clustered in miro.

Co-creation session

The Co-creation session was organized together with the IDE team within the LIFE project the goal In the introduction we provide our broad vision of what the LSP could be. The event was on October 25th, 2022, with all the stakeholders within the LIFE project: AMS Institute, CoForce, Stichting WOON!, Johan Cruijf ArenA, Spectral, Delft University of Technology, and Liander. The main focus of the co-creation session was not on energy relations. But the discussion between the different stakeholders revealed underlying factors that influence an energy relationship. The day started plenary with an introduction to the future of the LIFE social platform. Later we divided the group and four and started the workshops. All sessions were recorded and later transcribed. The most relevant quotes were picked out and later clustered, the results can be found in Appendix B.

Street research

To get insight into the needs and values of people from Venserpolder related to energy and their relation, I conducted street interviews at Bijlmerplein on the 29th of November 2022. This is a shopping area with a supermarket, small businesses, and cafes. A broad range of visitors pass by since it is close to a lot of offices. The research was conducted together with my fellow graduation student at LIFE, Vicky Toellner studying Design for Interaction. We brought a set-up including a camping table, a wooden plate with a question on both sides, and a more “interactive” part an energy slider where they could move a slider for how important energy was to them ranging from 1-5 (see figure on the left). We approached people and asked if we could ask them something thing. The approach was, first asking how important energy was for them. Then asked about what kind of energy they think when talking about energy, the options included “mijn eigen energie” (personal energy, biological energy), “de energie tussen anderen” (the energy between people, spiritual energy) en “elektrische energie” (energy outside of people, electrical energy). The third question was, what they would trade for energy, given the option of “spullen” (stuff), “geld” (money), “klusje” (small task), or “anders” (other). We asked them if they wanted to vote with a sticker and explain why they made that decision, afterwards we audio-recorded our findings and later transcribed these. In total we spend two hours on the market and had 16 conversations with 21 participants the transcribed audio and notes can be found in Appendix C.

Interview resident Amsterdam-Zuidoost.

The interview was with a resident in Amsterdam-Zuidoost who runs his own company which addresses energy transition challenges with youngsters in the Bijlmer. We met at the Donut Economy day at the Groene hub on October 1st. I conducted an hour interview with a semi-structured interview guide at his office. The transcribed interview can be found in the appendix D.

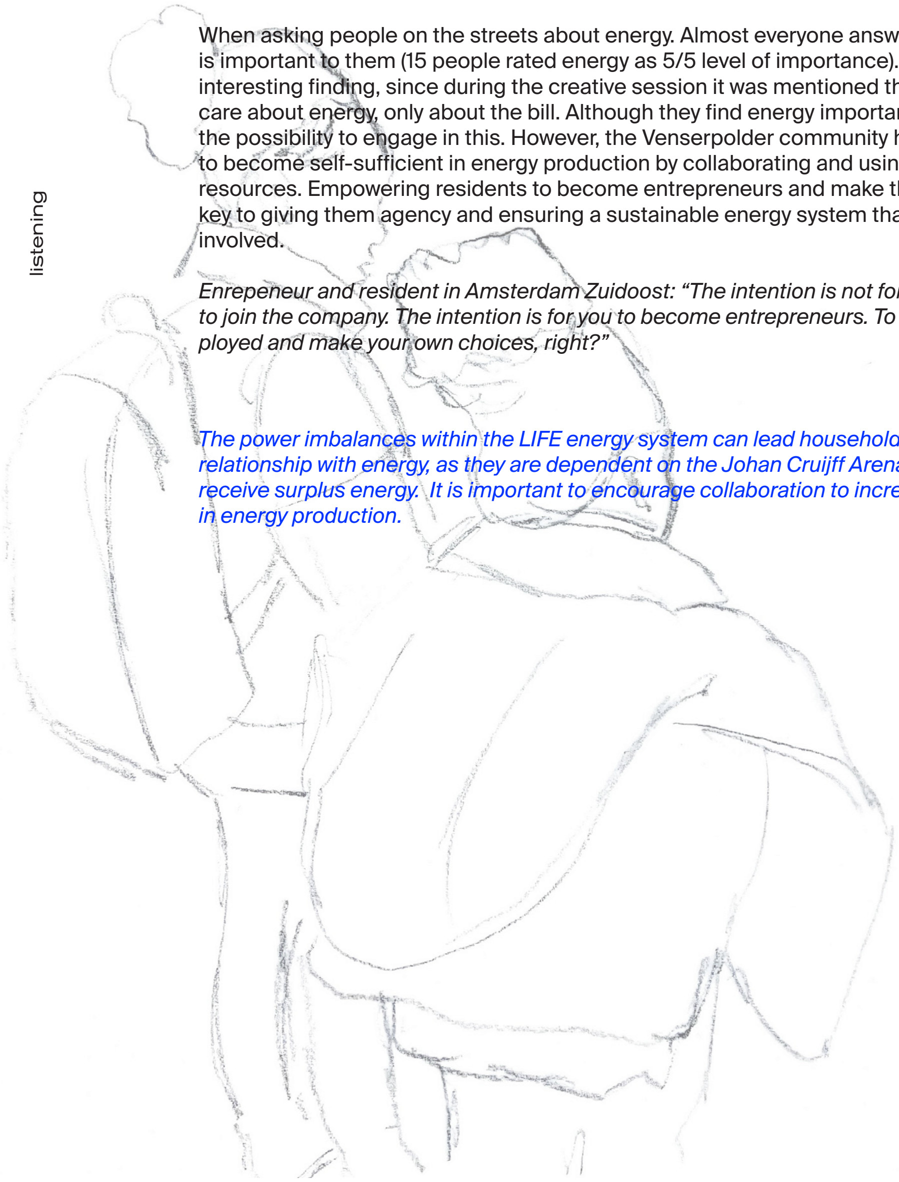
limited agency

The LIFE platform is designed to enable residents to trade or donate sustainable energy with their neighbors and should be accessible to large companies, small business owners and residents in Venserpolder. But as Eva mentions in the theather play, the energy transition could be seen as something only the rich can afford, which can lead to power imbalances. In the modern electricity system, there are different markets that help coordinate the supply and demand of electricity. These markets, such as the day-ahead market and real-time market, ensure that electricity generation matches the needs of consumers. As a result, there are more opportunities for companies that generate electricity or store energy to make money by using advanced control methods (Gao & Dowling, 2020). The Johan Cruijff Arena has the ability to earn a substantial amount of money from the energy transition through investments in solar panels, batteries, and flexibility tariffs, while the residents are still dependent on the Arena's goodwill to receive surplus energy. To ensure a fair and equitable energy transition, it is important to acknowledge and address these power imbalances.

When asking people on the streets about energy. Almost everyone answered that energy is important to them (15 people rated energy as 5/5 level of importance). This was an interesting finding, since during the creative session it was mentioned that the people didn't care about energy, only about the bill. Although they find energy important, they don't have the possibility to engage in this. However, the Venserpolder community has the potential to become self-sufficient in energy production by collaborating and using their combined resources. Empowering residents to become entrepreneurs and make their own choices is key to giving them agency and ensuring a sustainable energy system that benefits everyone involved.

Enrepeneur and resident in Amsterdam Zuidoost: "The intention is not for them [youngsters] to join the company. The intention is for you to become entrepreneurs. To become self-employed and make your own choices, right?"

The power imbalances within the LIFE energy system can lead households to have a passive relationship with energy, as they are dependent on the Johan Cruijff Arena's goodwill to receive surplus energy. It is important to encourage collaboration to increase self-sufficiency in energy production.



limited knowledge

Residents in Venserpolder have limited knowledge regarding the ongoing energy transition, which is increasingly becoming centered on technology and lacking in transparency. The LIFE technical platform, with its digital twin and focus on net congestion, may seem far removed from the people who will be most affected by these changes. As one resident stated, “But that’s it. It needs to be well-informed. Or informed by the housing association.” While initiatives such as the Green Hub may attempt to educate residents on the benefits of energy conservation, it is important to communicate in a way that is relatable to everyday people. Anthony noted, “If you don’t explain to that woman how much you’re going to save, no one wants to hear it. When Martin from the Green Hub said you can save 15% on your costs, that’s when that woman started to smile and said, ‘OK, come with us.’” It is crucial to not forget that in the end, it is people’s lives that are impacted by the energy transition, and ensuring they have the necessary knowledge to make informed decisions is essential.

The lack of transparency and knowledge regarding the energy transition in Venserpolder may create a disconnection between residents and the LIFE platform, which focuses on net congestion and may seem far removed from everyday people. This might result in a passive relationship with energy.

limited time

Residents in Venserpolder have a limited amount of time and other worries that may be more pressing in their lives than the energy transition. As Eva stated, “I worry about making ends meet at the end of the month. And my neighbors, too?” This sentiment is echoed by a resident in Amsterdam-Zuidoost, who explains, “It all starts with money. You have to pay for everything. I have worries and bills to pay.” With bigger problems to contend with, such as paying bills and managing daily expenses, residents may find it difficult to prioritize their energy usage and participate in initiatives that require additional time and effort.

Residents in Venserpolder have other concerns that take precedence in their daily lives. This might

design conditions venserpolder

Given that Venserpolder is an area that has been extensively studied, it is imperative to approach any interventions with caution to avoid research fatigue within the community. In this chapter, we will explore five design conditions that can promote inclusivity while keeping in mind the values of the residents in Venserpolder. These conditions were developed based on previous research within the LIFE project, such as Alisa's thesis on inclusive energy transitions in Amsterdam Zuidoost, Diede's work on participation challenges in renewable energy projects, and my own observations during neighborhood research. The design conditions include agency, safe spaces, lightheartedness, practical examples, and giving back, and they inform the design goal, which will be discussed further in chapter 7.

Agency: Local Ownership

Inclusive interventions should involve the local community in the plan development process and take into account their desires. The feeling of ownership has the potential to engage citizens long term to the project. The local community must be involved in decision-making processes and not merely informed of the plans. Alisa's research on interventions for an inclusive energy transition in Amsterdam Zuidoost found that involving the local community in the development of energy projects was crucial to their success.

Safe Spaces

Safe spaces are very important in the Amsterdam Zuidoost community. Therefore they need to be taken into account when intervening in the neighborhood. As a researcher it is important to not be intrusive.

Lightheartedness: A Gentle Approach

Complicated technology or terminology can scare people away and therefore exclude them. A gentle approach, in which small steps are taken, has the potential to include more people in the transition. The language and tone used when communicating with the community should be accessible and not intimidating. Alisa's research on challenges for participation in renewable energy projects found that a gentle approach increases inclusivity.

Practical Examples: Visual and Tangible

Visual and tangible examples can make the interventions more accessible to the community. Since visual and tangible examples speak more to certain people than long text, their usage increases the inclusiveness of communication. This condition was emphasized by the entrepreneur in Zuid-Oost who mentioned people want things that are simple and concrete.

Giving Something Back: Don't Just Extract Knowledge

Venserpolder is overstudied, and more projects and researchers see this area as an interesting place to conduct their research to find out how it can be improved. However, this can lead to research fatigue in the community. Therefore, it is essential to give something back to the community and not just extract knowledge. This condition is based on the observations Diede had when doing research in the neighborhood.

Figure 10: Dostojevskisingel, Daniël Defoelaan, Venserpolder. Architect: Carl Weeber. (Collectie Archief van de Gemeentelijke Dienst Volkshuisvesting)

conclusion

National level

1. The Dutch energy system is characterized by complexity and opaqueness, making it difficult for individuals to understand the impact of their energy consumption on the environment and wider energy system.

2. The ongoing energy crisis in the Netherlands has led to rising energy prices, energy poverty, and a decline in trust towards energy companies, creating a sense of worry and concern among the public.

3. There is a need for greater transparency and control in the energy market, as well as a shift towards a more active relationship with energy.

LIFE context

1. In the local context of Amsterdam Zuid-Oost, specific challenges are identified, including limited agency, limited knowledge, and limited time among residents.

2. Limited agency for residents can lead to power imbalances within the local energy system. It is important to encourage collaboration to increase self-sufficiency in energy production and increase their agency.

3. Lack of knowledge and understanding about the energy transition in the local community can create a disconnection between residents and energy initiatives.

4. Limited time and other priorities may make it difficult for residents to prioritize their energy usage and engage in energy-related initiatives.

5. From the reserch design conditions are constructed, such as local ownership, safe spaces, a gentle approach, practical examples, and giving back, can help promote inclusivity and address the specific challenges in the local context of Amsterdam Zuid-Oost. These conditions will be used as design requirements more in chapter 4.

towards the framework

characteristics of contemporary
energy context leading
to a passive energy relation

Complexity and opaqueness of the energy system

Limited trust energy companies

Limited agency

Limited time and other priorities

context factors that influence an energy relationship

Complicated regulations and policies

Technical aspects of energy production and distribution

Lack of public information on energy prices and profit margins

Limited energy supply

Inequality and lack of investment in renewable energy sources

Lack of trust towards energy companies

Limited access to financial resources

Inadequate education and information on energy

Regulatory and policy barriers

Limited public engagement and awareness campaigns

Work and family responsibilities.

Invisibility of energy sources and the energy system itself

Location of energy sources

Design of energy infrastructure

Complicated regulations and policies

Technical aspects of energy production and distribution

Lack of public information on energy prices and profit margins

Limited energy supply

Inequality and lack of investment in renewable energy sources

Lack of trust towards energy companies

Limited access to financial resources

Inadequate education and information on energy

Regulatory and policy barriers

Limited public engagement and awareness campaigns

Work and family responsibilities.

Invisibility of energy sources and the energy system itself

Location of energy sources

autonomy

Complicated regulations and policies

Regulatory and policy barriers

Lack of public information on energy prices and profit margins

Limited energy supply

Inequality and lack of investment in renewable energy sources

Lack of trust towards energy companies

Limited access to financial resources

integration in the context

Design of energy infrastructure

Location of energy sources

Technical aspects of energy production and distribution

Lack of public information on energy prices and profit margins

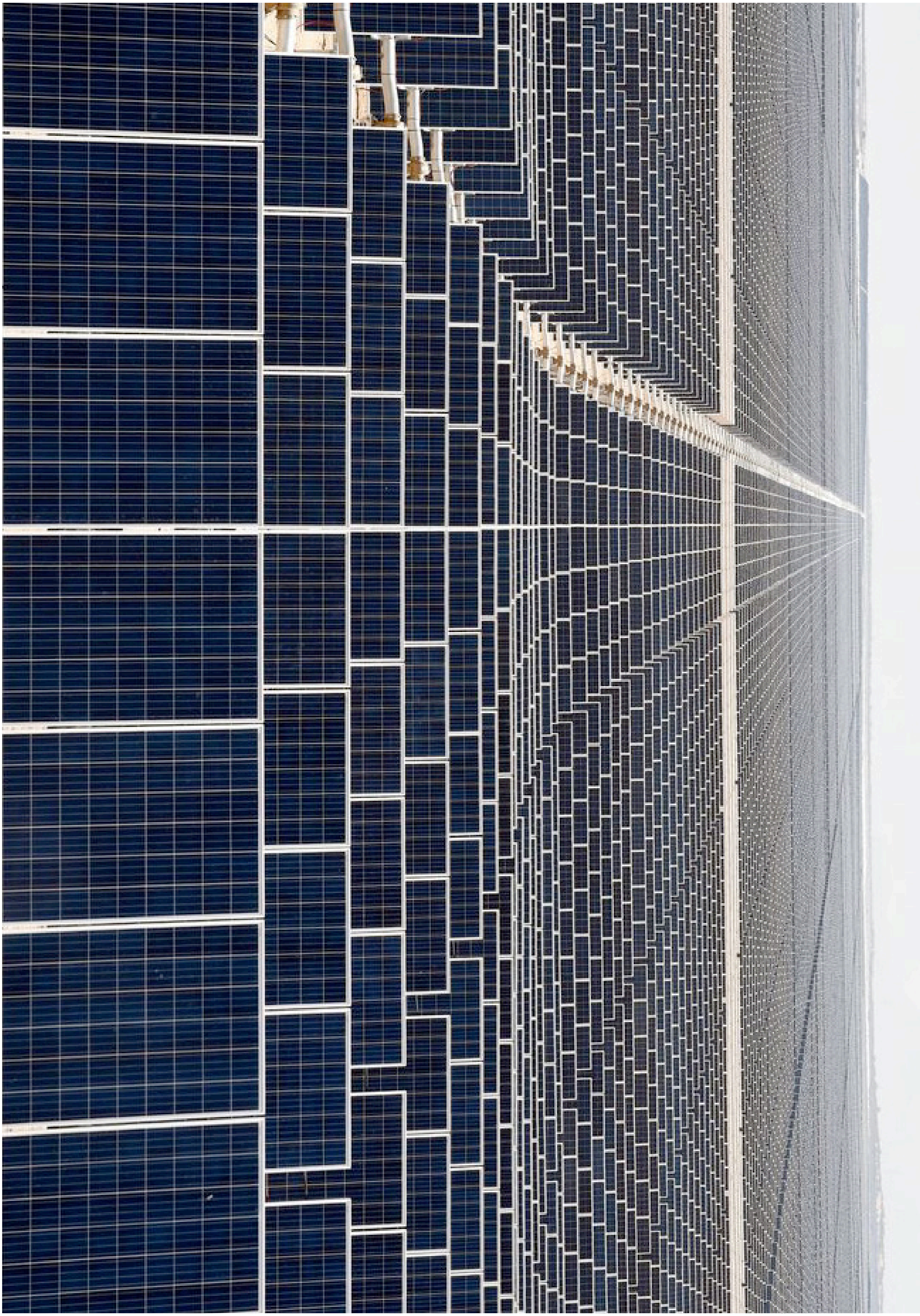
Invisibility of energy sources and the energy system itself

Work and family responsibilities

Limited public engagement and awareness campaigns

Inadequate education and information on

01.03.
the energy relation framework



the energy relation framework

In order to achieve a holistic comprehension of the context factors that shape energy relationships, an analytical energy relation framework was formulated using research findings from the southeastern region of Amsterdam and the distinctive attributes of the existing energy system. This framework encompasses two axes: the level of autonomy and the level of integration.

The level of autonomy axis within the framework is derived from various context factors, such as intricate regulations and policies, regulatory and policy barriers, insufficient public information regarding energy prices and profit margins, constrained energy supply, disparities and insufficient investments in renewable energy sources, lack of trust in energy companies, limited access to financial resources, and time limitations resulting from work and family obligations.

These findings highlight the importance of individuals having greater control and autonomy within the energy system to actively participate in and influence the energy transition. The recognition of local ownership and agency as significant factors in enhancing citizens' participation in energy initiatives further supports the need for increased control within the current energy system (Lennon et al., 2019). Thus, the level of autonomy axis was formed to address these factors and empower individuals in shaping the energy landscape.

The context factors, including the design of energy infrastructure, location of energy sources, technical aspects of energy production and distribution, lack of public information on energy prices and profit margins, invisibility of energy sources and the energy system itself, work and family responsibilities, limited public engagement and awareness campaigns, and inadequate education and information on energy, collectively contributed to the development of the level of integration axis within the energy relation framework.

The characteristics of the current energy system, particularly in the Dutch context, played a significant role in the development of the level of integration axis within the Energy Relation Framework. The Dutch energy system, with its complexities and opacity, creates challenges for individuals to actively engage with and understand their energy consumption.The physical aspects of the energy system contribute to the invisibility of energy sources and infrastructure in everyday life. Power plants and wind turbines are often located in remote areas, distanced from urban centers (Oudes, 2023). As I delved into the project, I became increasingly aware of the energy infrastructure and its prevalence in our daily lives. This newfound awareness was further amplified by a four-day workshop at the solar biennale, that focused on the influence of the sun on our living environment. I was surprised by the number of electricity boxes present in my living environment, which prompted me to document them through photography. The electricity boxes, each with its unique characteristics, made me ponder why energy, despite its omnipresence in our surroundings, remains invisible to us as we go about our daily lives. The design of energy infrastructure, such as electricity boxes, is often intended to blend in or remain inconspicuous. These factors make it challenging for individuals to grasp the full extent of their energy consumption's environmental impact and the broader functioning of the energy system.This leads to a passive relationship with energy

The relationship one has with energy is formed by the combined influence of the level of autonomy and level of integration axes. Without knowledge, control, and visibility, establishing a meaningful relationship with energy becomes challenging. Conversely, when individuals have full control and energy seamlessly integrates into daily life, a proactive relationship naturally emerges. The energy relation framework serves as a guide, allowing us to navigate the historical and future development of context factors and understand how we can actively shape our energy relationships.

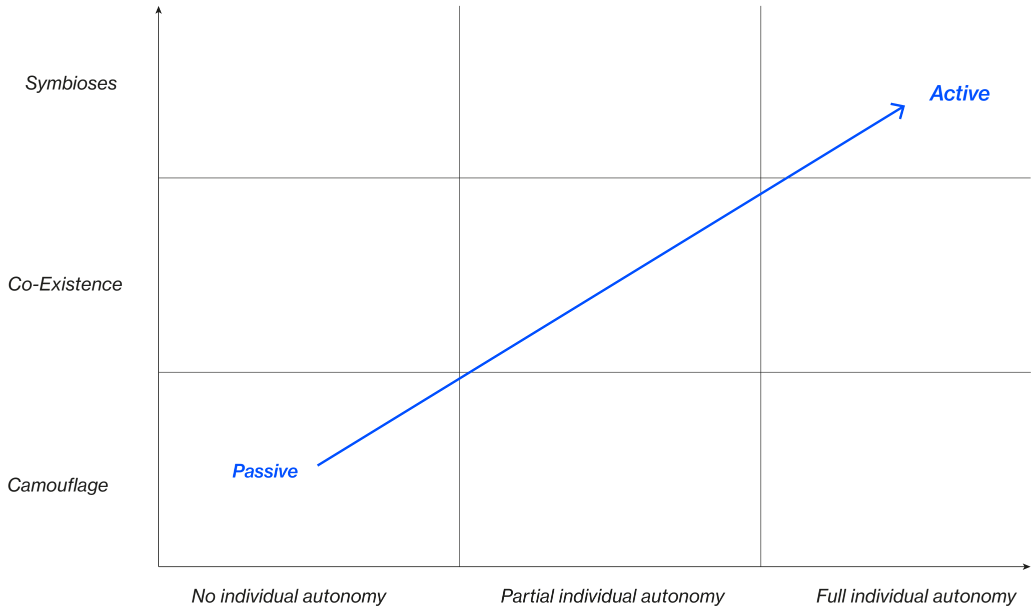
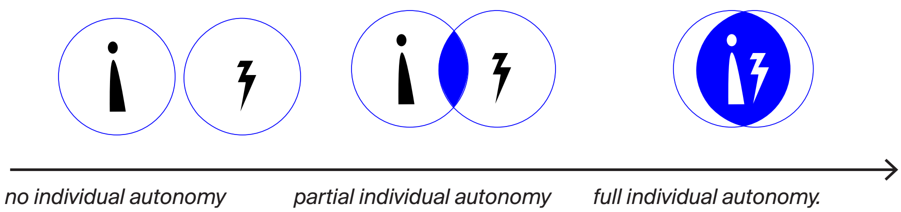


Figure 11: The energy relation framework in relation to an energy relationship.

In conclusion, the energy relation framework offers a comprehensive understanding of the context factors that shape energy relationships, with the level of autonomy axis focusing on individual household control and the level of integration axis highlighting the integration of energy in residents' lives and surroundings. By considering both axes, the framework serves as a guide in navigating the past and future development of context factors, influencing and shaping our energy relationships.

the level of autonomy

To begin with, Ecker et al. 2018, differentiates between two similar terms related to energy autonomy: Energy autarky and energy autonomy. Energy autarky is when a community or energy system is self-sufficient and doesn't depend on external sources of energy. On the other hand, energy autonomy is when a community or energy system has control over its energy supply and consumption. In practice, these concepts are often interconnected. For example, a person living in an off-grid tiny house has both a high level of autonomy and autarky, while a resident in Venserpolder who rents a house, has a low level of energy autarky and autonomy since they cannot generate their own energy and can only control their energy consumption by lowering their thermostat. My focus is on energy autonomy because it allows me to examine the degree of control that households have over their energy systems, even if they do not have a high level of energy autarky. I believe that energy autonomy is particularly important in this context. Given that energy is currently measured, billed, and managed on a household level, it makes sense to consider energy autonomy at the household level.



no individual autonomy

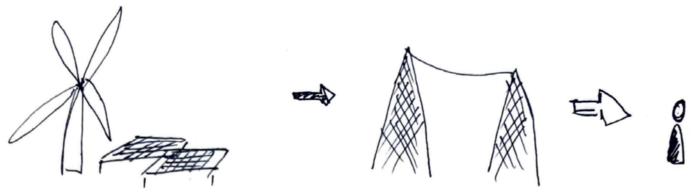


Figure 12: The current energy system that is a one way stream consisisting of energy production, distribution and consumption.

We are talking about a centralized energy system. You have no control of where your energy is coming from. It is an efficient system that is stable and reliable. It is sensitive for climate and geopolitical disruptions and is more dependent on non-renwable sources.

The current energy system in the Netherlands is centralized, consumers have the option to choose their energy provider and contract type, but not the net owner which is dependent on location. The energy market is opaque and technical, it is hard to have an influence on the centralized energy system. Since users don't have ownership of the production unit, they are limited in making technological changes, resulting in a passive role in energy production (Juntunen & Martiskainen, 2021b).

partial individual autonomy

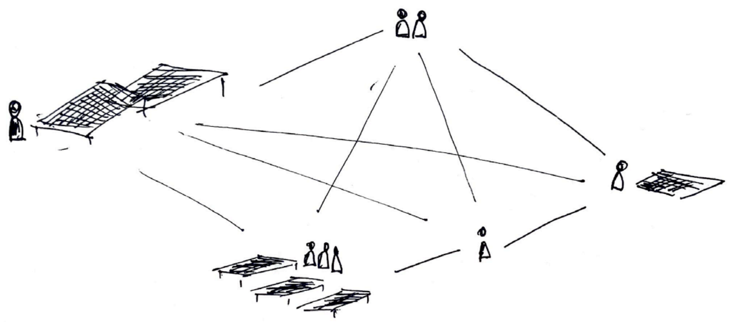


Figure 13: A decentralised local energy system, where everyone can participate. The bigger net is still connected for energy security reasons, but the main energy production and consumption is done on the local net.

An integrated community energy system provides improved energy efficiency, lower costs, increased resilience, and environmental benefits, but requires significant initial investment costs, technical expertise, and limited control for individual households because you have to share the energy and the decisions related to it with your local community.

They would also have a greater say in how the energy is produced and distributed, as well as how profits are used within the community. This increased participation in the energy system can lead to a greater sense of ownership, control, and community involvement in energy decision-making. Energy cooperations are a good example.

full individual autonomy

Figure 14: Off the grid, you are fully independent and disconnected from the grid.

An off-grid energy system for a single household provides full energy independence, lower long-term costs, and environmental benefits but requires a high initial cost, regular maintenance, and may have space constraints and a limited energy supply.

Adopting an off-grid energy system can provide a sense of autonomy for individuals or communities. However, the feasibility of such systems in areas with less sunlight and harsh winter conditions, such as the Netherlands, poses significant challenges. In particular, the required quantity of solar panels to produce sufficient energy during the winter months is prohibitive, which makes it an unrealistic option for most households. Additionally, the overproduction of energy during the summer months cannot be harnessed for use in the winter, since off-grid systems lack connectivity to the national grid, thus limiting their ability to exchange excess energy with other users.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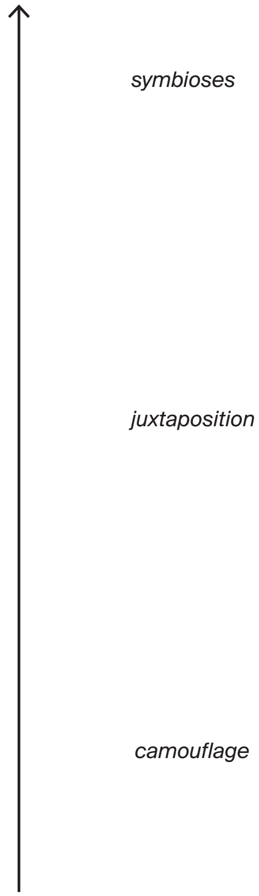
level of integration in the context

It seems that people's experiences with these [energy] technologies in specific places are still very important. These experiences shape how people see the world and the environment around them, and over time they form strong emotional connections. This means that people's access to renewable energy technologies is largely determined by the products, services, and designs that they encounter in their daily lives, and these things play a big role in shaping how people think and feel about renewable energy. (Solarscapes p. 12)

For long the common conception of power plants as dangerous and toxic facilities that need to be segregated from the surrounding landscape and public access is changing in the 21st century (Power of Landscape, p.). The increasing demand for energy, the development of new technologies, and a shift towards renewable energy sources will shape our future energy landscape and transform our relationship with energy. These changes will require a more conscious and sustainable approach to energy consumption, as well as a deeper understanding of our interconnectedness with the natural world and our responsibility to care for it. As we navigate these challenges, it is important to prioritize value creation instead of impact mitigation in our living environment and to aknowledge that the global energy transition requires local action.

The axis level of integration in the context of the energy relation framework consist of three categories: camouflage, juxtaposition, and symbiosis, each offering different trade-offs between visual impact, sustainability, and efficiency. Camouflage involves hiding or camouflaging energy infrastructure to reduce its visual impact on the landscape, while juxtaposition emphasises that treating technology and location as separate entities endangers the landscape quality. Symbiosis takes integration a step further by designing energy infrastructure in a way that enhances the ecological and social systems it interacts with. By considering these different approaches, stakeholders can make more informed decisions about the design and implementation of energy infrastructure projects.


symbioses
juxtaposition
camouflage

camouflage

The true function of energy production and infrastructure is hidden. Gas pipes and electricity cables went discreetly underground, creating an illusionary landscape, as Dutch landscape architect Dirk Sijmons calls it, in which energy lost its place as a visual productive cultural and urban endeavour[3]. The hiding of energy infrastructure can improve aesthetics, safety and reliability but it makes it expensive difficult to access and makes it impossible to have an interaction with.

Masking the true function of energy technology is a design attitude that is as old as the Invention of electricity itself. (Landscape of Power, Sylvia Crowe)

This approach emphasizes the need to make energy infrastructure blend in with the environment in order to minimize the negative visual impact on the landscape. While this approach can be effective in reducing visual impact, it may not be the most sustainable or efficient solution in the long term. Although camouflaging may not be the sole strategy for addressing today's energy transition, it could still be a viable approach in certain locations. Sylvia Crowe, for example, employed camouflage techniques at times because she believed that certain landscapes - particularly from a visual perspective - are most valuable when modern society's presence is minimized.

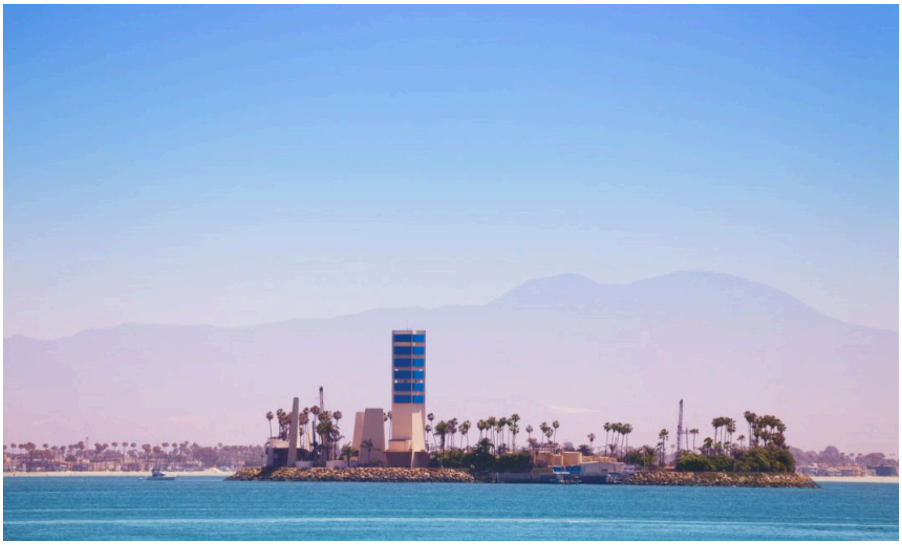


Figure 15: Island Grissom one of the four Long beach oil islands, view from the water (Meares, 2018)

camouflage

Figure 16: Island White one of the four oil islands, topview (Wells, 2023)

Example of camouflage: the story of the Long Beach Oil Islands:

The story of the Long Beach oil islands relates to camouflaging energy infrastructure in that the islands were designed with aesthetic considerations in mind. The oil company THUMS wanted the islands to blend in with the natural environment as much as possible. "Every element had a purpose. The large waterfalls were designed to muffle the sounds of the oil derricks and machines, and Goldman's sleek curving melon panels hid oil equipment. Borrowing tricks from Disney, derricks and even some trees and shrubs were placed on tracks for quick mobility" (Meares, 2018).

The goal was to create an infrastructure that was both functional and aesthetically pleasing, rather than an eyesore that would detract from the natural beauty of the surrounding area. This approach to designing energy infrastructure is similar to the concept of camouflaging energy infrastructure, which seeks to integrate energy infrastructure into the built and natural environment in a way that minimizes its visual impact.

juxtaposition

Throughout history, our pursuit of economic growth and progress through energy has influenced our landscapes. Energy infrastructure would often also just be Words referring to disease, monstrosity and decay were used very early on to describe their impact. In the 1930s, people in the Netherlands spoke of the pole plague', the historical variant of the word 'horizon pollution', which appeared for the first time when wind turbines were introduced in the 1980s (Oudes, 2023).

From the perspective of juxtaposing energy in the landscape, there are benefits and drawbacks. On one hand, energy systems contribute significant power to the grid, reduce reliance on non-renewable sources, generate employment opportunities, and make efficient use of land. On the other hand, this juxtaposition negatively affects the ecological environment, lacks visual appeal, and leads to conflicts over land use.

Currently, the approach treats technology and location as separate entities. While efforts are made to mitigate the impact of energy installations on existing landscapes, there is a risk of gradual decline in landscape quality despite attempts to maintain the status quo. While financial feasibility and compliance with legislation are important considerations, they can sometimes impede the visionary approach required to shape the future of our landscapes.

Figure 17: An example of juxtaposition in the Dutch landscape, took this photo on a bike ride.

Figure 18: View of Ferrybridge B power station behind the Church of St Edward the Confessor in Brotherton, North Yorkshire, photographed by Eric de Maré in 1960. Photo: Eric de Maré/RIBA collections

symbioses

Symbiosis is the concept of living in a mutually beneficial relationship between energy, environment, and society. In the past, when we relied on gathering wood for fire, we were actively aware of our environment and our interactions with it, as wood would regenerate at a pace that matched our needs. However, as human demand for wood increased, this symbiotic relationship became imbalanced, leading to overconsumption and depletion of wood resources. As a result, alternative energy sources like coal were adopted.

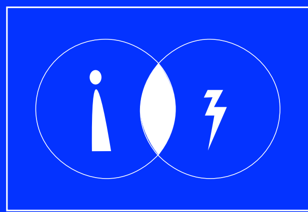
In the context of symbiosis, the design of energy systems involves integrating them harmoniously into the natural environment, considering the aesthetic appeal of the surroundings, and minimizing negative impacts on the local ecology. This approach recognizes the inherent complexity, interdependence, trade-offs, and resistance to change within these systems.

At the core of this perspective is the understanding that energy infrastructure can be planned and implemented in a manner that not only fulfills our energy requirements but also enhances the ecological and social systems it interacts with. It emphasizes viewing energy infrastructure as an integral component of a larger interconnected system and designing it to support and enhance the health and vitality of the surrounding ecosystem and communities. For example, this can be achieved through the design of solar panels and wind turbines that blend harmoniously with the natural environment or by integrating them with agricultural or urban land uses to create mutually beneficial relationships.

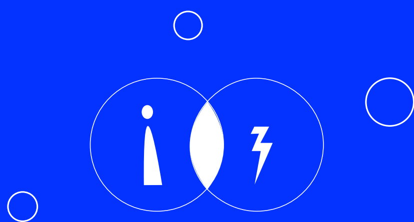
The Dutch pavilion at Expo 2020 Dubai exemplifies symbiosis in the realm of energy. Its design and construction embody the integration of renewable energy sources, such as specially designed solar panels that generate energy while nourishing edible plants with sunlight. By emphasizing the use of sustainable and locally sourced materials, the pavilion showcases a harmonious relationship between energy production, environmental preservation, and societal well-being.

Figure 19: Dutch pavillion Dubai with coloured solar panels, a good examples of symbioses (Projecten - V8 Architects, 2022)

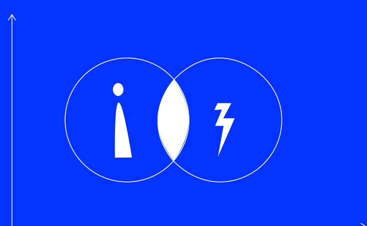
Figure 20: (Man En Een Vrouw Sprokkelen Hout, Anoniem, 1630 - 1700 - Rijksmuseum, n.d.)



framing



listening



understanding

conclusion

Framing

1. A pro-active relationship involves being mindful of the energy source, consciously monitoring usage, and regulating it, while a passive relationship entails less involvement and minimal control over energy consumption

2. Personal choices and contextual factors both influence energy relations.

Listening

1. The Dutch energy system exhibits complexity and opaqueness, leading to passive energy consumption.

2. The energy crisis and rising prices have increased concern and decreased trust in energy companies, potentially leading to a more active relationship with energy.

3. The LIFE project in Amsterdam Zuid-Oost faces challenges in establishing an active relationship with energy, including limited agency, knowledge, and time.

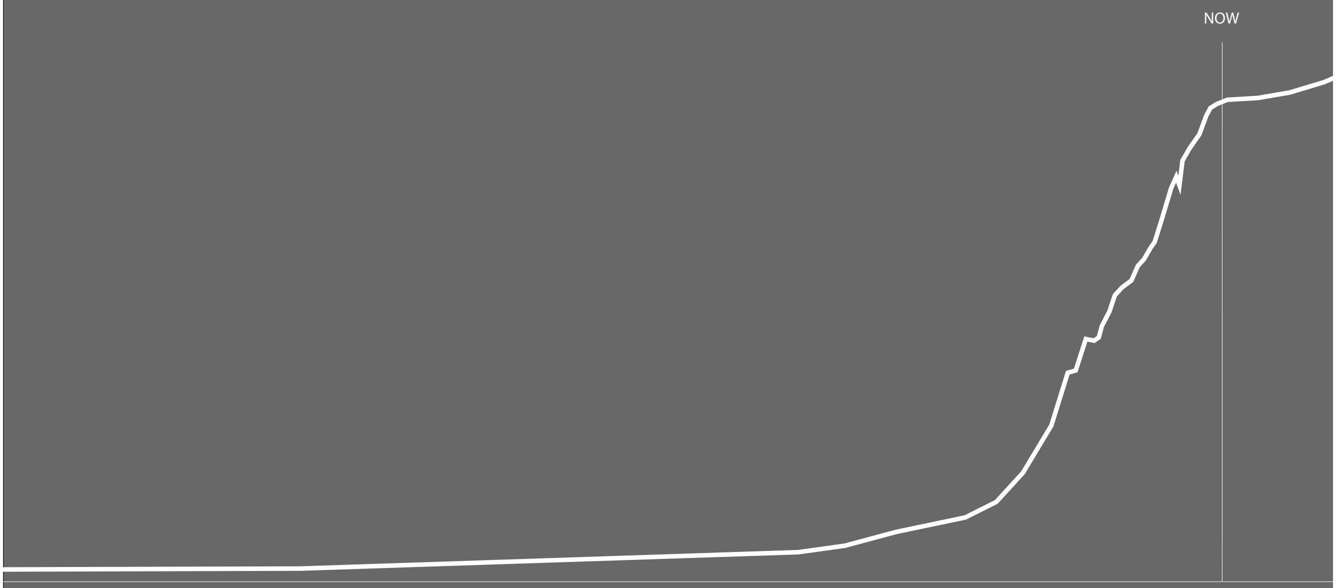
Understanding

1. The energy relational framework combines two axes: individual autonomy and integration in the context. It explores how these factors shape energy relationships and positioning within the energy system.

2. The level of individual autonomy axis identifies three stages: no individual autonomy (centralized energy system), partial autonomy (community energy system), and full individual autonomy (off-grid energy system). Each stage represents different levels of control and ownership over energy supply and consumption.

3. The level of integration in the context axis consists of three categories: camouflage (hiding energy infrastructure), juxtaposition (treating technology and location separately), and symbiosis (designing energy infrastructure to enhance ecological and social systems). These categories highlight different approaches to integrating energy infrastructure into the built and natural environment.

02. the evolution of energy relations


NOW

02.01. historical context

In this study, I aim to explore the historical development of the relationship between energy and society. Specifically, I will trace this relationship from the earliest forms of fire to the industrial revolution, the oil crisis, and the pledges that were signed in 2015. Throughout history, society has undergone multiple energy transitions, each with its unique characteristics that have influenced our interactions with energy. By examining the past, I have gained valuable insights into the origins of certain key characteristics that shaped our energy relationship. To begin with, I will provide a concise summary of the energy transitions that occurred leading up to the Industrial Revolution. Subsequently, we will delve deeper into the energy advancements of the last 150 years, which have shaped the present-day energy system. There are four different periods: -Energy for surviving, -Energy as a luxury -Enery as a limited resource, -Energy as something that needs to change, but not just yet.

Figure 21: A Mill on a Polder Canal, Known as 'in the month of july' by Paul Joseph Constatin Gabriel (Rijksmuseum)

energy for surviving

For more than 99% of human history, the main source of energy to do work was muscle, either human or animal. And the fuel for that muscle was food, usually plants, and plants ultimately get their energy from the sun. The first great energy technology was fire. It enabled us to cook, which gave us a greater variety of available food and thus more fuel for our muscles. Fire also led to metal work and improvements in tools. The earliest reliable evidence for organized use of fire dates to about 500 000 years ago (mens en energie, 1978). Roughly 100 000 years ago Homo sapiens switched from controlling fire to starting fire at will using stones and dry wood. 10.000 years ago we started domesticating animals for muscle. This started with sheep and evolved in the use of oxen and horses. The next big leap forward was the invention of machines that could run without the involvement of human or animal muscles. Scientists refer to such machines which convert a naturally occurring source of energy into mechanical power as prime movers. Around the 3rd century BCE the power of running water was first harnessed by ancient Greeks. Over the next millennium water wheelswheel spread throughtrough Europe and Asia. The water wheel remained the most efficient pre-industrial prime mover and was a key factor in Europe's technical supremacy during the early stages of industrialization; the industrialization the second most important pre-industrial prime mover was the windmill. The first windmills were used in Persia around the 10th century (The Renaissance of Renewable Energy, n.d.).

Innovations in the way energy was used did not substantially change from prehistoric times to the 18th century. At that time people were still using animal muscle for work and transport animal and vegetable fats for lighting, biomass for heating and methods of agriculture that had not greatly changed for millennia.

Overall, people's relationship with energy in the past was characterized by a reliance on natural, renewable sources of energy and a limited ability to control and harness energy in ways that we take for granted today. Their proactive approach to energy was essential as they had to be conscious of its usage to survive.

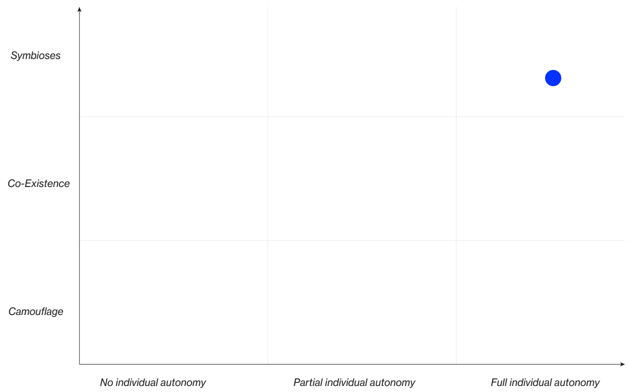


Figure 22: Location of energy relationship in energy framework for energy for surviving.

energy as a luxury

Society changed radically with the Industrial Revolution. Thomas Newcomen and James Watt in the mid 1700s gave 1700s that gave birth to the modern steam engine, opening up a world of possibility. The possibility the steam engine and new tools allowed for the first time thermal energy to be converted into mechanical energy then into motion or kinetic energy driving a wide variety of machines. After steam powered manufacturing, it was a short chronological leap to electricity. Electric light was a really big deal because it provided a clean and efficient way to allow people to work after dark. Oil was revolutionary because it could power not only electricity plants, and ships, and trains, but also the internal combustion engine, which makes cars and trucks possible.

In the Netherlands, the industrial revolution only started late, more than a hundred years after the one in England (1850). The late industrialization of the Netherlands is mainly explained by: the dominance of trade in our national economy and the broad use of wind and watermills as alternative sources of mechanized labor. (TB141E - Introduction to Energy and Industrial Systems, n.d.)

In The Landscape of Power, published in 1958, Crowe meticulously dissects the character of each energy source, and the sources in relation to the landscape as well as to human proportions. *“In a sense, steam and coal could still be seen as a natural force of the earth, she writes, while electricity belongs in the air, traveling through thin wires, carried on thin grey structures and there is no reason to relate it to a human scale.”*

Figure 23: Only the sun is better, coal merchant carrying a sack of coal off board, Stadhouderskade, Amsterdam, 1950s (MAI beelbank, n.d.)

Figure 24: 1967 gas advertisement, American Gas Association, Rchappo (n.d.)

In 1959, the NAM (Nederlandse Aardolie Maatschappij) discovered the famous Groningen gas field in Slochteren, which is one of the largest gas fields in the world. The discovery of natural gas in Slochteren led to strong government support to use this resource in the Netherlands. This started the energy transition from coal to natural gas.

The documentary "Heel Nederland aan het Aardgas" explains how, in less than 10 years, the entire Netherlands was converted to natural gas. People were pleased with the change: it was clean, without the soot and dust of coal, cheap, and the government took care of everything. Natural gas was seen as a new step toward prosperity after the war, promising more comfort and luxury, and people were willing to pay for it (NTR, 2019). It was a very different energy transition compared to what we are experiencing now with high energy costs, the need to reduce energy consumption and energy insecurity .

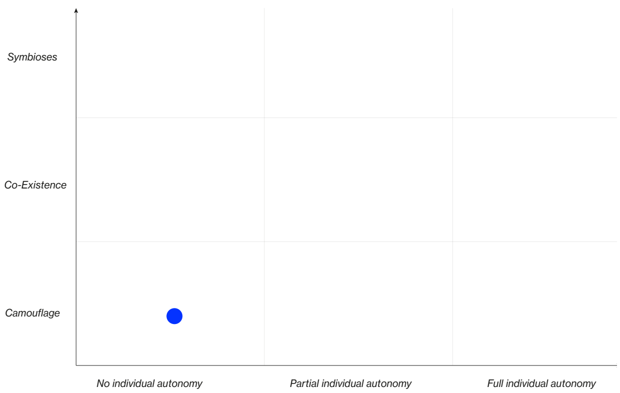


Figure 25: Location of energy relationship in energy framework for energy as a luxury.

The convenience, cleanliness, and government support associated with these new energy sources led to a more passive relationship, where energy became a perceived luxury and an essential part of our modern society.

energy as a limited resource

The period from 1950 to 1973 saw unprecedented economic growth (Koops (2022). This was a combination of population growth, the world population grew by about one and a half times, and prosperity growth, prosperity almost doubled. This also increased the demand for energy, which in 1973 was more than two and a half times higher than in 1950. The Netherlands relied heavily on imported oil and gas to meet its energy needs. At that time, nuclear energy was also being considered as a possible solution to reduce the dependence on imported fossil fuels. However, public opposition to nuclear power was growing, and there were concerns about the safety and environmental impact of nuclear energy.

Around the same time Limits to Growth is a report produced by the Club of Rome, a group of international scientists and experts in various fields, in 1972. The report predicted that the world would soon reach its limits to growth due to the interplay between these variables and that this would lead to a global collapse within the 21st century.

In 1973, The Organization of Petroleum Exporting Countries (OPEC) decided to impose an oil embargo on countries that supported Israel in the Yom Kippur War. This resulted in a global oil crisis. The crisis demonstrated the vulnerability of industrialized nations to sudden disruptions in the supply of fossil fuels and highlighted the urgent need to transition to more sustainable energy sources. This also put the Limits to Growth in the spotlight. Scientists, green activists, and inventors in several European countries and North America turned simultaneously to ideas of harnessing the wind, the sun, and geothermal water to produce electricity domestically. A whole new industry based on renewable energy emerged as a result of the crisis.

The oil crisis and the focus on renewable energy sources led to a shift in our relationship with energy, as it prompted a greater awareness of the environmental impact and limitations of fossil fuels. This, in turn, fostered a growing recognition of the importance of transitioning to sustainable energy sources, encouraging a more conscious and proactive approach to energy consumption and the exploration of alternative, renewable options.

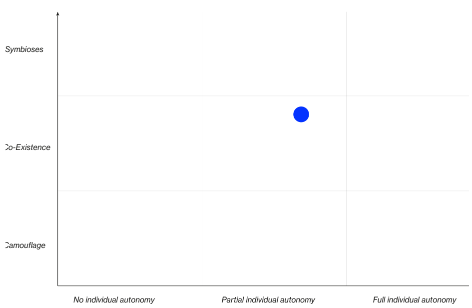


Figure 26: Location of energy relationship in energy framework for energy as a limited resource.

Figure 27: Kids playing at the highway at "Autoloze zondag" in 1973 as a policy to save energy. (Benelux Press)

energy as something that needs to change, but not just yet

What caught my attention was the fact that during the oil crisis, people seemed to be willing to make changes, as den Uyl stated on Dutch television: “Zo bezien, keert de wereld van voor de oliecrisis niet terug” (“Looking at it this way, the world before the oil crisis will not return”). However, no significant changes were made, and I wondered why.

A Volkskrant newsarticle explains this very well. Professors Geert Buelens and Noelle Aarts, argue that The Limits to Growth report, despite coming from an unlikely industrial source, was dismissed by businesses, progress optimists, and increasingly neoliberal economists as left-wing doomsday thinking. The New York Times also criticized the report, calling empty and misleading work. Claiming that the world was unable to adapt to problems of scarcity and that its authors were ignoring technological advancements and pollution reduction. Meadows’ message was deemed threatening and pushed into the corner of environmental activists. In the 1980s, neoliberalism further marginalized environmental pessimism, as technological advancements led to the discovery of new resources and global living standards rose while pollution decreased in Western countries

Since 2004, the Dutch energy market has been liberalized, meaning that it is regulated by supply and demand rather than the government, with the aim of encouraging energy companies to compete with one another and provide better services to consumers at lower prices, thereby allowing consumers to benefit from the liberalization of the energy market, according to the ACM.

In 2016, the Netherlands signed the Paris Agreement, pledging to limit global warming to below 2°C, with a goal of 1.5°C. As part of this agreement, the EU committed to reducing emissions by at least 55% by 2030 and becoming climate neutral by 2050. It’s been a challenging journey, but one that’s vital for the future of our planet.

Despite signing international climate agreements, our energy consumption has continued to rise at an alarming rate. In fact, according to Crosby, our primary energy use has increased 20 times since 1850 and nearly 5 times since 1950. This puts our environment at serious risk, and highlights the need for urgent action to reduce our carbon footprint and switch to renewable energy sources.

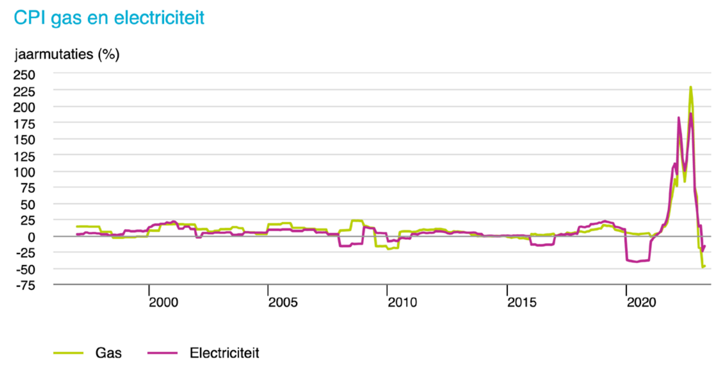


Figure 28: Data on gas and electricity prices (Centraal Bureau voor de Statistiek, n.d.)

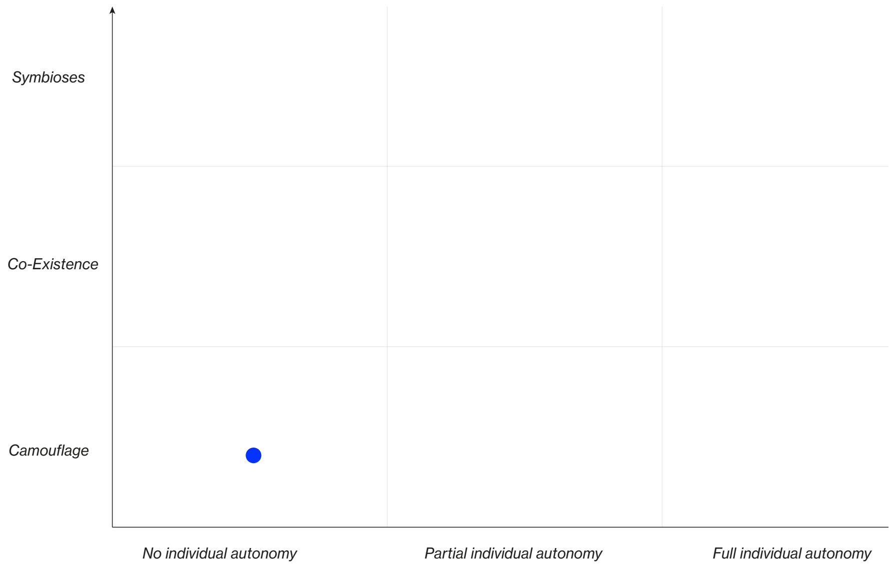


Figure 29: Location of energy relationship in energy framework for energy that need to change, but not just yet.

The focus on economic growth and reliance on fossil fuels perpetuated a mindset of energy abundance and convenience, which led to increased consumption a passive relation with energy and a delayed transition to renewable energy sources.

historical

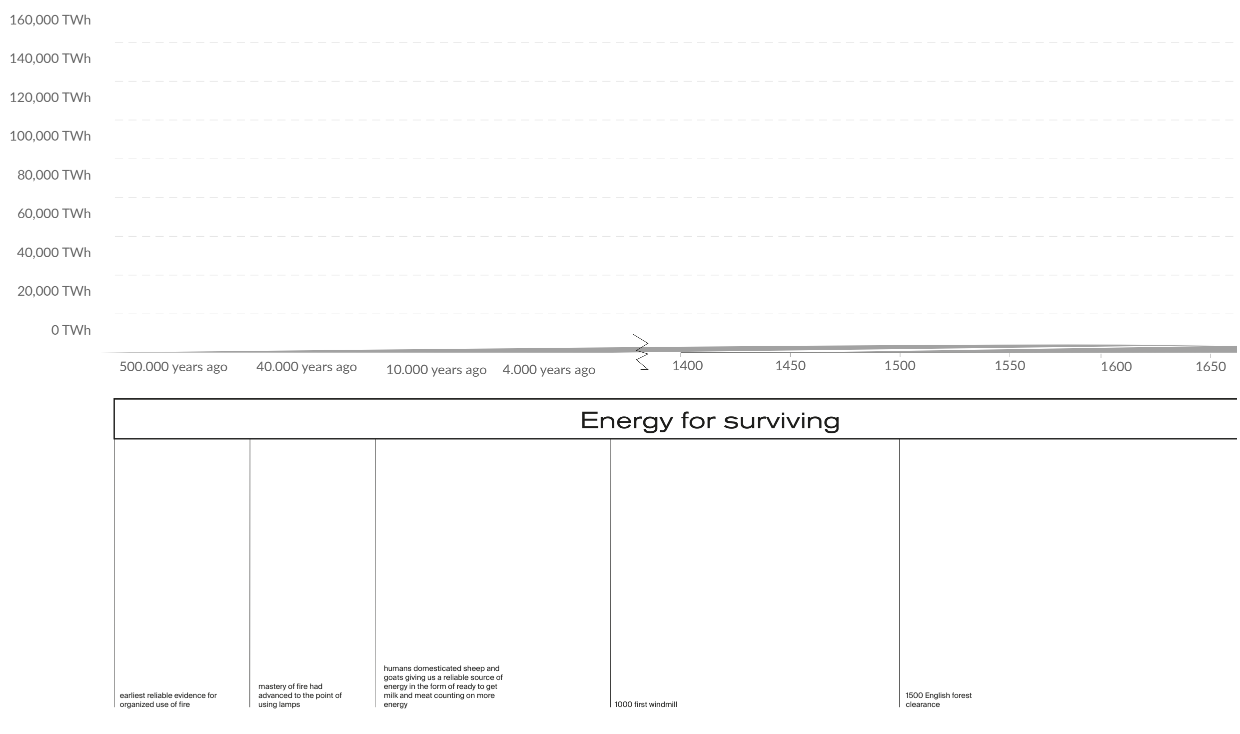
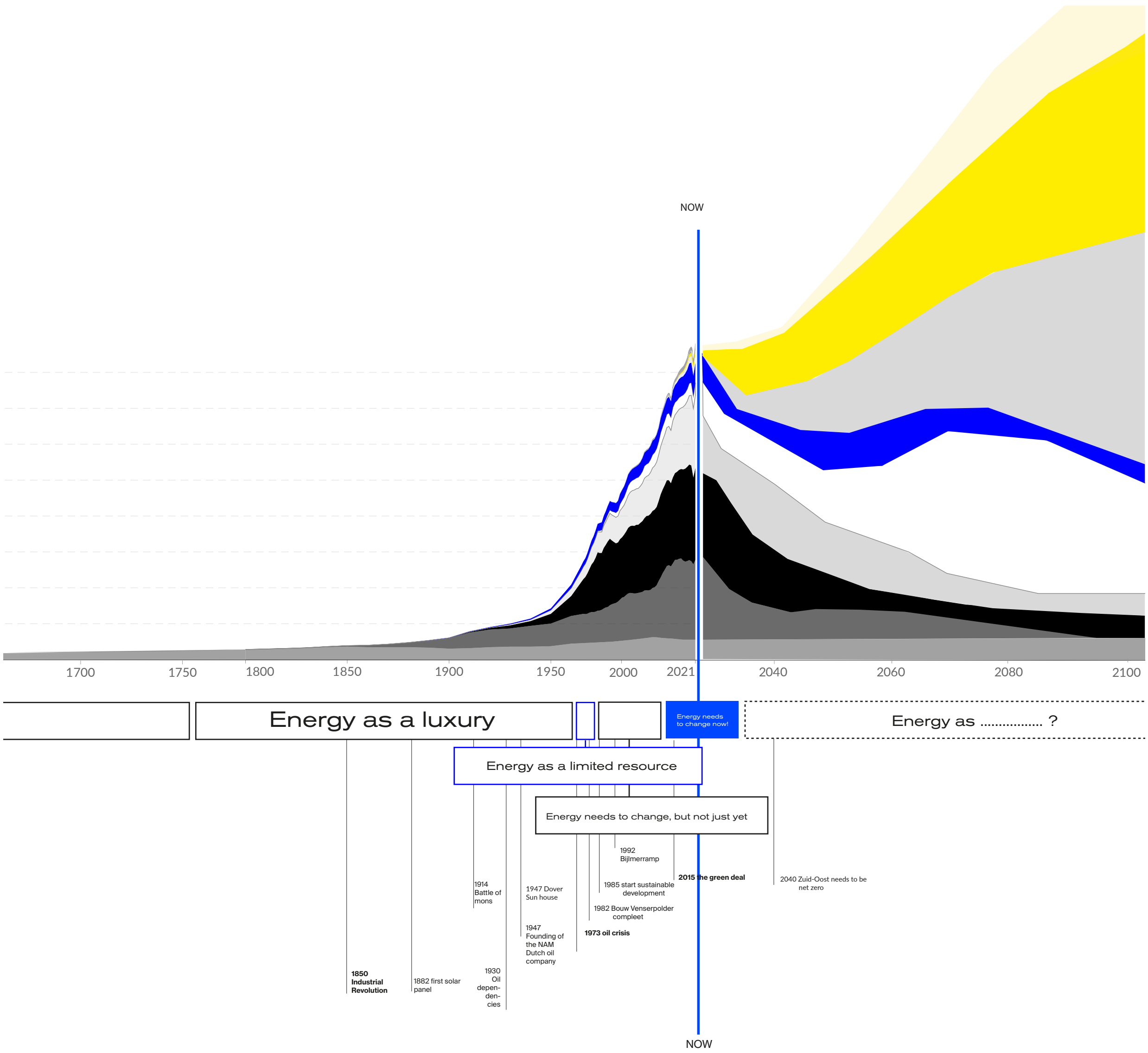


Figure 30: Overview historical timeline together with energy consumption (Statistical Review of World Energy | Energy Economics | Home, n.d.)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2040
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2100
Energy as a luxury
Energy needs to change now!
Energy as .... ?
Energy as a limited resource
Energy needs to change, but not just yet
1992 Bijlmerramp
2015 the green deal
2040 Zuid-Oost needs to be net zero
1914 Battle of mons
1947 Dover Sun house
1985 start sustainable development
1982 Bouw Venserpolder compleet
1947 Founding of the NAM Dutch oil company
1973 oil crisis
1850 Industrial Revolution
1882 first solar panel
1930 Oil depen-den-cies
NOW

evolution

evolution context

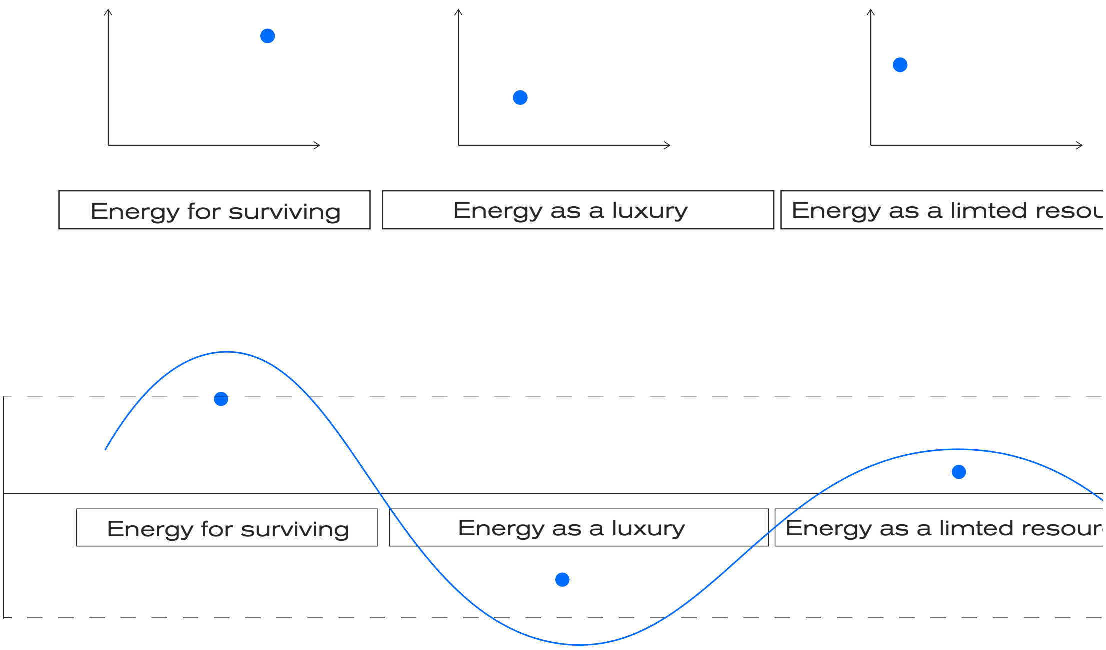
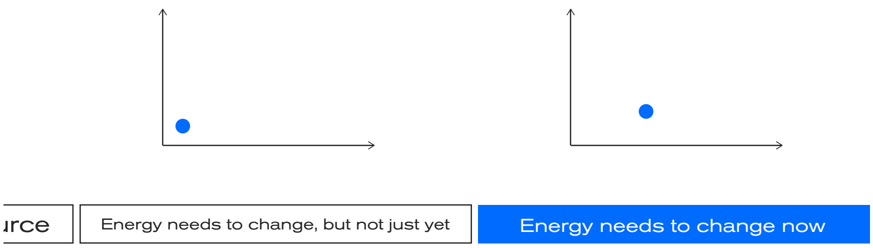
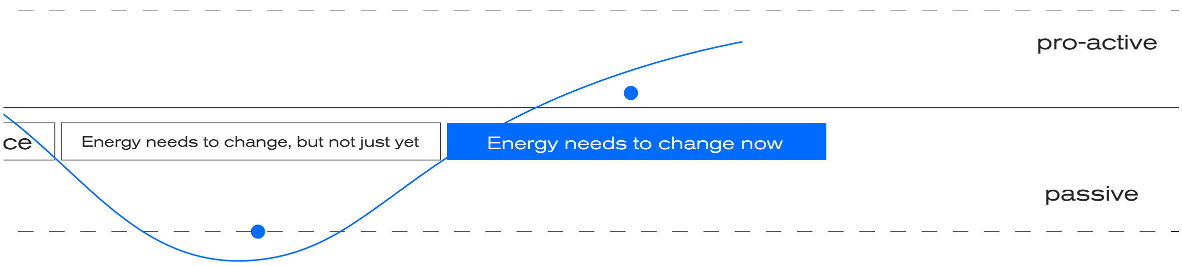


Figure 31: Overview historical timeline together with the influence on our energy relationship.





evolution energy relation

conclusion

The history of our relationship with energy reveals significant shifts and provides valuable insights for shaping our future energy dynamics. Energy has played a pivotal role in shaping society, driving progress, and enabling the conveniences we enjoy today. Reflecting on the past, we observe that our relationship with energy has evolved over time.

In earlier periods, people had an active relationship with energy, relying on natural and renewable sources. They had a limited ability to control and harness energy, requiring a proactive approach to ensure their survival. Energy consumption was a matter of conscious consideration and careful management.

However, as new energy sources emerged, characterized by convenience, cleanliness, and government support, our relationship with energy shifted towards passivity. Energy became a perceived luxury and an indispensable part of modern society. We grew accustomed to the abundance and convenience provided by these new sources, often taking them for granted.

Looking towards the future, we can draw several lessons from the history of energy.

1. We must recognize the transformative power of energy and its profound impact on society. Energy transitions are not new; they have been a driving force behind progress and increased luxury throughout history. The current energy transition will again have a profound impact on how we live.

2. The current transition we face differs from its predecessors. Rather than feeling like a step forward, it often feels like we are being deprived of certain conveniences. Understanding this sentiment is essential in navigating the challenges of our energy transition.

3. We must overcome the barriers posed by economic growth and our dependency on fossil fuels. We need to foster a mindset that values long-term sustainability over short-term convenience. This calls for collective action, imagining hopefull futures, and making the transition not only easier but also more fun.

Figure 32: “De Kolenboer Met Bloemenmeisjes” The coalmerchant with the flower girls (Wikimedia Commons, 1963)

02.02. future context

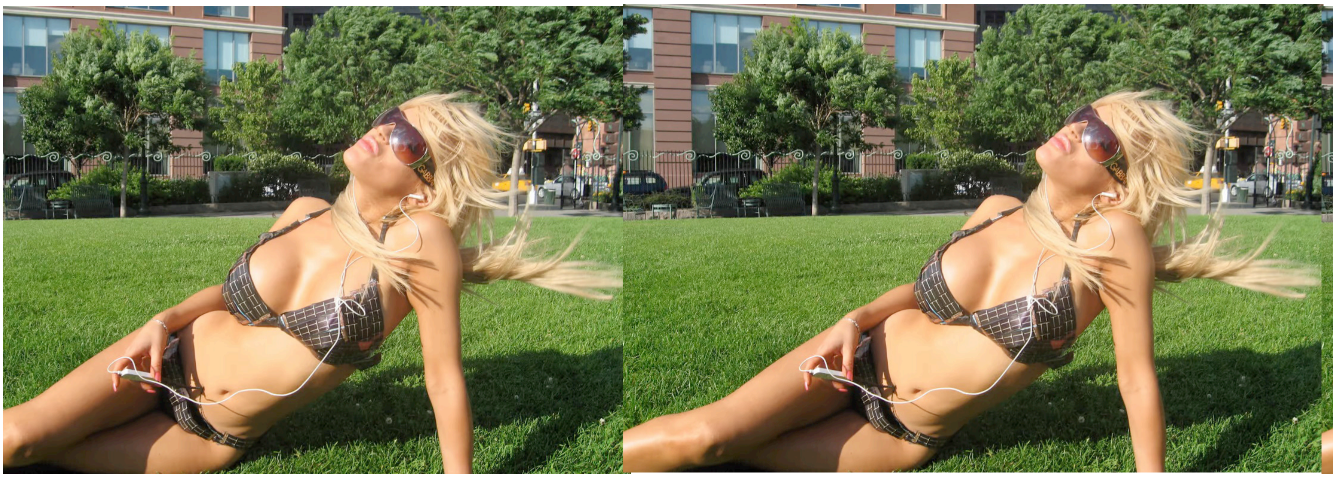


Figure 33: Solar bikini (Ridden, 2019)

As we stand at this critical juncture in history, the energy transition has emerged as one of the most pressing issues on the political agenda. The urgency of the situation cannot be overstated, and it is precisely at this moment that change can be made and the transition can be accelerated. What are the emerging trends that are shaping the energy system of the future, and how will they impact our relationship with energy? To classify these trends, I employed the DESTEP method (Van Boeijen, A. et al. 2013), drawing insights from events I attended (IABR 2022, Solar Bienalle 2022, Donut economy), the vision for Zuid-Oost in 2040, as well as thorough desk research.

reduction cost renewables:

Renewable power is increasingly cheaper than any new electricity capacity based on fossil fuels, stated by the International Renewable Energy Agency (IRENA). According to the International Renewable Energy Agency (IRENA), renewable energy is becoming more affordable compared to electricity produced from fossil fuels. In the past ten years, the cost of renewable electricity has decreased significantly due to technological advancements, larger production scales, more competitive supply chains, and more experienced developers. The most significant cost decline was seen in utility-scale solar PV power, with an 82% decrease since 2010

Energy relationship: As renewable energy becomes cheaper, more households may be able to afford to install renewable energy systems. This could potentially shift the power dynamic between households and traditional energy providers, as households become more self-sufficient and less reliant on the traditional energy grid.

Energy as something that can empower households

Figure 34: In the future renewables might be so cheap that they wouldn't have to put a fence around the solar panel. (Gent 2023, Ron Barten)

dynamic energy contracts

In recent years, there has been an increase in the number of energy providers in the Netherlands that offer dynamic energy contracts. A dynamic energy contract is a flexible and open-ended agreement with hourly rates, which can be terminated with one month's notice. The rates are determined by the demand and supply of energy and are billed at the prevailing wholesale price of energy (Vast of Variabel Energiecontract | ANWB, n.d.). The market price of energy is dependent on various factors, such as supply and demand, weather conditions, global market trends, production costs, and geopolitical events. These factors can cause the price to fluctuate on an hourly, daily, monthly, or even yearly basis.

Dynamic energy contracts incentivize households to use energy when it's abundant making it cheaper, leading to a more conscious and sustainable approach to energy consumption, in line with the natural rhythm of nature. However, it requires more planning and attention to energy usage, which may be a disadvantage for vulnerable households.

Dynamic energy contracts: Energy as something that is in sync with nature

Figure 35: Low-tech magazine is a website that runs solely on solar energy which means it is offline around 35 days per year. (https://solar.lowtechmagazine.com/nl/)about.html

elektrification vs anti-trend “human power”

In today’s society, we are increasingly turning to smart products for convenience and cost savings. In the Netherlands, 59% of households currently have one or more smart home products, up from 42% in 2020. However, there is also an anti-trend emerging as a reaction to the digitization of society. Projects like the Human Power Plant by Melle Smets, aim to harness human energy to power homes and buildings, rather than wasting energy at the gym. By emphasizing human labor and mindfulness, this trend promotes a more sustainable and resilient energy system. There is beauty in taking the time to do things ourselves, and we don’t always need to rely on smart products to make our lives easier.

The electric bike paradox
There’s a trend of a growing amount of electric bikes (Niemantsverdriet, 2023)in Amsterdam, but surprisingly, they’re often owned by young, fit urban professionals who don’t actually need the extra boost. Instead of relying on their electric bikes, they attend spinning classes at places like rocycle to stay in shape. It’s ironic when you think about it, as they could just as easily use a regular bike. Maybe it’s time for us to reconsider our reliance on technology and get back to the basics of staying fit and healthy!

The trend towards smart products can potentially lead to a more passive relationship between households and their energy use. With the convenience of automation and remote control, it’s easy to lose track of how much energy we’re consuming and where it’s coming from.

The anti-trend of the Human Power Plant, on the other hand, encourages a more active and mindful approach to energy use. By generating energy through physical activity, people can become more aware of their energy consumption and how much effort it takes to power their homes. This can ultimately lead to a more responsible and sustainable relationship with energy.

Anti-trend human power: Energy as something we are thoughtful about

Figure 36: Young fit guy on an electric bike (Van Moof)

Figure 37: Spinning class, (Rabbitt, 2018)

decentralised energy system

Since 2004, the Dutch energy market has been liberalized, the aim was for energy companies to compete and offer better services at lower prices. However, rising energy prices have led to concerns about potential abuse of the price ceiling and a lack of transparency around profit margins, which has contributed to a decrease of consumer trust, with only 12% of Dutch citizens trusting that energy suppliers are not taking advantage of the crisis to make unnecessary high profits (ACM).

"Omdat er verschillende verhalen vertelt worden over de levering en voorraad, maar dat we alleen de prijs zien groeien. Er is geen transparantie, allemaal vage informatiebronnen." (ACM)

Energy is invisible, and the energy market is complex and opaque. To gain more control over the energy supply, initiatives have emerged throughout the country. Energy cooperatives, which are local initiatives where residents invest in sustainable energy projects like wind turbines or solar parks, are an excellent way to achieve this. There is a big growth in the amount of energy cooperations. In 2016 there were 313 active energy cooperations (HIER Opgewekt, 2023) while there are currently 705 energy cooperatives in the Netherlands with over 12,000 members (Temmick, 2023).

The energy generated is controlled by the members of the energy cooperative, making the energy supply more transparent and democratic. All members have a say in what happens to the energy generated. Additionally, the cooperative's profits do not have to be distributed to shareholders, allowing all returns to be reinvested in the cooperative or returned to the members (Temmink, 2023a).

Siward Zomer: "There is a great opportunity for residents to reclaim power."

Households would have a more active role in the energy system as they become producers and consumers of their own energy. They would also have a greater say in how the energy is produced and distributed, as well as how profits are used within the community. This increased participation in the energy system can lead to a greater sense of ownership, control, and community involvement in energy decision-making.

Energy relationship: Energy as something that gives you control

Figure 38: Then we will simply generate our own energy! (Energy cooperation Delfshaven, 2023)

growth renewables

In the Climate Agreement, it has been agreed to strive for a 70% share of renewable electricity in the total electricity production by 2030. Additionally, the member states of the European Union (EU) have agreed with each other that by 2030 at least 32% of the energy (electricity, gas, and heat) generated in the EU must be sustainably produced (Ministerie van Algemene Zaken, 2023). The Netherlands mainly generates sustainable energy with: wind turbines at sea, windmills on land and solar panels on roofs and in solar parks.

Renewable energy sources, including wind and photovoltaics (PV), differ from conventional fossil-based energy generation in that they are dependent on the fluctuating weather conditions, making it challenging to balance energy supply and demand. The unstable production of renewable energy increases the risk of grid instabilities and raises the need of costly power plants to supply energy during periods of low renewable energy availability (Sims et al., 2011). Historically, we have always moved towards an energy source that has a higher power density. However, renewables have a lower power density than fossil fuels, which means that they will take a bigger place in our landscape.

As we face thechallenges posed by weather-dependent renewable energy sources and potential energy supply shortages, we are reminded of our interconnectedness with the natural world and the need for greater flexibility and adaptability in our consumption habits. By embracing new technologies and changing our behavior, we can not only navigate these challenges but also deepen our understanding of our place in the larger ecological system and our responsibility to care for it.

Energy relationship: Energy as something that reminds us of the interconnectedness with nature

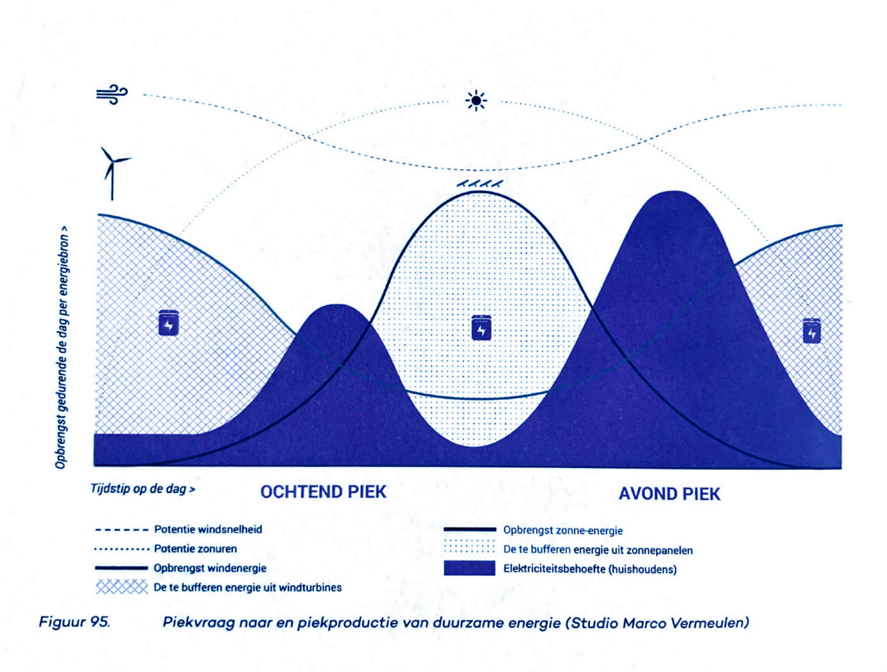


Figure 39: Piekvraag en piekproductie duurzame bronnen. (scan boek klimaar ruimte en energie)

The energy system is not something that exist outside of us. With solar, everyone is part of it. Consumers harvest sun rays and put them to use straight away. So with every design we put into the world, we have the chance to turn consumers into prosumers (Solar manifest, 2022).

Solar technologies have undergone significant developments and innovations over the past decades, which have not only improved their technological efficiency but also expanded their applications beyond electricity generation. Solar technologies now offer a diverse range of flexible forms and functions, from solar fabrics to solar lamps, enabling them to have a greater impact on our daily lives compared to other renewable energy technologies. This broadening and integration of uses has facilitated the permeation of solar technologies in our everyday lives, as described in Solarscapes:

"This marks a turn in the way solar energy can be perceived and utilised; from being a commodity energy resource akin to the way petrol is used to fuel cars, to becoming an attributable deliverable that is a desirable in contemporary popular culture" (solarscape).

The integration of solar technologies in our daily lives, allowing individuals to harvest and utilize the power of the sun, represents a shift in the relationship between human beings and energy. No longer an abstract concept that exists beyond our grasp, energy has become a tangible and attributed aspect of our lives, shaping our experiences and interactions with the world around us. The emergence of solar as a deliverable and desirable resource has transformed the very nature of energy, imbuing it with new meanings and values that have the potential to reshape our relationship with the environment and society.

Solar development: Energy as something that is personal

Figure 40: Table generating energy, (Current Table, n.d.)

double electricity demand

According to the EU 2050 Roadmap, electricity will have a more predominant role on the final energy consumption by almost doubling its share by 2050 in comparison to 2005 (EU 2050 Roadmap, 2010)]. Consequently, increasing electricity demand resulting from electrification may contribute to escalating congestion problems on local grids. Until now, the solution has been grid reinforcement, which is costly and not a durable solution. The growing use of renewable energy sources in the Netherlands has exposed the limitations of the current electricity grid, which was designed for a one-way flow of power from centralized plants to consumers. As a result, the grid's infrastructure, which becomes increasingly thinner the farther it is from the central power plant, is now struggling to handle the two-way flow of power from both centralized and distributed sources. This has created a bottleneck in the system that requires upgrades to accommodate the new energy landscape.

Disributed local generation will become more prevalent with the increasing electrification of different sectors. These changes in the energysystem will also predominantly change our energy landscape. For example, the electrification of our society results in the growth of transformer boxes. In the coming 10 years, 25 000 extra transformerboxes will be installed (Liander video youtube).

The doubling of electricity's share, requires to rethink how our energy system is designed. It will have a big influence on the future energy landscape. Hereby it is important to see a landscape not only as an area with all kinds of physical characteristics, but also an area to which people assign meanings and from which they partly derive their identity (Power of Landscape). Therefor it is important that if we design for this future energy landscape, we do not focus on impact mitigation, but instead focus on value creation.

Double in electricity demand: Energy as something that influences our landscape

Figure 41: Dall-e promt: Large amount of transformer boxes in Amsterdam

energy security

Currently, the issue of energy security has rightly gained significant political and societal attention. The Russian aggression against Ukraine and the resulting energy crisis have exposed our dependence on other countries for energy supply, and energy security is no longer taken for granted as it once was.Our energy system currently relies heavily on gas or coal power plants to compensate for energy shortages during periods of high demand. However, when there is an excess of (renewable) energy, it becomes difficult to match the supply with demand. This has already led to energy supply shortages during peak demand hours, a trend that is projected to continue beyond 2030 (TENNET leveringszekerheid, 2023).

Climate change further exacerbates the situation, as evidenced by the increasing frequency of extreme weather events and rising temperatures. With July 25, 2019 marking a significant milestone as the mercury crossed the historic threshold of 40°C. Additionally, the frequency of extreme rainfall events has risen over the past two decades (KNMI - KNMI Klimaat-signaal'21, 2021). These climate-related impacts necessitate proactive measures to adapt and enhance the resilience of our energy system. Achieving climate targets and reducing reliance on fossil fuels require robust collaboration at the European level. This transition introduces challenges that demand increased attention in the coming years. Households may face trade-offs between energy autonomy and security as the energy system shifts towards renewables, potentially relying on energy imports from other European countries.

As the energy system undergoes a shift towards renewable sources, households may face trade-offs between energy autonomy and security. This transition may require them to consider relying on energy imports from other European countries, potentially limiting their energy autonomy. Balancing these factors becomes crucial in ensuring a secure and sustainable energy future.

Households may have to choose between energy autonomy and energy security as our energy system transitions to more renewable sources. With a greater reliance on renewables, households may face limited energy supply, and they may choose to rely on energy from other countries in Europe, which may reduce their energy autonomy.

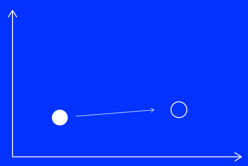
Energy security: Energy as something that is not always there

Figure 42: Heavy rainfall in Amsterdam (Amsterdam strijdt tegen het water, n.d.)

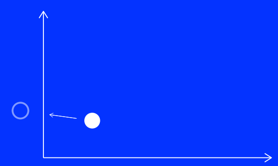
conclusion

The trends examined in this chapter shed light on the dynamic connection between households, and energy. Understanding these trends and their consequences is crucial as we shape our vision of the future. The visualization below demonstrates how these trends influence our relationship with energy. In the upcoming chapter, we will further explore future scenarios using speculative design. This approach allows us to imagine and analyze the potential outcomes and consequences of these trends.

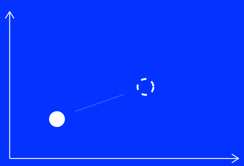
Decentralized energy system:
Energy as something that gives you control



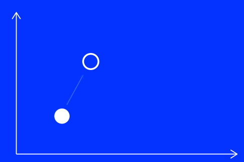
Energy security:
Energy as something that is limited



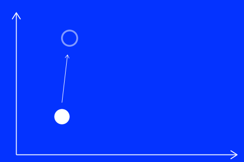
Reduction costs renewables:
Energy as something that can empower households



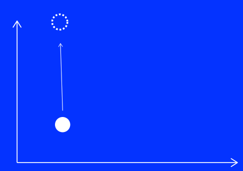
Anti-trend human power:
Energy as something we are thoughtful about



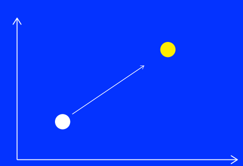
Growth renewables:
Energy as something that reminds us of the interconnectedness with nature



Double in electricity demand:
Energy as something that influences our landscape



Solar development:
Energy as something that is personal



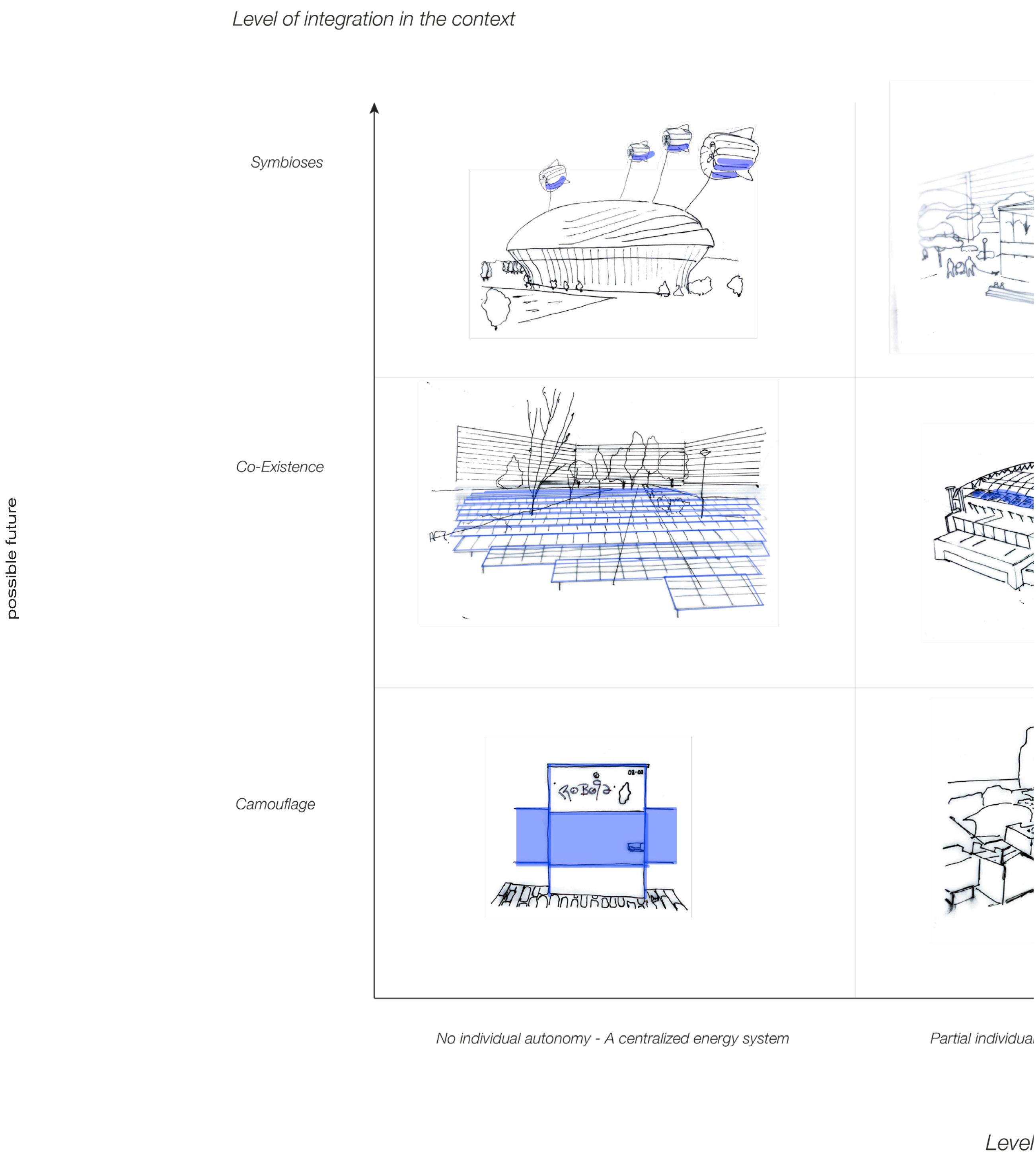
03. the future energy relation

In the next chapter, we will use speculative design to explore future scenarios. This allows us to imagine and analyze the potential outcomes of the trends we discussed. We will specifically focus on how these scenarios could impact Amsterdam-Zuidoost.

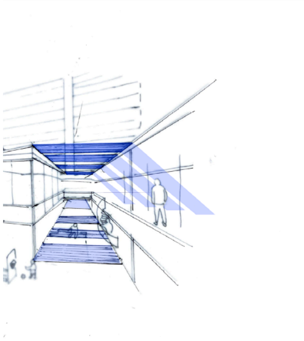
Figure 43: Solarpunk future visualized (Solarpunk | Aesthetics Wiki | Fandom, n.d.)

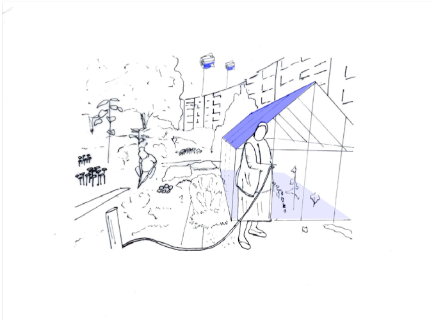
03.01. possible future energy relations in venserpolder

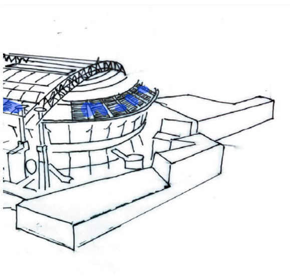
Figure 44: Felixx investigated the urbanistic potential of the Amsterdam Zuidoost Spoorzone (Amsterdam southeast railway area)

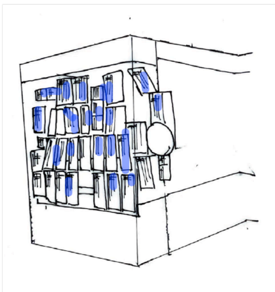

Level of integration in the context
Symbioses
Co-Existence
Camouflage
possible future
No individual autonomy - A centralized energy system
Partial individua
Level

energy relation framework - LIFE context









evolution

l autonomy - Local energy community

Full individual autonomy - off the grid

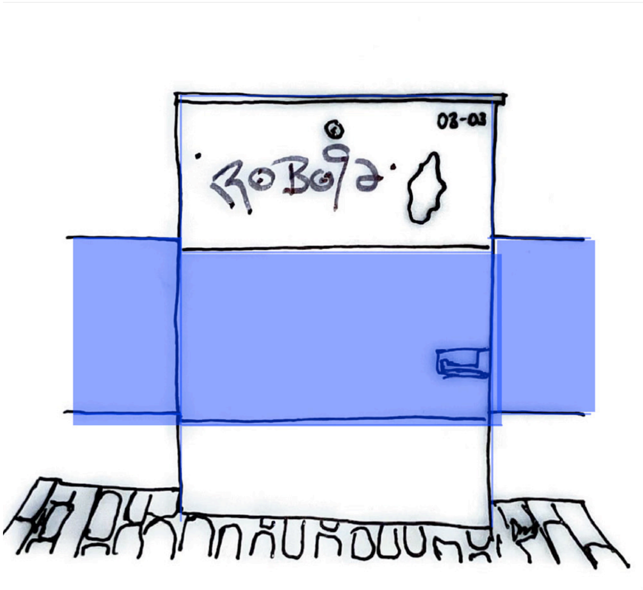
' of individual autonomy

possible future energy relations in venserpolder

Based on the framework and research findings, I have developed various scenarios that depict potential future energy relationships. These scenarios are valuable for facilitating discussions and gaining insights into the future landscape. Visual representations in the form of drawings make these scenarios more accessible and enhance communication. It is important to emphasize that these scenarios do not prioritize one future over another. Each scenario has its own advantages and limitations, and it is crucial to acknowledge them.
By making the future tangible, we can stimulate meaningful discussions and engage in collective decision-making processes.

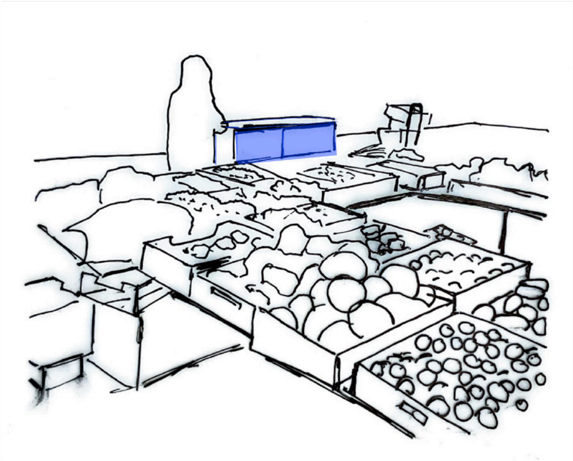
Furthermore, the Energy Framework can be used as a tool to explore and envision desired energy relationships in the future. By considering the different components of the framework, we can imagine and discuss a more desirable energy landscape. For instance, we can explore decentralized and community-driven energy generation and consumption instead of relying solely on large centralized power plants. This opens up possibilities for a more sustainable and inclusive energy system.

camouflage - no individual autonomy



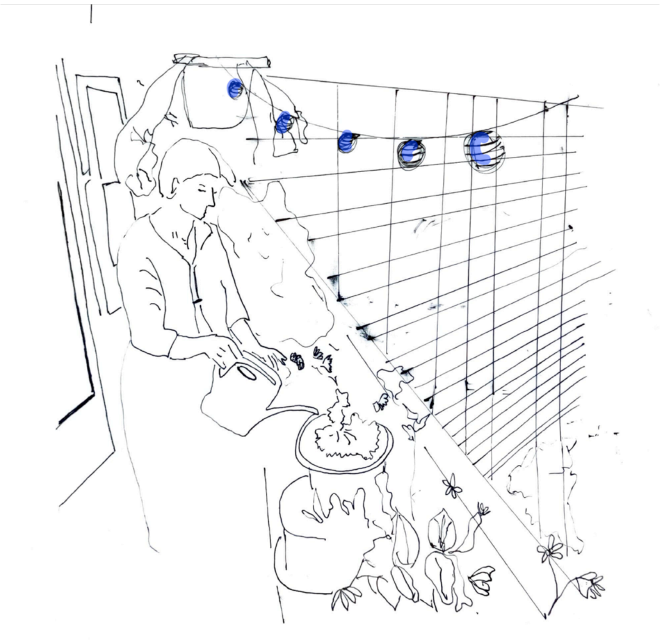
In this future context, there is a centralized energy system with limited individual autonomy. Everything is seamlessly and automatically organized, removing the need for individuals to actively manage their energy consumption. However, this convenience comes at the cost of personal control over energy usage and visibility of the energy infrastructure. The energy system operates behind the scenes, hidden from view, and individuals have no direct influence or awareness of their own energy consumption.

camouflage - partial individual autonomy



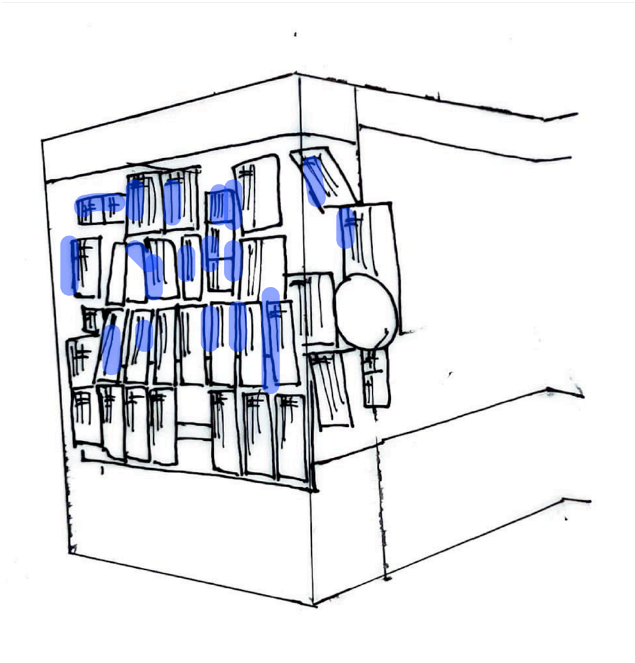
In this future world, portrayed in a painting of an energy market with hidden infrastructure among various stalls, there exists a partially individual autonomous energy system. The energy market operates on a sharing basis, where individuals allocate and distribute their energy resources among others. The infrastructure blends seamlessly into the vibrant market, making it difficult to differentiate from the surroundings. Individuals have some autonomy in managing their energy but must navigate the shared marketplace and make conscious decisions about resource allocation.

camouflage - full individual autonomy



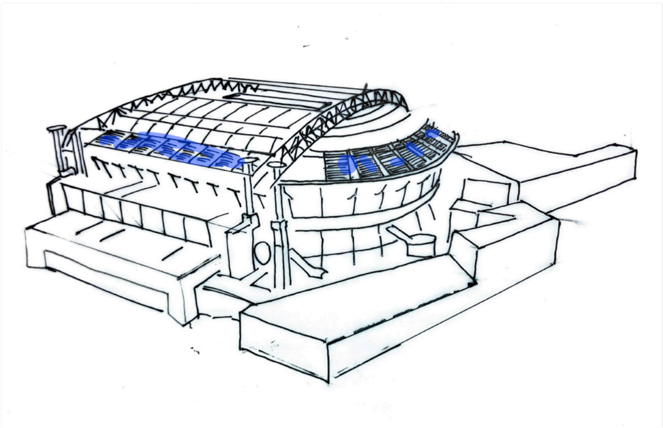
In this future world, depicted in the drawing of a woman on her balcony in a Bijlmerflat, solar-powered lights illuminate the surroundings, providing light at night. These lights operate independently, without the need for a grid connection. The energy production is cleverly hidden from view, seamlessly integrated into the environment. In this setting, individuals enjoy full autonomy over their energy usage, making decisions on how to utilize their energy resources. However, this autonomy comes with occasional limitations, as there may be times when access to energy is not available.

juxtaposition - full individual autonomy



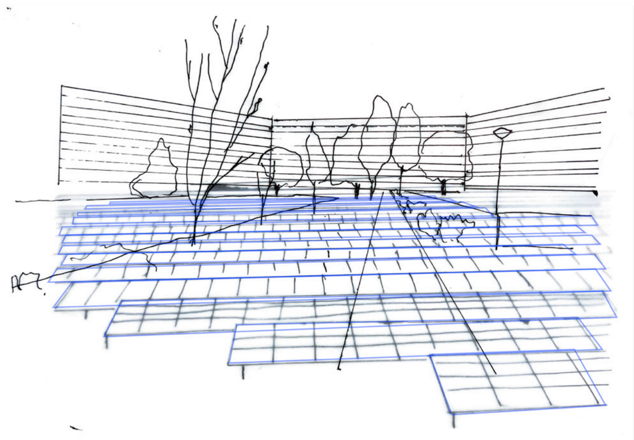
In this future world, depicted in the drawing of a balcony covered in solar panels, a man seeks full individual autonomy over his energy consumption. Frustrated with high energy prices, he covers his balcony with solar panels to generate his own electricity. While he gains significant energy independence, the trade-off is sacrificing his balcony view.

juxtaposition - partial individual autonomy



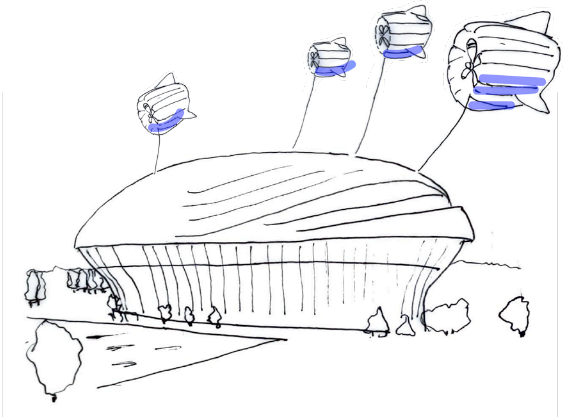
In this future world, the residents near the Johan Cruijff Arena experience partial autonomy in their energy choices. The Arena produces its own energy and shares excess power with the local energy community. Residents actively engage with their energy consumption, benefiting from shared resources. This partial autonomy enhances their relationship with energy, although it remains an add-on to their daily lives, not fully integrated.

juxtaposition - no individual autonomy



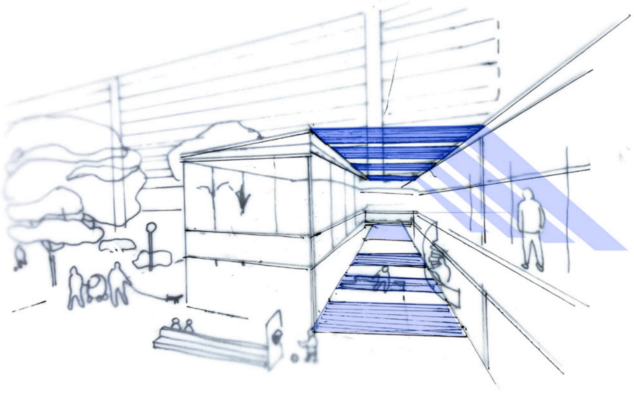
In this future world depicted by the drawing of a solar field in front of Bijlmer flats, individual autonomy is absent as the government fully regulates the energy system. The focus is on efficiency, with abundant solar energy provided by the expansive solar fields. However, the trade-off is the visual juxtaposition of a field filled with solar panels, raising the question of whether residents are willing to sacrifice the aesthetic appeal of their surroundings in exchange for ample energy supply. It highlights the tension between an efficient energy system and the desire for a visually pleasing environment.

symbioses - no individual autonomy



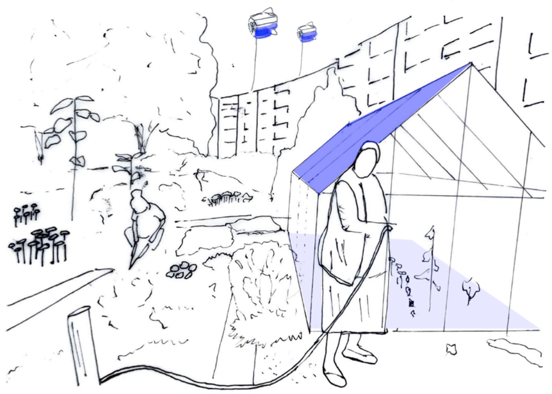
In this future world depicted by the drawing of a futuristic Johan Cruijff Arena with zeppelin windmills producing energy, individual autonomy is limited, and there is a focus on symbiosis between nature and the energy infrastructure. The vision is centered around respecting and preserving the natural environment, with the energy infrastructure seamlessly integrated into the surrounding context. Despite the integration, the energy system remains centralized, prioritizing efficiency and effective energy distribution.

symbioses - partial individual autonomy



In this future world depicted by the drawing of a scene in the Bijlmer with a roof covered in colorful solar panels, there is an emphasis on partial autonomy and symbiosis in energy production. The solar film panels showcase that solar panels can be aesthetically pleasing and blend seamlessly into the urban landscape. Not only do these panels generate energy, but they also provide shading for the neighborhood, enhancing comfort and reducing the reliance on external cooling systems. Moreover, the energy produced by these panels is shared with the nearby flats, fostering a sense of community and cooperation.

symbioses - full individual autonomy



In this future world depicted by the drawing of a community garden with a greenhouse covered in solar film and homegrown vegetables, the Groei & Bloei Vereniging exemplifies a model of full autonomy and symbiosis. The greenhouse, adorned with colored solar panels, generates energy for the vereniging while also serving as a hub for food production. It becomes a gathering place for the community, where meals for the local area are prepared and shared. However, despite its utopian appeal, there are limitations to consider. In winter, when food and energy resources are scarce, the garden is closed. It is a seasonal activity.

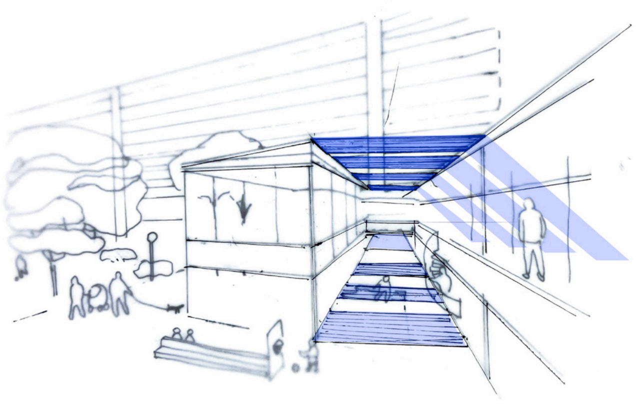
one possible future

This chapter explores one possible future energy relationship characterized by partial individual autonomy and symbioses. By choosing the aspect of partial autonomy, which aligns with future characteristics, and symbioses where energy is integrated into life, we establish a framework for designing interventions. The concept of partial individual autonomy emphasizes personal agency and self-reliance in energy practices, while symbioses highlight interconnectedness and mutual benefit.

In this future world:
The integration of solar technologies in our daily lives, allowing individuals to harvest and utilize the power of the sun, represents a shift in the relationship between human beings and energy. No longer an abstract concept that exists beyond our grasp, energy has become a tangible and attributed aspect of our lives, shaping our experiences and interactions with the world around us. The emergence of solar as a deliverable and desirable resource has transformed the very nature of energy, imbuing it with new meanings and values that have the potential to reshape our relationship with the environment and society.

In this future world, there is a transformation in the relationship between humans and energy, as solar technologies become an integral part of daily life and energy is no longer an abstract concept but a tangible aspect of people's lives. Energy systems become more democratic, and the availability of energy and weather patterns influence daily routines.

In the context of Venserpolder, a future energy relationship for residents could be characterized by a heightened awareness of their energy usage, a more direct and tangible interaction with energy, and a recognition of the importance of renewable energy sources like solar power. This relationship would be influenced by community energy usage and the weather patterns that affect the availability of energy.



one possible future

Residents *current* relation with energy:

1. Energy as something they have no autonomy over

2. Energy as something they don't know a lot about

3. Energy as something they don't have time for

→

Residents *future* relation with energy:

1. Energy is democratized and they have decision making power

2. Energy as something that is an integrated part in their daily life

3. Energy availability depends on the natural rhythms, which in turn shape the rhythms of the city.

04. exploring the possibility space

In this chapter, we embark on an exploration of the possibility space for our intervention. Our objective is to define the purpose of the intervention, identify desired interaction qualities, establish clear design goals, and consider the local conditions that influence our context. Through the examination of design literature and brainstorming, we aim to generate innovative solutions that extend the boundaries of what is considered achievable. This chapter serves as a foundation for our subsequent discussion on the intervention itself

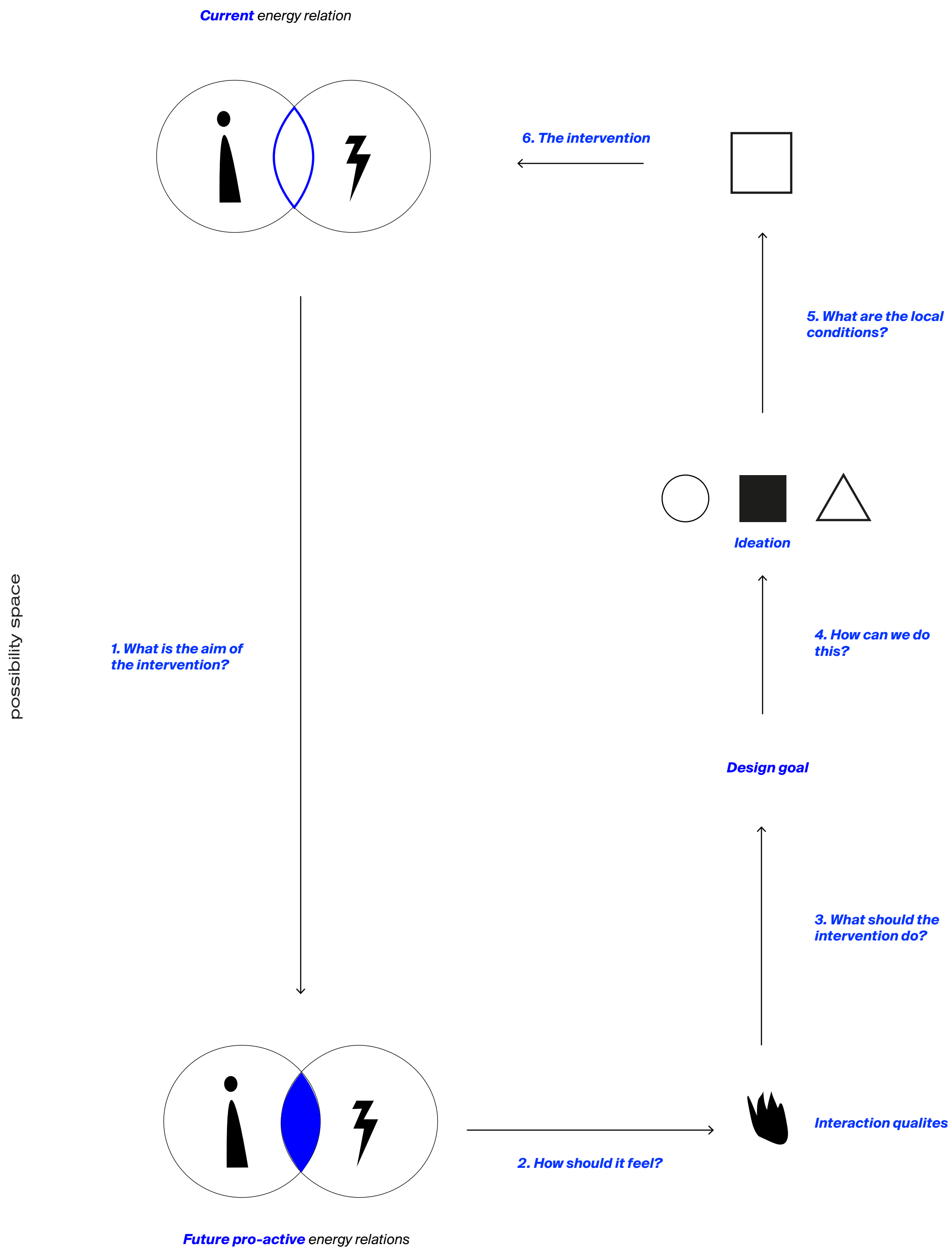


Figure explaining the design process.

design process

After establishing the desired future, the next step in the Systemic Design Toolkit involves exploring the potential options for designing new interventions. This process involves the creation of a functional prop that will allow residents to experience a future pro-active relationship with energy. Such props are critical tools in design speculations, as they help individuals imagine and consider alternative possibilities that challenge our societal ideals, values, and beliefs reflected in material culture (Speculative Everything, p. 89). As a side project separate from my main research, I enjoyed delving into the concept of a future energy relationship. To further explore this topic, I organized an "energy dinner" where I asked friends to prepare a dish related to energy, allowing them to interpret this theme creatively.

My goal is to design an intervention that could facilitate experiencing a pro-active relationship with energy including having control over their energy consumption. Ultimately shifting the perception of energy from a human-made and manipulated commodity to a natural and finite resource that we need to foster.

interaction vision

In order to establish a pro-active relationship between households and energy, understanding the desired emotions and interactions that the intervention should evoke is crucial. Therefore, an interaction vision was developed to capture these qualities. The interaction vision provides a description of the experience people have when interacting with the intervention, described with an analogy.

Energy as something we should care for

Fire, like energy, can bring us many benefits, but we also need to be aware of its limits and the impact it can have on our society and the environment. If we have an abundance of energy, we may be tempted to use it without much consideration, like putting big pots on top of a roaring fire. However, if we have a scarcity of energy, we need to be more careful and intentional with our use, like treating a dwindling fire carefully to keep it burning.

I especially choose the fire Calcifer, it is a character from the Japanese animated film "Howl's Moving Castle," by Studio Ghibli. Calcifer is a fire demon who powers the castle and has a close relationship with the main character, Sophie. This energy companion would be a tangible representation of our relationship with energy, something we can physically interact with and care for.

Interaction qualities

Enchantment:
Enchantment is related to the idea of a fire's allure, as it draws people in with its flickering flames and warmth. In the same way, an enchanting design intervention can capture people's attention and inspire wonder and curiosity, just as the fire metaphor seeks to do.

Feeling of control:
Feeling of control is related to the idea that energy, like fire, can be unpredictable and potentially dangerous. Giving residents a sense of control over the energy usage through an interactive installation can help mitigate the potential dangers and make them feel empowered in their relationship with energy.

Connectedness:
Connectedness is related to the idea that fire can bring people together, as they gather around it for warmth, light, and companionship. Similarly, an interactive installation that fosters a sense of connectedness can encourage residents to work together to conserve energy and care for their community.

enchantment

connectedness

feeling of control

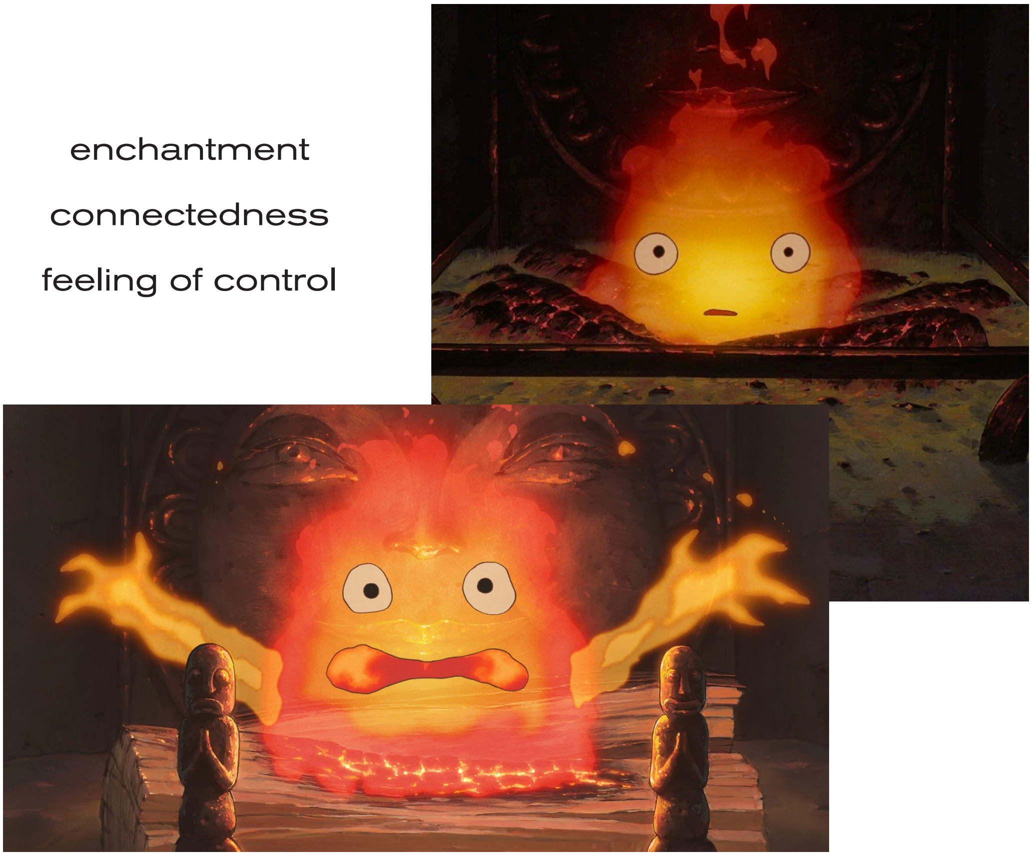


Figure 45: Calcifir, a still from Howl's moving castle, Ghibli studio, (Calcifer | Ghibli Wiki | Fandom, n.d.)

design goal

Design an *installation* *for* *residents in the public space* that allows for *enchantment* in order to get a better understanding of *the fluctuating energy on the local net* which is dependent on both the *energy income of the weather* and the *local energy demand.*

ideation

In this chapter, we delve into the process of ideation to explore how I can design for my identified design goal. The integration of renewable energy sources into our daily lives offers new opportunities for designers to shape the way we interact with energy. As Ilstedt Hjelm notes, design plays a critical role in shaping the material environment of our everyday lives and has the power to enable or disable human activity and behavior (Ilstedt Hjelm, 2004).

In the context of energy consumption, designers can create products that not only perform their intended function but also encourage energy awareness and conservation. As explored in “STATIC! The Aesthetics of Energy in Everyday Things,” design strategies such as decontextualization, defamiliarization, fragmentation, and other methods can create a resistance toward easy acceptance and use, leading users to reflect upon objects, their functions, and how we relate to them (Blauvelt, 2003; Dunne, 1999).

Moreover, the paper “Erratic Appliances and Energy Awareness” explores how critical interaction design can increase energy awareness by creating objects that expose issues related to energy consumption in various ways. By redesigning everyday objects around the theme of ‘erratic appliances,’ the aim is to use designerly and experience-based means to make people aware of their energy consumption instead of relying solely on meters and numeric displays.

“Design is a paradox in our lives, both anonymous and conspicuous, familiar and strange. It surrounds us while fading from view, becoming second nature yet standing apart from the world in which it exists, an alien presence against the grain of everyday life. “ (Strangely Familiar: Design and everyday life, Blauvelt 2003)

From the literature one primary design direction emerged, detaching energy-consuming objects from their usual contexts, prompting users to reconsider their relationship with these objects and their energy consumption.

Brainstorm sessions with 5 design students thinking about questions as how can you embody energy, how can you evoke surprise, how can you sense energy and a drawing session for the specific location at ArenApoort, can be found in Appendix E.

design conditions

As mentioned in chapter 1, Venserpolder is an overstudied area and we need to be careful for designing in this area. In this chapter I will explain how these design conditions influenced the design goal and the test set-up. Since Venserpolder is already overstudied, designing something for the residents is challenging and it is important to respect the residents and their safe spaces. This lead to the choice to do it in the public space. Also I will be taking their time, so its important to give something in return. It might just be a snack. This lead to design requirements.

Agency: involve the local community in plan development process and decision-making. The design intervention should give a feeling of control

Safe Spaces: take into account the importance of safe spaces and avoid being intrusive. The design intervention should be placed in the public space

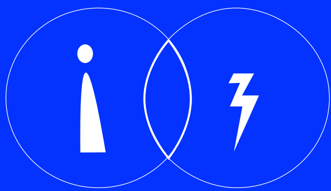
A Gentle Approach: gentle approach, with an emphasis on personal relationships, friendliness and fun. Gentle approach: The design intervention should be inviting and fun

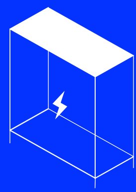
Visual and Tangible: use visual and tangible examples to make interventions more accessible.The design intervention shoud use easy language and visuals.

Giving Something Back: Give back to the community and avoid research fatigue.The design interventiontion should give something back to the residents.

conclusion

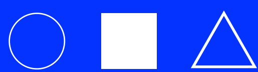
***Current** energy relation*





Design criteria
Agency
Safe Spaces
A gentle approach
Visual and tangible
Give something back

Aim
Allow residents to experience a future pro-active relationship with energy



How
1. Detaching energy-consuming objects from their usual contexts

2. Breaking down complex energy information into simpler parts

pro-active

Design goal

Design an installation for residents in the public space that allows for enchantment in order to get a better understanding of the fluctuating energy on the local net which is dependent on both the energy income of the weather and the local energy demand.

***Future pro-active** energy relations*

Interaction qualities

echanting
connectedness
feeling of control

05. the intervention

Figure 46: Prototype in local context

05.01. forekast


LIDL
0800 - 024 24 10
JOHN FLUEVOG
UNIQUE SOLES
FOR
UNIQUE SOULS
JOHN FLUEVOG SHOES
HEILIGEWEG 37 020 891 4255
FLUEVOG.COM

forekast

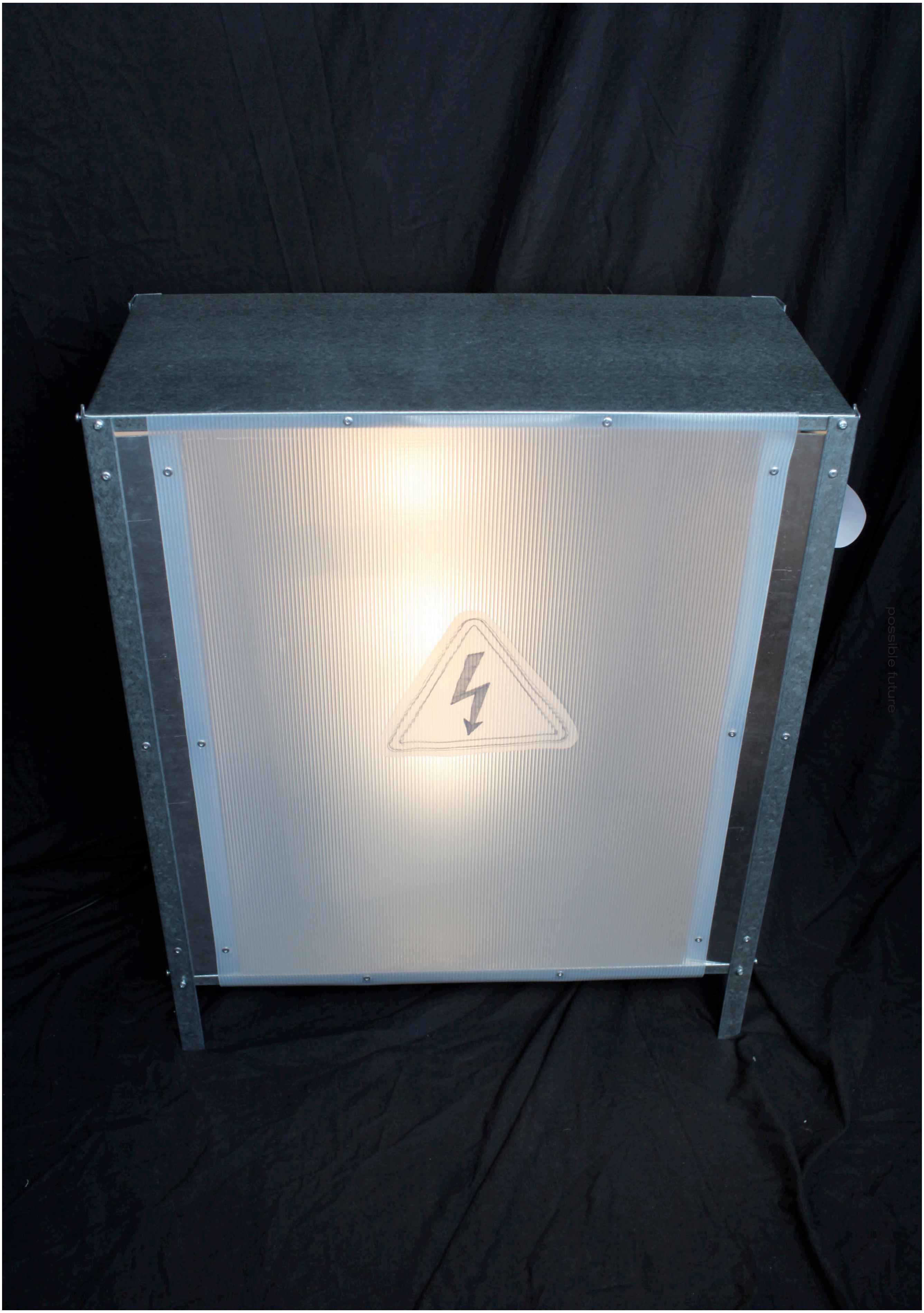
My aim with the design is to redesign the transformer box, which often blends into its surroundings and becomes unnoticed. By bringing attention back to this strange object, my goal is to increase energy awareness among users and demonstrate the dependence of energy on local weather conditions and energy consumption patterns.

To make energy more perceptible, my idea is to create a transparent transformer box that reflects the net fluctuations through lighting. This box will be installed in a public area, in the same spot as a regular transformer box. Additionally, it will generate an energy receipt that provides your personal local energy balance, which is influenced by the weather conditions and energy demand in your area. The product's purpose is to provide a tangible sense of the net fluctuations, conveyed through gentle exterior lighting.

Forekast impact on their energy relationship, evaluating the prototype's interaction qualities including enchantment, feeling of control, and connectedness, which aim to captivate attention, empower residents by informing, and foster a sense of community in the local area.

Value for residents
Forekast aims to bring value to residents by increasing their energy awareness and understanding of the interplay between energy consumption and local weather conditions. By making energy perceptible through the transparent box and providing personalized energy receipts, residents can develop a stronger connection with their energy usage and its impact. The intervention seeks to empower individuals to make informed decisions about their energy consumption.

Value for the LIFE project
Forekast aims to holds value for the LIFE project by aligning with its objectives of promoting sustainable energy practices and fostering community engagement. The intervention contributes to the project's goals by raising energy awareness and encouraging residents to actively participate in the energy transition. Additionally, Forekast's emphasis on community connectedness helps create a sense of shared responsibility and collective action working towards a local energy system.


possible future

05.02. forekast details

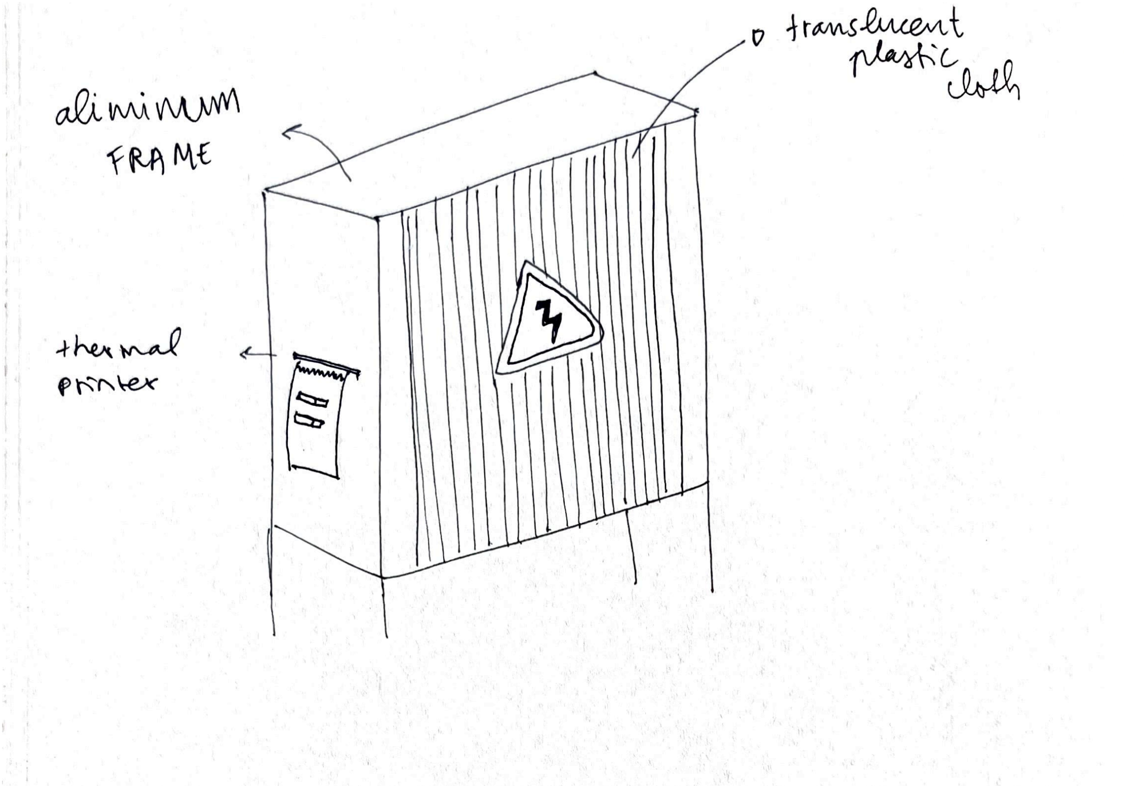
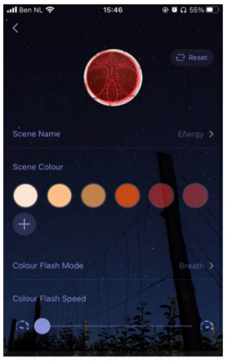


Figure 47: Sketch Forekast

lights

The lighting system implemented in Forekast utilizes different colors and intensities to represent the amount of energy on the net. Drawing inspiration from the analogy of a fire, the color and intensity of the light bulb resemble the vibrant and dynamic nature of flames. When there is an abundance of energy available, the lights shine brightly, almost emanating from the transformer box, creating a sense of invitation and prompting passersby to engage with it. By captivating people's attention the intervention aims to create an enchanting experience. Drawing parallels to the magnetizing characteristics of a fire's flickering flames and warmth, the design intervention seeks to evoke similar emotions. Conversely, when energy availability is low, the lights dim down, indicating a more conservative approach to energy usage, it should evoke a feeling that we need to care for the energy.

To represent the fluctuations of the net, given limited programming skills and real-time data access, the chosen approach is to mimic the net's changes using programmable light bulbs arranged in a sequence (refer to Figure X). The vertical arrangement of the lights, stacked above each other, was selected as it creates the closest resemblance to a real fire, enhancing the overall effect and immersion of the intervention.



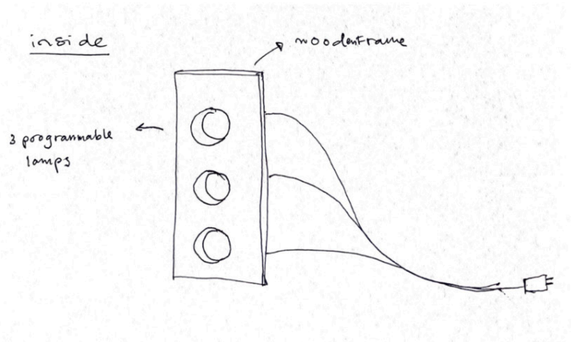


Figure 48: Screenshot of app to install lights
Figure 49: Sketch set-up lights

Figure 50: Four stages of lighting prototype.

receipt

The receipt serves as a tangible takeaway, reminding residents of their impact on energy fluctuations and empowering them to take control of their energy usage. By making energy visible , the intervention aims to enhance residents' autonomy and engagement with the local energy system. Connectedness is an important aspect of the design intervention, drawing inspiration from the idea that fire brings people together. In the same vein, the interactive installation seeks to foster a sense of connectedness among residents, encouraging them to work collectively to conserve energy and care for their community. The receipt serves as a point of connection, creating a shared experience and common understanding of the importance of energy conservation. A Bluetooth thermal printer is integrated into the Forekast installation to print the receipt. Prior to printing, I would manually reflect on the current weather conditions and light intensity. These factors will determine the content of the receipt (one of the four options, see figure below). By leveraging real-time environmental data, the intervention ensures that the receipt is tailored to the specific energy fluctuations being represented, enhancing its relevance and contextual significance.

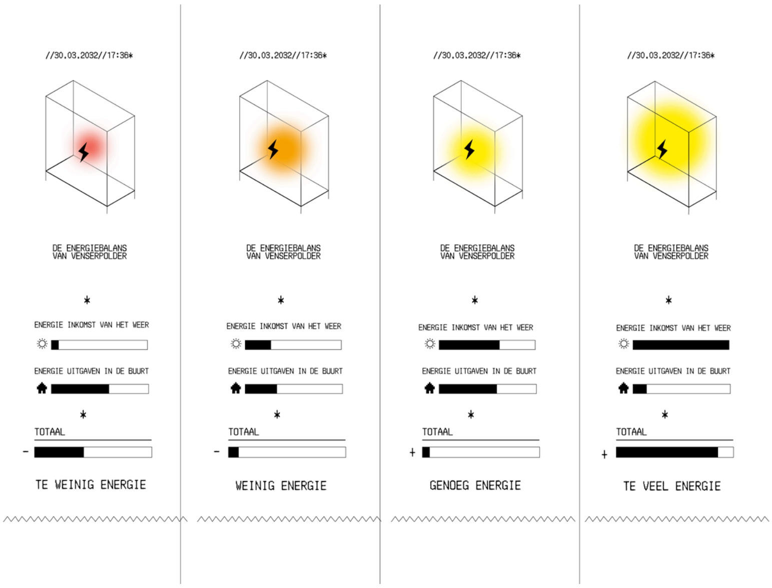
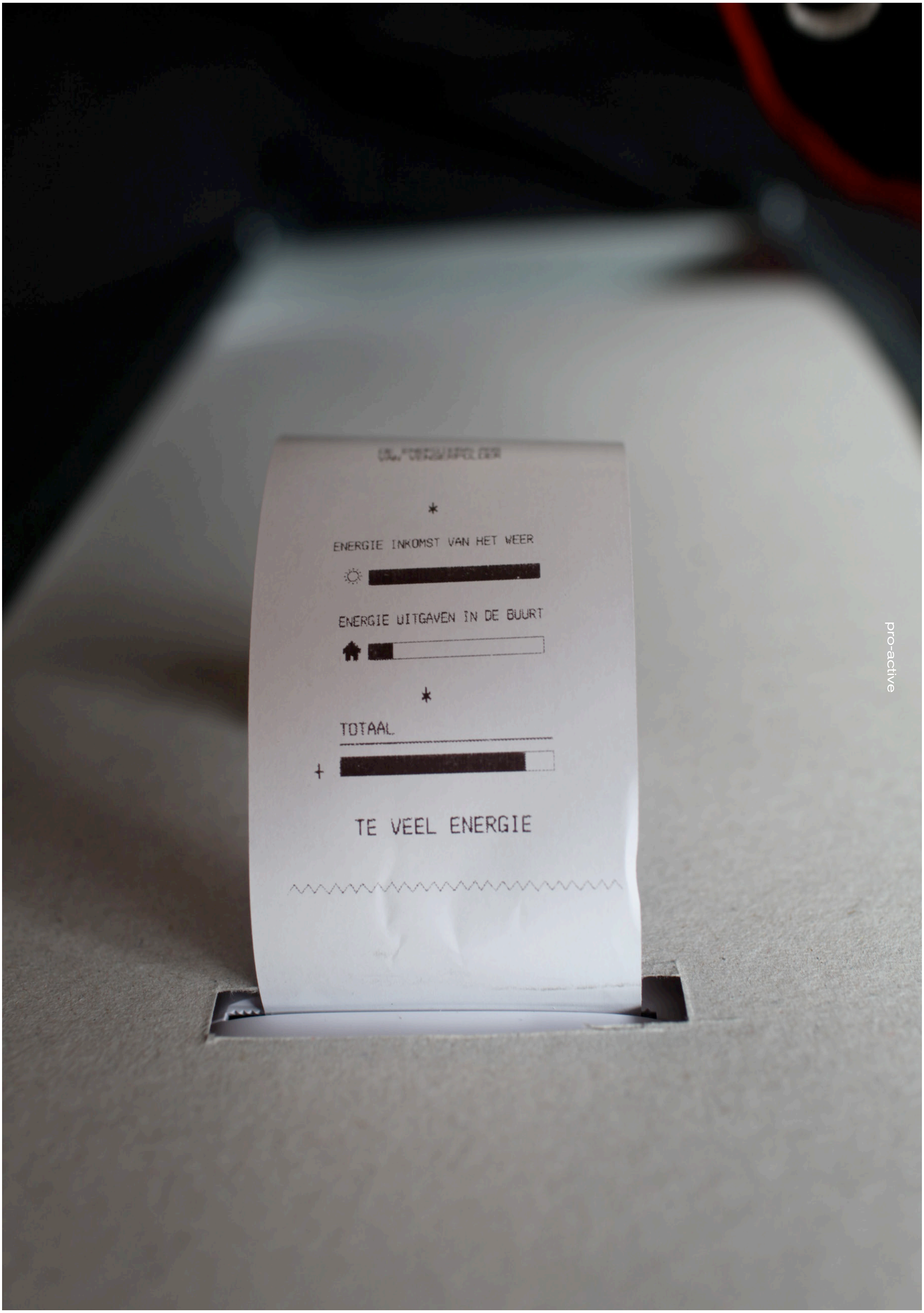


Figure 51: Design of the receipts for the different stages


*
ENERGIE INKOMST VAN HET WEER
ENERGIE UITGAVEN IN DE BUURT
*
TOTAAL
+
TE VEEL ENERGIE

06. evaluation

The evalution chapter explores how the framework and Forekast work in practice. It seeks public opinion on the impact of the framework and Forekast on their energy relationship. The chapter is devided in two parts: 1. Testday 1: Seminar Energie lab Zuid-Oost and 2. Testday 2: Streettest Bijlmerplein.


AMSTER
DAMSE
POORT
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JONGE
REPORTERS
COFFEE&FOOD
PUMA

06.01. Test 1- Seminar Energie lab Zuid-Oost

aim and set-up

The aim

The primary objective of the test was to assess people's understanding of Forekast and determine the suitability of the energy relation framework as a tool for discussing a desired future energy relationship that aligns with the vision of multiple stakeholders. The test at the seminar aimed to gather initial insights into people's reactions to the intervention, while the second test at ArenApoort delved deeper into evaluating whether the desired design goal was achieved.

The set-up

The event was the yearly seminar from the Energie Lab Zuid-oost from the municipality. The event took place on the 30th of March and was attended by 90 people at the Groene Hub in Amsterdam-Zuidoost. The event consisted of a plenary part and an interactive part where there was the choice to join one of the four workshops. During the breaks, people could walk around and see the posters of the graduating students. This was where I set up my intervention. The Forekast was plugged in so it could change colour and attract attention. It was placed below a poster of the different transformer boxes with a print of all the receipts, next to this I brought an A2 format of the framework placed on cardboard and hung it next to the Forekast, together with an invitation to vote (see Figure 52, below). When people approached I explained them first a bit out the Forekast and gave them a receipt hereafter I explained the basics of what the energy relation framework tries to communicate and asked them two questions: 1. Where would you place our current relationship with energy? And 2. Where would you like our future energy relationship to go?

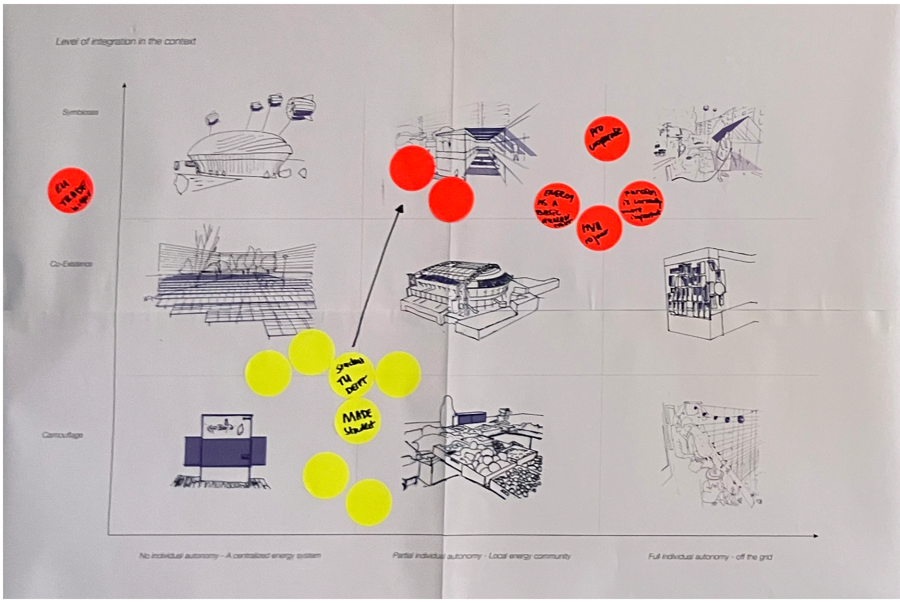


Figure 52: Framework with votes

current & future energy relations

The drawings on the framework captivated people's attention. Having something visual and tangible really helped form an opinion on an energy relation. People had to reflect on their current behavior and what they thought was desirable. Having to position yourself in a framework it helps you reflect and argue why you think why you want to go there. I noticed that everyone knew quite well where they wanted to position themselves. What was also interesting is that all the participants were quite like-minded, especially for the current energy relation positioned at camouflage on the vertical axis and between no individual autonomy and partial individual autonomy. The future relations were a bit more spread out but were almost all positioned towards a higher level of autonomy and a higher integration of the context.

"Yeah, I was just having a closer look at the drawings"
"Hmm I am a big fan of energy cooperations, so I would put it more in the middle"
"I think it would be good to have more autonomy, thats why I put it more to the right"

Conclusion:
The framework successfully explored the contemporary attitude towards current and future energy relationships, with participants using the visual and tangible framework to reflect on their behavior and position themselves in the framework, revealing a majority towards higher autonomy and integration in future energy relations

Limitations:
The Target group was knowledgeable about the energy sector:
The framework was tested with a group of people who all had a background within the energy sector. This could potentially limit the generalizability of the findings to a broader audience who may have different levels of knowledge and perspectives on energy. This could also explain why the answers were quite like-minded.

The explanation took too long:
The process of explaining the framework to participants took quite long. This could potentially impact engagement of the testing process, as participants may have become fatigued or lost interest during the lengthy explanation, additionally it might be confusing. This limitation highlights the need for concise and clear communication when testing the framework especially when testing in a context where there is less time and people have limited knowledge on the topic.

Recommendations:

R1 Framework: *Make the framework easier to understand and concrete*
Make the text simpler especially when testing with participants that don't have too much knowledge about the topic. With the drawings in the area of ArenApoort I already tried to make the future energy relations more recognizable, but I think it is important to do it on a more individual level, how does if affect an individual household. A start could be with changing the names of the axis for example changing the level of integration in the context to the level of how much energy plays a role in my life: 1.Energy is hidden 2. Energy and I live next to each other, 3. Energy and I are working together. The horizontal axis could be changed from level of autonomy to level of control: 1. Energy you get 2. Energy teamwork - sharing energy, 3. Your own energy - full control.

R2 Framework: *Test with residents venserpolder*
It was confirmed that people within the energy sector can position themselves, but it is also crucial to test if this would work the same with residents in venserpolder. The difficulty here is to set-up a session in a safe space in order to get valuable insights. A street test could also work but it is crucial to simplify and shorten the framework in order to make the test valuable.

framework as a tool

The framework was tested during the breaks, where people get something to eat and drink. This resulted in more individuals rather than groups of people testing the framework. This made it harder to have a discussion. But there were definitely interesting starting points for discussions. Due to the practical and reflective nature of the framework, people were speaking their thoughts out loud. There was one man who worked at the Hoge school van Amsterdam, who positioned the sticker outside the framework all the way to the left. His reasoning was that we should even be more connected to the global energy network therefor giving up more individual autonomy. This was an interesting choice, and could have lead to an interesting discussion if discussed in a group with different stakeholders. Some other interesting statements were made regarding the visibility and efficiency of solar panels and seeing energy as a basic human right.

Man HVA: "I choose to put the sticker all the way to the left because I think we need to be connected to the European network."

Student AMS: "In my opinion energy is a basic human right and should be accessible for everyone"

Man: "Function of the panels is currently more important, than what they look like"

Conclusion:
The primary objective of the testing was to assess the framework's potential as a tool for envisioning and discussing a more desirable future energy relationship. However, due to suboptimal conditions in the current setup, it is challenging to definitively determine its effectiveness as a tool. Further testing in a different setting is necessary to obtain conclusive results. It would need more testing in a different setting. Nevertheless, it showed signs of traction.

Limitations:

Tested in an informal setting
The test was conducted in an informal setting without facilitating group discussions using the framework as a tool. This limited the opportunity for participants to collectively explore and evaluate its effectiveness in envisioning and discussing a more desirable future energy relationship.

Recommendations:

R3 Framework: *Test in groups with different stakeholders*
Aim for a diverse range of participants from different backgrounds, experiences, and perspectives. This will provide a better evaluation if the framework is suitable a s a tool for both people with and without background knowledge in the energy sector.

R4 Framework: *Test in a different context*
To fully explore the potential of the framework as a discussion tool, it is recommended to organize structured group discussions. This could helpe finding the underlying motivations of the choices made in the framework and help allign stakeholders on a desired future relationship with energy.

forekast

Aim:

The primary objective of the test was to assess people's understanding of Forekast and to get a first glimpse of their attitudes toward the design.

Findings:

People were intrigued by the box that was changing lights, they were curious and it attracted people, which in turn led to interesting conversations. It was not directly clear that it communicated the fluctuations on the net, after giving the receipt many of the people understood and were very positive. It was a surprising view of looking at energy. Since the people dind't understand what the changing lights represented it was important to stand next to the design to provide additional information.

"Oh yeah now that you say it, I see that it is a transformer box"

Student AMS: "Ahh Funny, I never looked at that this way, nice work"

Conclusion:

The test revealed that people were initially intrigued by the changing lights of the box, which attracted their curiosity and sparked interesting conversations. Although it was not immediately clear that the design communicated the fluctuations on the energy grid, many participants understood its purpose after receiving the receipt and responded positively. The unconventional perspective on energy was surprising to them,

Limitations:

Location inside
The Forekast was placed indoors, and although positioned underneath a poster of transformer boxes, people did not recognize its purpose. This could be due to the design, but another possibility could be that you don't normally see transformer boxes placed indoors which might make it harder to recognize one as such. In the next test the design will be placed outside in the normal context of a transformer box.

R1 Forekast: *Possibility to be a standalone object*
Since the people didn't understand what the changing lights represented it was important to stand next to the design to provide additional information. There is also something to say about this because it sparks people's curiosity and discussion. But it can also be interesting to investigate a design that could be a stand-alone object that can be easily recognized and understood by people without the need for additional information. This can be achieved through an informative sign that conveys the purpose and meaning of the changing lights, allowing it to reach more people.

Figure 53: Poster Trafokast

Figure 54: Set-up evaluating Energie Lab Zuid-oost

06.02. Test 2 street test ArenApoort

aim and set-up

Aim of the test

The test aims to assess the design goal of an enchanting installation in the public space, enhancing residents' understanding of fluctuating energy and fostering their pro-active energy relation. It also seeks public opinion on the Forekast impact on their energy relationship, evaluating the prototype's iinteraction qualities including enchantment, feeling of control, and connectedness, which aim to captivate attention, empower residents by informing, and foster a sense of community in the local area.

Set-up

The test was conducted together with Chia a fellow design student doing her graduation thesis within the LIFE project. The location was similar to the last street test at Bijlmer-plein, because we will have both business people, residents and visitors. A mixed group of residents, and people that work in the area. In total we had 11 conversations with 15 participants. From all age groups. The test was conducted on Tuesday afternoon 2nd of May, the weather was good and there were a similar amount of people around since the last time. I rented a battery so I had freedom in placing the forekast wherever I wanted.

The findings were recorded directly afterwards with a voicememo, these were later transcribed and can be found in Appendix F.

Figure 55: Testing forekast at Arenapoort.

feeling of control

Aim:

The installation should provide clear and meaningful information about the fluctuating energy on the local net, including how it is affected by weather and local energy demand.

Findings:

When asking what they thought the Forekast often they didn't have an answer. Twelve of the respondents would say it had something to do with energy. But only three kids could tell me it was a transformer box and none of the respondents could tell that the changing lights were reflecting the fluctuations on the net. The electricity sign helped and the receipt as well by explaining what the intervention tries to communicate. A reason could have been that the sun was shining quite brightly the changing of the lights was not that visible this could also play a role.

Ghanese woman: "Huh but why is the energy fluctuating?"

Two guys working at Vattenfall: It has something to do with energy? High voltage?

Father with two kids: "No idea", I really don't know"

Conclusion:

The findings of the test indicate a need for improvement in providing clear and meaningful information about the fluctuating energy on the local net through the Forekast installation. While some respondents had a general understanding that the installation had something to do with energy, very few were able to recognize it as a transformer box or understand that the changing lights represented fluctuations on the net. If the

Recommendations:

R2: *Brighter lights*
Enhance the visibility of the installation by using brighter lights. This will help draw attention to the changing lights and make it easier for people to notice and interpret the representation of energy fluctuations. Currently there are three lamps included, this could easily be 9. The only thing to take into account is the electricity demand that will also increase and wiring.

R3: *Improve connection with the weather & local net*
Establish a connection between the installation, the local net, and the weather. Incorporate visual cues or information that link the changing lights to weather conditions, such as displaying weather icons or using color patterns that correspond to different weather patterns. This will provide a clearer context and enhance the understanding of how weather influences energy fluctuations on the net. It would be ideal if could be realised real time.

Limitations:

There were two possible limitations that might have affected how people recognized and understood the installation as a representation of energy fluctuations. Firstly, somet of the particpants were not familiar with the concept of energy fluctuations on the net, which made it difficult for them to identify and understand the installation's message. Secondly, transformer boxes don't stand out in the public space, which could have made it more difficult for people to connect the installation with energy infrastructure.

enchantment

Aim:
The installation should be designed to evoke a sense of enchantment, capturing people's attention and inspiring wonder and curiosity.

Findings:
This worked incredibly well. Standing in the public space with the design we sometimes didn't even have to address people on the streets, they came to us. They were curious and approached us asking what we were doing and what the intervention was. The participants were very interested.

Three men from the Gemeente: "What are you doing here if I may ask?"

Lady around the age of 80: "Why are you doing this, are you part of an organisation?"

Middle aged man: "Is this an art project"?

Conclusion:

Based on the findings, it can be concluded that the installation successfully captivated the attention of the public. The sense of enchantment generated by the design attracted people's curiosity, leading to spontaneous engagement and inquiries about the intervention.

Recommendations:

R4 Forekast: *Use as a conversation starter to engage with local residents*
The design intervention has demonstrated its effectiveness in capturing attention and generating curiosity, making it an ideal tool for initiating conversations and gathering insights from the community. Its non-intrusive nature and interesting appeal make it well-suited for further research within the LIFE project.

connectedness

Aim:

The aim of the test regarding connectedness is to evaluate how Forekast, as an interactive installation, can foster a sense of connectedness among residents, creating a shared experience that emphasizes the interdependence of energy availability on both weather conditions and the energy usage of their neighbors.

Findings:

The statements from residents primarily focused on their own energy usage and its impact on the installation, rather than emphasizing the interdependence of energy availability among neighbors. This suggests that the installation might not have effectively conveyed the message of interdependence. One resident mentioned the importance of raising awareness and the benefit of learning from their neighbor's experiences. This indicates that knowledge sharing and community interaction can be beneficial in the context of adopting sustainable energy solutions.

Grandmother with her grandson: "Before I didn't know how to get solar panels but when I was talking with a neighbor they told me about this energy cooperation, and now that I joined it is much easier because they have already been through the process once so you can just ask your neighbors. It is very important to make people aware about this. Because it is really nice to part of this cooperation."

Conclusion:

While the residents mentioned the importance of community and connectedness, , it can be concluded that the installation did not effectively foster a sense of connectedness among residents or significantly promote a communal understanding of energy dynamics. The data suggests that there is a need for clearer communication and better explanation of the installation's purpose and its representation of energy fluctuations.

Limitations:

Not interactive:
One limitation of the installation was its lack of interactivity. Due to time constraints and limited technical expertise, the original plan to create an interactive installation could not be fully realized. The only interactive element present was the receipt, which may have limited the overall sense of connectedness with the neighborhood. The absence of interactive features may have hindered opportunities for active engagement and participation, potentially reducing the level of community involvement.

Recommendations:

R5: *Enhance interactivity:*
To deepen residents' engagement and cultivate a stronger sense of active participation, it would be intriguing to explore innovative ways to enhance the interactivity of the installation. One idea could be to introduce a "prisoner's dilemma" scenario with energy use in the neighborhood. Each resident could be provided with a lightbulb that they can turn on when there is ample energy supply. However, when the energy supply becomes limited, not everyone would have the capacity to turn on their lightbulbs simultaneously. This interactive element would encourage residents to make conscious decisions about their energy usage, promoting a sense of responsibility and collaboration in managing energy resources within the community.

R6: *Incorporate real-time data*
To provide a more authentic and dynamic representation of energy fluctuations, it is recommended to connect the installation to the actual local energy grid and incorporate real-time weather conditions. This integration would enable residents to observe the immediate impact of weather patterns and energy demand on the local net, enhancing their understanding of energy consumption and feeling of connectedness in the local area.

R7: *Expand presence at larger events or festivals*
What could be interesting to investigat is increasing the installation's reach by showcasing it at larger-scale events or festivals. An intriguing idea could be connecting multiple food trucks to a transparent transformer box, visually demonstrating the fluctuations on the local net that are influenced by both weather conditions and the energy demand from the food trucks. When the sun is shining everyone can use the energy they need, but when it is not, your fries might take longer or you have to choose a less energy intensive dish. Or you might even have to use your own human power to generate the energy needed for cooking.

Such an expanded setup would facilitate discussions and raise awareness about the intricate relationship between energy supply, demand, and sustainability. I am enthusiastic about further exploring these ideas.

Figure 56: Testing Forekast ArenApoort

energy relations

Aim:

My goal is to test if the intervention increased energy awareness among users and demonstrate the dependence of energy on local weather conditions and energy consumption patterns would lead to a change in their relation towards energy.

Findings:

The findings indicate mixed responses regarding behavior change and the adoption of a more active relationship with energy. The overall note was that participants would not consider changing their behavior based on the availability of energy. Based on the interviews I identified factors they mentioned for not changing their behaviour. Some were in line with my previous findings.

Age matters
The responses from different age groups varied. Older participants, such as an elderly lady, expressed less inclination to change their behavior. On the other hand, children mentioned adapting their activities based on energy availability, opting to play outside when energy is scarce and engaging in energy-consuming activities indoors when energy is abundant.

Older lady around 80:I don't think so. I'm too old for that. I will not change my behavkour anymore. I think other people can change their behavior. Like now is not the time anymore.

Three kids on the bike around 10: Like when there's not a lot of energy, I would just go play outside. I was like, yeah. And then I said, like, yeah. And when there's a lot, I would maybe stay inside and say yeah, because then maybe when there's a lot, you can do things that cost energy.

Earlier findings confirmed

Limited Knowledge
Some participants admitted that they hadn't previously thought about energy fluctuations. This indicates a lack of awareness or concern about energy consumption, which could be a significant barrier to behavior change.

Ghanese women around 40 : "Huh but why is the energy fluctuating?"

Limited agency
Several participants mentioned that they did not have control over their energy consumption or the means to make significant changes. For example, one person mentioned living in a studio and not having the agency to install solar panels. Others mentioned living in shared flats or being unable to afford energy-saving measures.

They wouldn't change their behaviour because they didn't have agency they lived in a shared flat. With the knowledge they wouldn't change their behaviour, only if the money difference would be really big.

Man that works in the area mid 30's: No, don't think about it [energy fluctuations] that much, but I think would be different if I had solar panels myself. Then I would check it all the time.

Two guys from around 20 working at Vattenfal : "No I wouldn't change my behaviour if I knew about the fluctuations, I live in a shared flat you know" [...] "maybe if the money difference would be really big I would consider it"

Limited time and other priorities
Some participants acknowledged the potential benefits of changing their behavior based on energy fluctuations, but they expressed a lack of motivation or willingness to put in the effort. They mentioned that it would require too much time and effort to consider when to perform energy-consuming tasks, such as laundry.

Man that works in the area:
But mainly I think it would take a lot of time also to think of like, OK, when do I do the washing and these kinds of things. So it was a bit. Much effort to to do that.

Conclusion:

The intervention aimed to raise energy awareness and foster an active energy relationship. While participants showed varied responses to behavior change, with older individuals exhibiting less enthusiasm compared to children, engaging with the residents of Venserpolder and discussing energy fluctuations had value in itself. It increased awareness among participants about energy fluctuations and their potential impact on energy consumption. These findings offer insights for the LIFE project and highlight the importance of continued engagement with residents to explore further opportunities.

Limitations:

The study may have limitations in terms of sample size and representativeness, which could affect the generalizability of the findings.

Recommendations:

R1 LIFE project: *Continuous Engagement*
Maintain an ongoing dialogue with residents to sustain their awareness and interest in energy-related issues. This can be achieved through community events, workshops, or online platforms that provide opportunities for information sharing, discussions, and collective problem-solving.

Testday 1: Seminar Energie lab Zuid-Oost

The framework successfully explored the contemporary attitude towards current and future energy relationships.

Participants used the visual and tangible framework to reflect on their behavior and position themselves, revealing a majority leaning towards higher autonomy and integration in future energy relations.

Testday 2: Streettest Bijlmerplein

The Forekast installation intrigued participants with its changing lights and sparked interesting conversations.

Although it was not immediately clear how the design represented energy fluctuations, participants understood its purpose after receiving the receipt and responded positively.

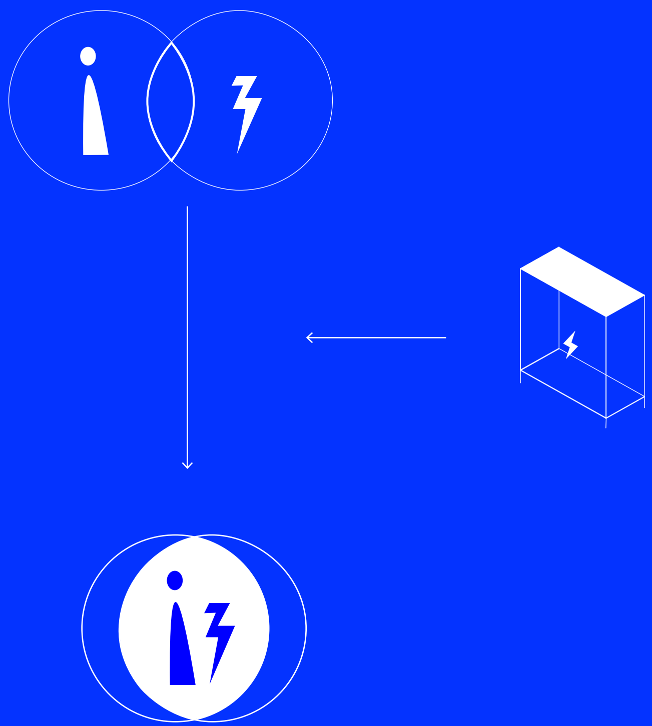
Clearer communication is needed to convey the installation's purpose and its representation of energy fluctuations.

Conclusion:

The evaluation chapter provides valuable insights into the effectiveness of the framework and Forekast installation as tools for envisioning and discussing a more desirable future energy relationship.

The framework engaged participants and revealed a preference for higher autonomy and integration.

The Forekast installation attracted public attention and generated curiosity, but clearer communication is needed to enhance understanding and foster a sense of connectedness among residents.



recommendations

Framework

R1 Framework: Make the framework easier to understand and concrete

Make the text simpler especially when testing with participants that don't have too much knowledge about the topic. With the drawings in the area of ArenApoort I already tried to make the future energy relations more recognizable, but I think it is important to do it on a more individual level, how does if affect an individual household. A start could be with changing the names of the axis for example changing the level of integration in the context to the level of how much energy plays a role in my life: 1.Energy is hidden 2. Energy and I live next to each other, 3. Energy and I are working together. The horizontal axis could be changed from level of autonomy to level of control: 1. Energy you get 2. Energy teamwork - sharing energy, 3. Your own energy - full control.

R2 Framework: Test with residents venserpolder

It was confirmed that people within the energy sector can position themselves, but it is also crucial to test if this would work the same with residents in venserpolder. The difficulty here is to set-up a session in a safe space in order to get valuable insights. A street test could also work but it is crucial to simplify and shorten the framework in order to make the test valuable.

R3 Framework: Test in groups with different stakeholders

Aim for a diverse range of participants from different backgrounds, experiences, and perspectives. This will provide a better evaluation if the framework is suitable a s a tool for both people with and without background knowledge in the energy sector.

R4 Framework: Test in a different context

To fully explore the potential of the framework as a discussion tool, it is recommended to organize structured group discussions. This could helpe finding the underlying motivations of the choices made in the framework and help allign stakeholders on a desired future relationship with energy.

Forekast

R1 Forekast: Possibility to be a standalone object

Since the people didn't understand what the changing lights represented it was important to stand next to the design to provide additional information. There is also something to say about this because it sparks people's curiosity and discussion. But it can also be interesting to investigate a design that could be a stand-alone object that can be easily recognized and understood by people without the need for additional information. This can be achieved through an informative sign that conveys the purpose and meaning of the changing lights, allowing it to reach more people.

R2 Forekast: Brighter lights

Enhance the visibility of the installation by using brighter lights. This will help draw attention to the changing lights and make it easier for people to notice and interpret the representation of energy fluctuations. Currently there are three lamps included, this could easily be 9. The only thing to take into account is the electricity demand that will also increase and wiring.

R3 Forekast: Improve connection with the weather & local net

Establish a connection between the installation, the local net, and the weather. Incorporate visual cues or information that link the changing lights to weather conditions, such as displaying weather icons or using color patterns that correspond to different weather patterns. This will provide a clearer context and enhance the understanding of how weather influences energy fluctuations on the net.

R4 Forekast: Use as a conversation starter to engage with local residents

The design intervention has demonstrated its effectiveness in capturing attention and generating curiosity, making it an ideal tool for initiating conversations and gathering insights from the community. Its non-intrusive nature and interesting appeal make it well-suited for further research within the LIFE project.

R5 Forekast enhance interactivity:

To deepen residents' engagement and cultivate a stronger sense of active participation, it would be intriguing to explore innovative ways to enhance the interactivity of the installation. One idea could be to introduce a "prisoner's dilemma" scenario with energy use in the neighborhood. Each resident could be provided with a lightbulb that they can turn on when there is ample energy supply. However, when the energy supply becomes limited, not everyone would have the capacity to turn on their lightbulbs simultaneously. This interactive element would encourage residents to make conscious decisions about their energy usage, promoting a sense of responsibility and collaboration in managing energy resources within the community.

R6 Forekast: Incorporate real-time data:

To provide a more authentic and dynamic representation of energy fluctuations, it is recommended to connect the installation to the actual local energy grid and incorporate real-time weather conditions. This integration would enable residents to observe the immediate impact of weather patterns and energy demand on the local net, enhancing their understanding of energy consumption and encouraging mindful energy usage.

R7 Forekast: Expand presence at larger events or festivals:

Consider expanding the installation's reach by showcasing it at larger-scale events or festivals. An intriguing idea could be connecting multiple food trucks to a transparent transformer box, visually demonstrating the fluctuations on the local net that are influenced by both weather conditions and the energy demand from the food trucks. When the sun is shining everyone can use the energy they need, but when it is not, your fries might take longer or you have to choose a less energy intensive dish. Or you might even have to use your own human power to generate the energy needed for cooking.

Such an expanded setup would facilitate discussions and raise awareness about the intricate relationship between energy supply, demand, and sustainability. I am enthusiastic about further exploring these ideas and engaging in meaningful conversations.

R1 LIFE project:

Continuous Engagement: Maintain an ongoing dialogue with residents to sustain their awareness and interest in energy-related issues. This can be achieved through community events, workshops, or online platforms that provide opportunities for information sharing, discussions, and collective problem-solving.

07. fostering the transition

The final chapter of this thesis focuses on fostering a future relationship with energy in the context of the LIFE project. This chapter encompasses the final conclusion, discussion, limitations, and recommendations derived from the research conducted.

conclusion, discussion, limitations

Conclusion

The objective of fostering a proactive future energy relationship through the redesign of the transformer box was not fully achieved. The study's mixed findings revealed that participants were generally unwilling to actively engage with energy solely based on the redesigned box. It is clear that behavior change cannot be expected through object redesign alone. However, the conversations held with participants proved valuable in increasing awareness about energy fluctuations and gaining a deeper understanding of the drivers behind residents' behavior. While the impact may not have been significant, it marks a positive starting point for future interventions aimed at fostering a proactive energy relationship in Venserpolder.

Discussion

The value of my thesis is hard to quantify. It serves as a thought-provoking exploration of our current energy system and challenge the status quo. Overall, the impact of my thesis might lie in its potential to inspire and guide future research, influence decision-making processes, and contribute to the overall progress of fostering a proactive future energy relationship. To make both residents and project team members reflect on the way we interact with energy and ask the question, is this desired. Its value lies in its potential to inspire, guide, and contribute to a broader societal dialogue on energy transition and sustainability.

Limitations

Tested One Possible Future Relationship with Energy
The thesis focused on exploring one specific future relationship with energy through the redesigned transformer box. To gain a comprehensive understanding of fostering proactive behavior, it is recommended to design interventions for other future energy relationships and compare their effectiveness. This will provide insights into the variations across contexts and help tailor interventions accordingly.

The Complexity of the Context
Transitioning to a proactive energy relationship involves multiple stakeholders and systemic factors. While the thesis aimed to increase integration within the Venserpolder community, it is crucial to recognize that individual agency may still be limited. The ongoing LIFE project should play a pivotal role in addressing the complexities of the context and empowering residents to actively participate in the energy transition.

Time Constraints and Framework Readjustment
Conducting an in-depth investigation of context factors and their influence on the relationship with energy requires adequate time and resources. The thesis may have been subject to time constraints, which limited the depth and breadth of the research. To overcome this limitation, a readjustment of the framework and further research should be considered to delve deeper into the complexities of the context and gain a more comprehensive understanding.

Context Specific
The findings and conclusions of this thesis are based on the specific context of the Venserpolder community. It is crucial to acknowledge that the results may not be directly applicable to other communities or regions with different socio-economic conditions or cultural factors. Future studies should account for the specific characteristics of each context when designing and implementing interventions to foster a proactive energy relationship.

recommendations for LIFE

Recommendations for the LIFE project:

R1: Continue to test something tangible:
Building effectiveness of using tangible objects as conversation starters, it is recommended to continue exploring and testing tangible elements that can effectively engage residents and facilitate discussions about energy-related topics. This could include interactive displays, prototypes, or physical representations of energy concepts.

R2: Iterate on the current framework:
Acknowledging the limitations of the current framework, it is important to reflect on its effectiveness and iteratively improve it. Consider additional context factors that were not fully explored in the thesis and incorporate them into the framework. Engage with stakeholders, including residents, to gather their insights and feedback in order to refine and enhance the framework.

R3: Test the framework as a tool: Collaborate with stakeholders, including residents, to further refine and make the framework more concrete. This could involve conducting workshops or co-design sessions to explore different scenarios and understand the implications of the framework for various stakeholders. Additionally, consider testing the framework in a different context or community to gain a broader understanding of its effectiveness and adaptability.

R4: Practice what you preach: Encourage project members to actively engage with their own energy relationship by organizing activities that provide firsthand experiences related to the decisions made within the LIFE project. For example, organize a “human power day” where participants generate their own energy or an “energy lunch” where project members directly experience the impact of energy-related decisions. These activities will deepen their understanding of the practical implications of energy choices and improve the teambonding within the rpoject.

R5: Create redundancy within the project: As residents in Venserpolder may experience research fatigue, it is crucial to share all the findings and ensure continuity within the project. With new graduation students joining, it would be beneficial to communicate the thesis findings and insights to them, providing a comprehensive understanding of the project’s progress and enabling them to build upon previous work. This redundancy will ensure a smoother transition and avoid duplication of efforts.

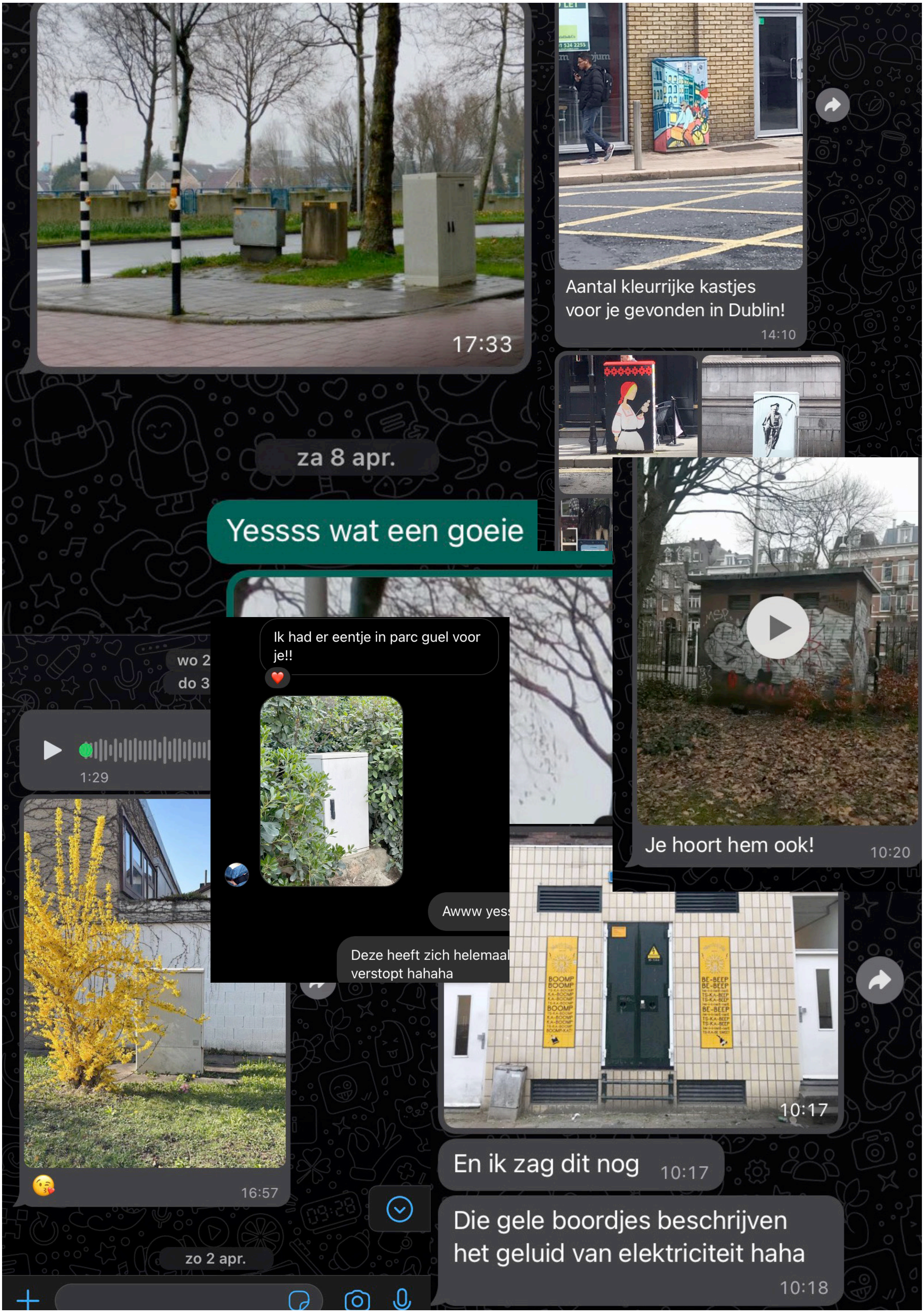
R6: Test outside of Amsterdam-Zuidoost: Explore the transferability of the project’s approach and framework to other contexts or communities. Assess what aspects of the intervention are specific to the Venserpolder context and what elements can be adapted and applied elsewhere. By testing the framework in diverse settings, the project can gather valuable insights into its scalability, effectiveness, and potential for wider implementation.

personal reflection

Energy has always held a special place in my heart. The complex and multifaceted nature of the topic, connects to many of my interests: a relation approach, technology, envisioning the future, and bringing tangible creations to life. As I delved into this topic, I gained profound knowledge about its history and the broader context surrounding it the energy system from reading papers about energy security to losing myself in a reddit page about solarpunk. The experience of immersing myself in documentaries and engaging in conversations with others was an absolute joy, taking me on a deep dive into the intricacies of energy. However, amidst this enthusiasm, I encountered a challenge - how do you distill a subject you love so dearly into a concise form? Energy is an incredibly complex problem, intricately intertwined with various aspects of existence. Where do you draw the line? Where do you stop exploring?

Right from the beginning, I anticipated the difficulties I would face, as expressed in my design brief. I aspired to improve my ability to document my thoughts and make timely decisions. I already knew that these precise aspects would prove to be the most daunting hurdles. I struggled with effective documentation and decision-making, despite recognizing their inherent value. I found myself perpetually caught in a cycle of doubt, constantly seeking additional information without diligently recording it. This lack of rigor made it immensely challenging to construct a coherent narrative by the project's end.

Nevertheless, throughout this endeavor, energy relations served as my guiding light, keeping me grounded and focused. The topic of the relational side of energy has rooted itself in my being, and I eagerly anticipate continuing my work in this field beyond graduation. While I acknowledge that the final report may not fully encapsulate the depth of my experiences and insights, I believe that this project has brought me a lot. From organizing energy dinners, making energy playlists to receiving photos from friends who are making pictures of transformer boxes for me (see collage on the right). These experiences are very valuable to me and I am curious to see how our relation with energy will further develop in the future.


17:33
Aantal kleurrijke kastjes voor je gevonden in Dublin!
14:10
za 8 apr.
Yessss wat een goeie
wo 2
do 3
1:29
Ik had er eentje in parc guel voor je!!
Je hoort hem ook!
10:20
Awww yes
Deze heeft zich helemaal verstopt hahaha
16:57
10:17
En ik zag dit nog 10:17
Die gele boordjes beschrijven het geluid van elektriciteit haha
10:18
zo 2 apr.

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