Local values towards a local heat transition

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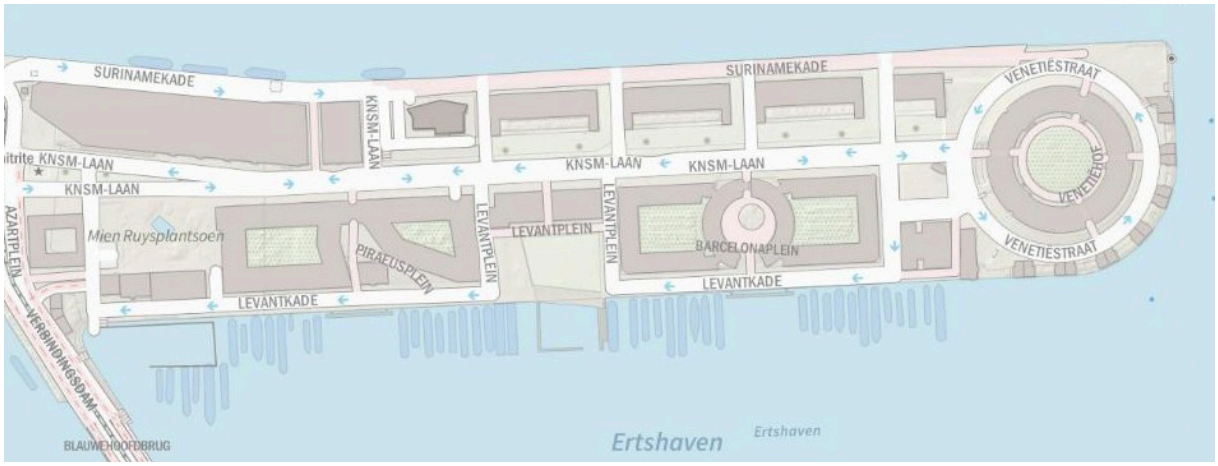

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Local values towards a local heat transition

Guiding neighbourhood participation in the Dutch urban heat transition through the IAD framework

by

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Executive summary

Within the Netherlands, the built environment is responsible for around 13% of total emissions, 71% of which can be allocated to households (CBS, 2021). As deemed a crucial part of the energy transition, the Dutch government addresses the heat transition in their national climate agreement. Where the goal is to achieve seven million natural gas-free households by 2050. To accomplish this feat, municipalities are assigned as directors of the heat transitions within the built environment. They are to compose neighbourhood-level implementation plans together with residents and building owners, since support and acceptance won't be achieved via traditional top-down decision-making. Thus, it is deemed crucial that municipalities plan neighbourhood heat transitions through participation (van de Grift et al., 2020; Rodhouse et al., 2021), as homeowners will remain responsible for investments. The problem identified is that policymakers lack a comprehensive set of tools to engage in participation, better understand their stakeholders and thus better enable their decision-making within the local context of a neighbourhood transition. The research question underlying this thesis, scoped on the urban built environment, is therefore:

"How can decision-making throughout urban heat transitions of Dutch neighbourhoods be guided?"

To design a toolkit for this purpose the Institutional Analysis and Development (IAD) framework by Ostrom is proposed. A framework that dismantles complex and dynamic processes into critical and manageable elements (Baldwin & Tang, 2021), centred around decision-making. To assess the framework's fit for purpose, the concept of participation is first researched. As a state-of-the-art literature review has brought forth the following pitfalls of traditional approaches and requirements to novel participation practises:

Pitfalls of traditional participation

- Local publics & values tend to be forgotten
- Stances of publics are assumed and stereotyped, leading to decontextualization
- A non-representative display of the local context entails that the silent majority is left out
- Ethical connotations are often lost
- Aiming to avoid social conflict results in "boomerang effects"

Requirements to novel approaches

- Avoid "technocratic and populist" pitfalls
- Acknowledge and involve a variety of stakeholders, including stances and values
- Utilize local expectations as starting points for engagement
- Focus on contextual, direct and tangible barriers
- Thoroughly understand the decisions to be made
- Embrace social conflict

Utilising these findings, this research proposes the design of a novel, enhanced IAD framework. Through the combination of Milchram's (2019) value perspectives on the IAD framework, value theory by Schwartz and a nested structural design. As this is argued to help decision-making steer away from traditional pitfalls and adhere to novel requirements of participation. First, because decision-making lies at the core of the IAD framework. Secondly, since value perspectives and value theory support the identification of local values, stances and ethical connotations. Finally, the nested structure forces this research to analyse multiple planes of decision-making. Therefore, acknowledging the variety in stakeholders and uncovering views of the silent majority.

To operationalize this proposed toolkit, input variables are required. First, this is achieved on a national and omnipresent level, delineated through technical and institutional contexts. It is concluded that there are two technical alternatives most potent. These are both high and low temperature heating networks for the urban built environment (Verhagen et al., 2021; Avest, 2020). According to Liu et al. (2021) sustainable heating systems can then be distinguished by two main factors: the heat source and the delivered heat temperature. Regarding high temperature district heating (HTDH), the heat source is often co-produced (or waste) heat. The main advantage of HTDH is that little isolation within housing is required. The disadvantages are an (indirect) dependency on fossil-fuels, lower efficiency and the fact that sustainability is up for debate. Lowering the temperature of heat networks increases the efficiency of DH systems. More importantly, it allows for a better integration of sustainable heat sources and thermal energy storage (Boesten, 2019; Leoni et al., 2020). Resulting in an increase in flexibility and utilization of volatile renewables (Schmidt, et al., 2018). However, the main disadvantages are the requirement of high isolation levels, the right mix of financial support schemes and more novel forms of organization.

The omnipresent institutional context is as follows; first, changes in the gas law will likely allow municipalities legal power to disconnect households from the gas grid. Second, the new heat law 2.0 will grant municipalities the handles to assign “warmtekavels”, neighbourhoods with dedicated transition designs (heat networks) operated by heat companies assigned by municipality. Finally, the new environmental law will make participation throughout transition processes mandatory. Which entails that the municipality must create its own participation policy. According to which participation processes can be assessed and weighted. Going forward, the analysis identified the following (in)formal institutional tension fields at play:

- Homeowners are initially placed as foremost decision-makers. However, municipalities are granted progressively more (legal) tools to force decisions onto households
- Municipalities are placed even more focally in the heat transition. However, they do not possess the resources to live up to expectations set
- Proposed national laws have caused uncertainty, disagreement and show inability to tackle the current issues of the heat transition
- Again, participation is placed central throughout the institutional design. However, tangible handles or guidelines for participation are still not presented

To uncover more contextual input variables, this research utilizes a case study, namely that of the heat transition on the neighbourhood KNSM-eiland in Amsterdam. Throughout this part of the analysis omnipresent insights have unfolded into more detail. As technical and institutional arguments for alternatives manifest itself into a very practical reality. The municipality of Amsterdam wants to achieve natural gas-free neighbourhoods by 2040. To fulfil this goal, stadswarmte (HTDH) presents an easier to implement solutions whilst TEO (LTDH) enjoys more sustainable and local qualities. Albeit TEO is more in line with the vision of policymakers, the municipality seems to prefer stadswarmte. Not only through inherent organizational qualities, but also through deals made. To tackle sustainability barriers, these entities proclaim stadswarmte to transition to sustainable heat sources around 2030. However, research shows that retrofitting stadswarmte into LTDH networks is quite the task, covered in insecurities not pertained by policymakers nor heat companies. Finally, the position of the municipality Amsterdam is leaving households feeling frustrated due to their previous placement as key decision-makers. Afraid of being forced onto stadswarmte.

As the research furthers, local engagement through focus groups and interviews are required to complete the input data for the operationalization of the enhanced IAD framework. The nested structure to the analysis is designed so that three nests are considered, including all relevant stakeholders and decision-making arenas. The three nests identified are as follows: first, the municipal nest. Second, the nest in which collective decision-making takes place, dubbed neighbourhood associations. Finally, the nest in which households of the KNSM-eiland are placed central. Participation is infused in the nested design to gain final insights into the following input components of the toolkit:

- Deeper understanding of the attributes of community (value laden)
- The main action situations at hand
- Deeper understanding of the nature of interactions (value laden)
- Evaluative criteria of decision-makers (value laden)

Through the case study, engagement takes place in meetings with the local energy initiative, housing corporations, owners' associations and households. Furthermore, this research has designed a low-threshold and spontaneous approach to participation with households. Constructed to engage with locals that are not intrinsically motivated to attend heat transition related meetings. As it is found that this silent majority is not reached through traditional forms of (informational) participation. All insights have been utilized for the operationalization of the enhanced IAD framework. Throughout which case specific recommendations regarding participation design are given.

First and foremost, results highlight that goals, criteria, values and decisions are misaligned across all levels of analysis. Again, the municipality favours a fast-paced roll-out of a solution that can be standardized, utilizing their close relations to housing corporations and heat companies. The local initiative however aims for a tailored sustainable alternative which embraces qualities true to their neighbourhood; TEO. As they wish to realize this transition through participation and acceptance. With their impressive technical research, they have however encountered pitfalls to the more traditional approach of their engagement. As clearly technocratic debate takes the stage during engagement. Furthermore, only households intrinsically motivated attend the collective nest, risking decontextualization regarding decision-making in this nest.

When aiming to reach the local public they are struggling to engage with, it is advised to bring participation back to its bare bones. Handles presented to do so have also been utilized for the operationalization on a household level. Through an artefact, in the form of an infographic, the knowledge playing field is levelled. As those without intrinsic motivation have been engaged. Leading to case specific insights as to why this observed silent majority does not currently care for their transition as much as other nests. Purely technocratic and sustainable arguments are found to be insufficient in creating urgency and thus participation. As for most this transition is not yet relevant. Only when confronted with tangible and practical problems such as flue gas outlet replacement, households seem much more willing to engage. Furthermore, the omnipresent tension fields presented above have emerged in a lack of trust towards the municipality and their partners. As households fear of being the victim of top-down decision-making. Households prefer local initiatives to guide their transition, on the condition of them proving their expertise. Finally, homeowners highly value the democratic nature of decision-making through their owners' associations. Whereas tenants argue themselves to be in a more powerless position, subject to their housing corporations.

As a result of these insights a proposed design to future participation and decision-making across this neighbourhood is presented. Utilizing value structures and goals deemed important per nest analysed, harmonizing former inconsistencies. Furthermore, this shows that the research approach was able to mitigate risks identified when other processes are deployed. As, in contrast to traditional methods, this approach has allowed for the identification of:

- Misalignment between technology, institutions and values
- Misalignment between different layers of decision-making and their inherent values
- Reoccurring pitfalls to participation and means to employ or mitigate them
- A silent majority, currently underrepresented but critical to a successful transition
- A participation and decision-making design to capitalize on inconsistencies and realign values across nest

Which highlight that the enhanced IAD framework can deliver upon its promises. A structured lens through which the complex and dynamic heat transition is dissected, unfolding insights that lead way towards more optimal processes. To conclude, the IAD framework, nested and value enhanced, has served this research as a toolkit to guide decision-making across a neighbourhood heat transition. The design allowed the researcher to work beyond pitfalls of traditional participation and alongside novel standards. Leading to a tailor-made approach for engagement and decision-making, uncovering tension fields and misalignment in the process. Thus, answering the main research question. This iteration of the IAD framework is a toolkit that can help guide decision-making of urban neighbourhood heat transitions in the Netherlands.

Preface

Rotterdam, August 2022

This thesis is written to obtain a masters' degree in Complex Systems Engineering and Management at the faculty of Technology, Policy and Management, Delft University of Technology. My strong affiliation for the energy transition, combined with my academic desire for practical application of policy have brought me to the topic of guiding decision-making throughout the Dutch heat transition. It is my belief that our heat transition is best designed when those affected most are understood. Which has let me to analyse decision-making through participation on a very local level. In my opinion, such bottom-up practises are crucial if we are to successfully transform our heating towards fully sustainable systems. This does, however, ask for a shift in paradigm which I hope to have contributed to with this research.

I would like to thank Resourcefully for providing a graduate intern position, a very hospitable working environment and access to their insights and data. Hugo Niesing has been my guide in the field throughout this process. Not only inspiring me with his seemingly effortless enthusiasm and optimism towards the energy transition, but also for introducing me to his professional network. His insights, kind gestures and our shared frustrations have kept me on track.

I would like to thank the Energy Commission of the Oostelijk Havengebied Amsterdam, in particular Jos van der Lans and Marian Prins, for their practical insights and access to their meetings. Our sparring sessions have ensured a strong focus on the tangible, practical and realistic elements of the heat transition. Furthermore, they have provided me with the opportunity to be in the midst of the action. Allowing me to test findings and designs, whilst simultaneously implementing my work in a real-life transition. This process has brought forth some major insights.

Finally, for scientific guidance I want to thank dr. Aad Correljé and dr. Udo Pesch. They have ensured that my research was kept within scope. As I do have a tendency to "go down the rabbit hole" when it comes to research I find extremely interesting. In particular, I want to thank dr. Aad Correljé for his expertise and guidance concerning the IAD framework. His insights have brought forth a newfound admiration this tool. Finally, special thanks are owed to dr. Udo Pesch for guiding me in the value filled process of participation.

I wish you a pleasant read,

Floris Jacob Pieter Alberda van Ekenstein

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Introduction

During the 26th UN Climate Change Conference countries were urged to come forward with progressive 2030 emission reduction targets that line up with the Paris Agreement (COP26, 2021). According to Thornton (2021) decarbonising domestic heating and upgrading the energy efficiency of homes is key in reaching the stated targets. This claim is strengthened by statistics that show that direct and indirect emissions from heating and electricity usage in the built environment rose to a global record high in 2019 (Abergel & Delmastro, 2020). Within the Netherlands, the built environment is responsible for around 13% of total emissions, 71% of which can be allocated to households (CBS, 2021). This chapter will first discuss the general course of the Dutch heat transition whilst highlighting initial problems that have come to light. Thereafter, the research problem, knowledge gap and objective will be presented. This section is followed by the research approach. Finally, the academic and societal value of this thesis is presented and the introduction this concluded is with a reading guide.

1.1 The urban heat transition in the Netherlands

Urban areas present an interesting paradox, as they are both a concentration of consumption as well as an opportunity for progress (Pesch et al., 2017b). This paradox reflects in the features of urban energy transitions, a constant tug of war between comfort and innovation (Droege, 2008). Urban energy transitions are dynamic, highly complex multi-actor processes that require intense collaboration betwixt a wide variety of national, regional, and local stakeholders (Sillak et al., 2021). They involve an assorted and discreet set of processes, operations, and policies which all may vary in time and place (Rutherford & Coutard, 2014). Furthermore, this dynamic mix of variables is interpreted and experienced differently by different sets of actors, creating an arena in which decision-making is everything but convenient. On top of that Droege (2008) identified that some of the great challenges within the urban energy transition are highlighted by the fact that there are many accepted ownership patterns, institutional agreements, and customary interests in place. A transition challenges and threatens these “normal” and conventional factors, something that is often viewed as undesirable.

As crucial part of the urban energy transition, attention for the heat transition within the Netherlands is rapidly growing (Doggen, 2021). To be clear, this concerns the ways in which the built environment is heated. The Dutch government addresses this transition in their national climate agreement via the “Programme Natural Gas-free neighbourhoods” (PAW), the obligatory “Transition Vision Heat” and its subsequent “Neighbourhood Implementation Plan”. These programs are all in support of achieving 7 million natural gas-free households by 2050. In short, the PAW facilitates testing grounds for a transition to natural gas-free neighbourhoods, providing funding and support whilst harvesting knowledge and best practices (Ministerie van EZK, 2021). The mandatory Transition Vision Heat enables municipalities to dictate the planning of local urban energy transitions, having to adhere to a given set of criteria.

Municipalities have delivered their transition vision at the end of 2021, slowly setting out to create their Neighbourhood Implementation Plans. These plans are deemed to be the effectuation of their transition visions. Whilst the focus of said visions lies on replacing gas-based heating systems, an integral approach to the implementation of these transitions is requested. The Dutch climate agreement presents several promising alternatives for the built environment to leave natural gas behind. Amongst others, Geo- and Aqua-thermal energy as a heat source, renewable electricity through local generation, insulation and the utilization of loans and subsidies for homeowners and homeowners' associations are presented (Ministerie van EZK, 2021). As transition visions have been presented it can be stated that municipalities envision a heat transition through mainly district heating, by utilization of residual heat or biomass, and renewable electricity. Heat networks utilizing aqua- or geo- thermal heat are little mentioned (Gemeente Enschede, 2021; Gemeente Rotterdam, 2021; Gemeente Utrecht, 2021). Realistically, whether a certain alternative or perhaps a combination of technologies is advised depends completely on the local context. Neighbourhoods throughout the Netherlands are vastly heterogenic, varying in factors such as socio-demographics, geographics, resource availability and sentiment. Furthermore, the built quality within neighbourhoods, or sometimes even buildings, can vary widely. Again, very important factors to considers when advising on substitute heating technologies as argumentation per alternative might differ according to factors mentioned. This demonstrates why tailor-made and local approaches to these transitions are required.

A key understanding here should reflect the fact that homeowners, housing associations or corporations are ultimately responsible for investing in said sustainability measures (Hansen et al., 2021). Where municipalities throughout the country have delivered their Transition Vision Heat and will soon start with translating these into the more tangible plans, they won't be the parties responsible for final investments. Their proposed transition plans won't be definitive for a neighbourhood nor is it compulsory (for now) for citizens to invest in said proposals (Gemeente Amsterdam, 2021). Citizens, associations, and corporations are thus final and therefore critical decision-makers regarding the urban energy transition. Unfortunately, Hansen et al. (2021) highlight that households or housing cooperatives are not always able to make these final decisions. This can be since they lack information or financial means, it can however also be because some sustainable projects require collaborative decision-making within or between buildings. From this perspective municipalities should be enablers of local heat transitions, providing handles and support to those who require it through their visions and implementation plans.

Finally, according to the national government, municipalities should plan their support through participation with citizens, they should also "unburden" citizens as much as possible by creating their neighbourhood implementation plans. Minkman (2021) noted that when municipalities employ "all-round nurturing" approaches to local urban transitions actual participation levels tend to be negligible, citizen engagement mostly consists of providing information. This approach is appreciated by those that are not willing to actively participate within their local transition. However, this raises the question of whether this appreciation is desired, as these citizens might need to decide on the course of their local transition too. Furthermore, participation through information discourages households who are seeking to engage in the transition of their neighbourhood (Minkman, 2021). Thus, the ways in which municipalities should enable decision-making and support neighbourhoods through their implementation plans remains debatable and requires further research (Yazdanie & Orehounig, 2021).

1.2 Towards the research objective

Through the context provided in section 1.1 some key findings can be highlighted. The heat transition within the Netherlands is crucial in the overall energy transition and can be depicted as highly dynamic and complex. Furthermore, municipalities have been given a leading role in this transition whilst home and housing owners are the final decision-makers. To provide neighbourhoods with tailor-made heat transitions municipalities are advised to utilize participation towards their implementation plans. The way in which said participation should support local decision-makers is however still up for debate.

1.2.1 Problem statement through the main knowledge gaps

Not only the issuing of the Transition Vision Heat (Doggen, 2021) but also the rise of concepts such as smart grids or energy communities has resulted in a strong interest in the role of households within the Dutch energy transition. Nowadays citizens are faced with a rising dependency on them to enable the local transitions (de Koning et al., 2020). As pointed out in section 1.1 municipalities are providing neighbourhoods with transition visions however homeowners are the crucial and final decision-makers. This in turn raises the question on how to enable or steer homeowners towards the implementation of sustainable features within their local context (Doggen, 2021). Purely presenting them with several alternatives will not suffice. Therefore, in the coming years, municipalities will have to translate their neighbourhood transition visions into “implementation plans” (Duurzaam Gebouwd, 2021). This translation will be crucial, as seemingly global reports on the “why, what, when and how?” of the urban energy transition (and especially the heat transition) will have to be transformed into very specific plans. Moreover, they will have to be designed in such a fashion that homeowners will accept and adopt the proposed plans.

Support and acceptance won’t be achieved via top-down decision-making, as this approach has already been widely pressed. Within the academic community there is a growing consensus that, in the field of urban energy transition planning and policymaking, participation of local communities is critical (van de Grift et al., 2020; Rodhouse et al., 2021). Participation could help policymakers better understand the local dynamics, overcoming the dilemma of having to design for a “public’ without knowing who or what this “public” exactly is or entails (Pesch, 2019). Household inclusion via participation is also considered a key factor for the acceptance of said transition. Acceptance, in turn, is considered a critical element for legitimate decision-making (Pesch et al., 2020). Therefore, these transitions are locally organized and coordinated by municipalities according to Rodhouse et al. (2021). According to Sillak et al. (2021) the planning of said transitions requires, besides a better involvement of stakeholders, specific attention to their respective roles. Underlined by expert speakers at the “Warmte Transitievisies 2021 van Duurzaam Gebouwd”, attention should be focused on intense participation, social value added, transparency, tailored planning, increasing acceptance and co-creation (Duurzaam Gebouwd, 2021) when creating neighbourhood implementation plans.

Participation is key, a statement that is endorsed not only by academics but also by the national government and professionals in the field. Nevertheless, according to Keij (2020), Dutch municipalities lack clear instructions for taking measures to plan or organize homeowner participation. Furthermore, municipalities and professionals require clear guidelines on how the engage with variable interests and values of local communities and how to translate these into planning efforts (van de Grift et al., 2020). On top of this all, it has already been assessed

that enabling or encouraging a vast group of heterogenous households to actively participate in planning and execution phases is a very difficult task (Rodhouse et al., 2021). To achieve this feat, novel and adaptive forms of collaboration are required. Forms in which the different values, interests and responsibilities of stakeholders are considered (Rodhouse et al., 2021). These statements are underlined by Reda et al. (2021), calling for a better understanding of prominent stakeholders, their roles and values, in the multi technological and sectoral context of their transition. Kieft et al. (2021) identified that a lot of the barriers within this transition are of sectoral and context specific nature, and not so much technical. Thus, utilizing a framework or a set of tools for a better understanding of prominent stakeholders, increasing participation by doing so, might very well tackle the main barriers in said transition.

The question of how to design and implement participation in the heat transition remains. For participation can take on many shapes and sizes, never adhering to a single definition. Collins & Ison (2009) stated that participation is critical in combating climate change across all levels of decision-making. However, back in 2009, they already noted that policymakers lacked knowledge of what participation entails within the context of climate change and how it is to be utilized. The key issue with participation applied within an energy context and its definitions is captured quite aptly in the following quote from their research.

"The meaning of participation should be reconsidered, as situations under consideration are better characterized by complexity, uncertainty and multiple stakeholding. We argue that the roles, responsibilities and purposes of those involved have to be re-conceptualized, not as participation bracketed by power, but as a process of social learning about the nature of the issue itself and how it might be progressed." (Collins & Ison, 2009).

Their quote also underlines key knowledge gaps that are still encountered in literature today, as presented throughout section 1.2.1. There is a substantial call for the utilization of participation within the complex and uncertain urban energy transition. However, policymakers are insufficiently equipped with tools that uncover the core of "situations under consideration" or decisions to be made. The nature of the decision to be made should be researched, reconceptualizing participation through learning of values and roles in a local context.

1.2.2 The main research question

Research into the Dutch urban energy transition has revealed some critical issues that have to be addressed. First, it is clear that homeowners are key decision-makers within the transition towards a more sustainable built environment. Whether it is a household, housing corporation, homeowners' association, or a combination of the above, their transition towards sustainable homes is one that should be supported by policymakers. Secondly, as municipalities have delivered their Transition Vision Heat, initial findings and rough scenario's will have to be translated into more concrete neighbourhood implementation plans. Literature, as well as signs from practice, indicate that the way this translation takes place is crucial. For these plans to gain acceptance it is widely recognized that participation with local decision-makers is of great importance. Furthermore, participation should also lead to a better understanding of prominent stakeholders. To support these stakeholders in their decision-making a deeper comprehension of their values, roles, customary interests and institutional agreements is required, as participation is reconceptualized. The problem this has revealed is that policymakers lack a comprehensive set of tools to engage in participation, better understand their stakeholders and thus better enable their decision-making within the local context of a neighbourhood transition.

These findings have led this research towards the formulation of the following main research question:

"How can decision-making throughout urban heat transitions of Dutch neighbourhoods be guided?"

1.2.3 Scope of the research

The scope of this thesis is set on the urban Dutch heat transition. Within this research this scope is further delineated on the heat transition for urban neighbourhoods. At first this entails a presentation of theory, technology and institutions relevant to the Dutch (urban) heat transition. Subsequently, a strong focus on participation approaches towards households is developed. Through a case study, namely that of the neighbourhood heat transition of the KNSM-eiland in Amsterdam, the scope is further detailed and finally fixed.

1.3 Identifying a comprehensive toolkit

Section 1.2 has presented the main knowledge gaps upon which this research finds its foundations. It has become clear that both academic research and practise call for novel feats of participation within the heat transition. Local decision-makers are to be better understood to better support them is said transition. Furthermore, whilst Dutch municipalities have been given the leading role in this transition, they lack comprehensive toolsets to truly utilize the benefits of participation by which they are to assist local decision-makers. This section will thus identify a fitting framework that shall be used within this research to better understand local decision-makers. Once this tool has been identified, sub research questions can be formulated.

1.3.1 The IAD framework

As the main research question of this study indicates, the objective is to guide the decision-making of Dutch neighbourhoods within the urban heat transition. As Collins & Ison (2009) highlighted, situations under consideration can be better understood, and eventually guided, trough participation. However, they also indicated that participation is to be viewed in a different light than it is conventionally done, namely trough gaining a deeper understanding of the decisions to be made. According to Baldwin & Tang (2021) a framework that puts decision-making at its core is the Institutional Analysis and Development (IAD) framework. This framework, developed by Elinor Ostrom and peers, allows for the identification and description of crucial factors in decision-making situations within a certain process known as an "action situation" (Milchram et al., 2019). As portrayed in figure 1, the action situation plays a central role in the IAD framework. It can also be seen that the framework enables the identification of factors that influence said decision-making in action situations. Ostrom (2010) said that the IAD framework is designed to contain the most common toolkit of variables so that a diversity of settings can be examined, including human interaction with for instance community organizations, government, technology and (in)formal rules. McGinnes (2011) describes the IAD framework as a framework which allocates appropriate explanatory factors and variables to categories and places these categories into a formation of rational links. This allows for the disassembly of complex and dynamic processes into critical and manageable elements (Baldwin & Tang, 2021). In other words, a framework which acknowledges the complexity of the world whilst providing its users with a comprehensive tool to deal with said complexity. The IAD framework is broad enough to investigate shared action problems of all kinds and yet

defined enough to uncover the foundations of said problems (Cole et al., 2019). In essence, the IAD framework is concentrated on the physical, technical, social, and institutional context in which collective action occurs and outcomes are produced (Cole et al., 2019).

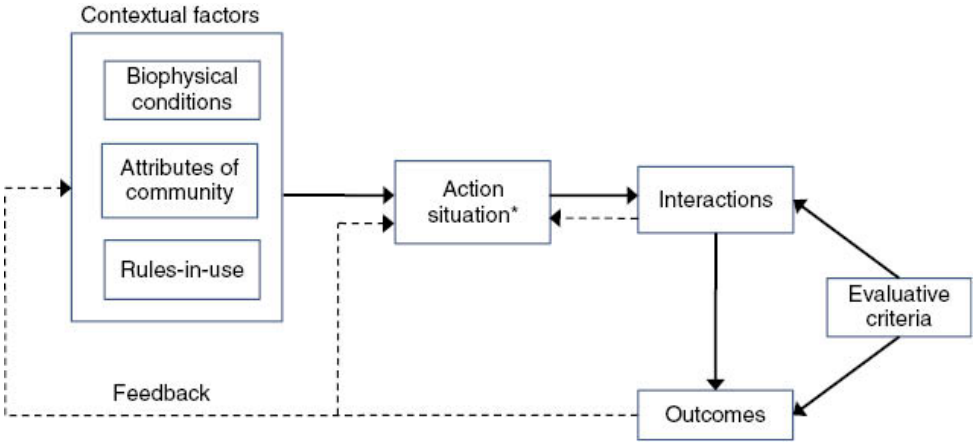

Figure 1: The IAD framework (Ostrom, 2010)

Throughout academic literature Ostrom and her IAD framework have been widely praised, receiving the Nobel Prize in Economic Sciences in 2009 (Levine, 2019). Regarding the IAD framework, Cole et al. (2019) conclude that the strength of the framework lies with its systematic centre on the impact of (in)formal rules and norms on individual incentives in complex systems. Furthermore, it provides an empirical analysis of several dynamic actions that collectively affect incentives and decisions. Milchram and peers (2019) add to this that the framework does not pretend to provide solutions in dynamic and complex situations. It does however highlight important aspects of decisions or problems which help understand the core of the situation at hand. Furthermore, the utilization of the framework can steer towards possible solutions when considering decision-making in complex systems, again making it suitable for this research. Another argument for the utilization of the IAD framework in this research is that it has been deemed useful when investigating energy systems (Baldwin et al., 2019; Milchram et al., 2019). Being that as it is, the IAD framework has also received some criticism over time. Cole et al. (2019) points out that due to its generic design the framework pays to little attention to diversity and complexity, resulting in “dynamic but underspecified analysis”. Including more relevant and context specific variables could however help solve this issue (Cole et al., 2019). Furthermore, with a strong focus on actions or decisions, the value of information seems to be somewhat underspecified (Henry & Dietz, 2011). Especially within this research this notion is useful, since scientific information is very important when it comes to sustainability debates (Henry & Dietz, 2011). Finally, Bertacchini & Gould (2021) notice that researching a single action situation in such complex and dynamic contexts is insufficient to fully understand what is at hand. Thus, the utilization of “nested” or multiple connected action situations is advised. These criticisms and more are further handled throughout chapters 2 and 3. To conclude it is important to note that the operationalization of the IAD framework for the goal of this research is novel. That is, through literature research, a similar interpretation and utilization of the framework has not been found. It has been operationalized within the context of the energy transition, however not with the specific goal of it being a toolkit for participation in the urban heat transition of neighbourhoods.

1.3.2 Sub research questions

The research thus far has led to the formulation of the sub research questions as presented below. These sub questions are constructed with the aim to support answering the main research question of this study.

1 Which requirements should be placed upon novel participation approaches?
2 Can the operationalization of the value laden IAD framework support novel participation approaches?
3 What is the technical context of the urban heat transition for Dutch neighbourhoods?
4 What challenges do the formal and informal institutions present the Dutch heat transition?
5 Which context specific insights are crucial to consider before the operationalization of the IAD framework?
6 How should participation approaches be designed once supported by the IAD framework?
7 How does the value laden IAD framework perform within the context of this research?

1.4 Outlining the research approach

The approach central to answering the main research question is the utilization of the IAD framework. To implement said approach the methods required, and the acknowledgement of their main limitations, will be presented below. The data required will be subdivided into two categories, qualitative and quantitative. According to McLeod (2019) qualitative data entails a dynamic and negotiated reality whereas quantitative data represents a fixed and measurable reality. Identifying and presenting these findings will result in a blueprint for this research, made tangible in the final section of this chapter.

1.4.1 A case study

The operationalization of the IAD framework requires a case study. The utilization of this method is endorsed by both Lammers & Heldeweg as Milchram and colleagues. A case study can simply be defined as a study of a single unit with the purpose of universalizing over a larger number of units (Gerring, 2004). Hafiz (2008) states that a case study allows researchers to investigate complex events within their natural context. It is especially relevant when researching decision-making and factors influencing decision-making (Hafiz, 2008). Such research requires the whole context of decision-making is to be considered. Furthermore, the benefits of a case study lie in its flexibility and ability to capture reality (Murphy, 2014). These statements are in line with the purpose of this research, as the aim is to understand decision-making within a neighbourhood context and extrapolate findings fit for policymakers. Research however indicates that this methodology does come with its pitfalls. Stake (1995) and Yin (2003) noted that researcher who do not place well defined boundaries on their case study get lost trying to answer to grand or broad research questions. Furthermore, novice researchers often tend to focus their analysis on parts of the case unit at hand, failing to reflect and translate to the more universal goal set out at the start (Yin, 2003). In this translation lies another challenge, one should be very careful with generalizing case specific findings. These pitfalls need to be kept in mind, otherwise the benefits of this methodology are put to waste.

1.4.2 Data collection through desk research and interviews

When it comes to identifying the local technical context, relevant decision-makers, or institutional challenges a vast amount of data can be found online. This required data exists of both quantitative and qualitative data. Quantitative data can provide technical or financial characteristics of alternatives for sustainable heating, electricity generation or housing requirements. Furthermore, this type of data can provide insights into laws, regulations and organisations involved. The qualitative end of the required data provides knowledge on, for instance, institutional challenges or powers at play. Since dynamic relations are to be negotiated here, framing the essence of the problems at hand. It is important for both categories of data to be relevant to the Netherlands (or countries alike), up to date and harvested from reliable sources.

The method by which the delineated data should be acquired is known as desk research (Ubacht, 2021; Jaleel & Prasad, 2018). Desk research is applied with the goal to synthesize an overview of published information (Guerin et al., 2018). Johannesson & Perjons (2014) state that this method is preferred over surveys or interviews regarding quantitative data in the form of government and academic publications. Qualitative data on the other hand is procured in the form of text, images and video, also easily accessible (Johannesson & Perjons, 2014). Limitations are slender as academic publications in established journal do not tend to pose any credibility problems. However, political purposes might bias governmental reports (Johannesson & Perjons, 2014). Another limitation is the vast scale of data available online. Therefore, structured search methods via document analysis and literature reviews are highly recommended (Guerin et al., 2018).

To gain insights into values at play within the community and the key decisions that form barriers towards a more sustainable neighbourhood, a different tool is required. This tool must be able to provide the researcher with qualitative data that explains the decision-making process or highlights values attached to certain elements of the transition. According to Angelov et al. (2017) such data is characterized by and acquired through the translation of observation, which is known as empirical data gathering. The problem with this translation however is that the process of decision-making takes place in very dynamic and complex environments. Thus, the objectives of certain decisions, or the reasoning behind said decisions, can be hard to extrapolate objectively. Luckily, empirical data gathering enjoys many analytical tools (Ubacht, 2021), fit for specific purposes by which charactered problems can be overcome. Interviewing, including focus groups, is a method which aims to understand and interpret knowledge from the participant(s) perspective (Johannesson & Perjons, 2014). It is also an inexpensive way to detailed and first-hand insights. However, data gathered through interviews has downsides such as dependency, subjectiveness, and the fact that it is very time consuming. Preferably these interviews are conducted semi-structured, asking only a few predetermined questions and letting the rest of the interview take its natural course. This way interviews are comparable through standard questions (semi quantitative data), whilst they allow room to extract unique and spontaneous insights.

To visually represent the research design a Research Flow Diagram is created. This diagram presents the main phases of the research project, indicating the sub questions, methods and deliverables of each of these phases. The Research Flow Diagram is presented in figure 2.

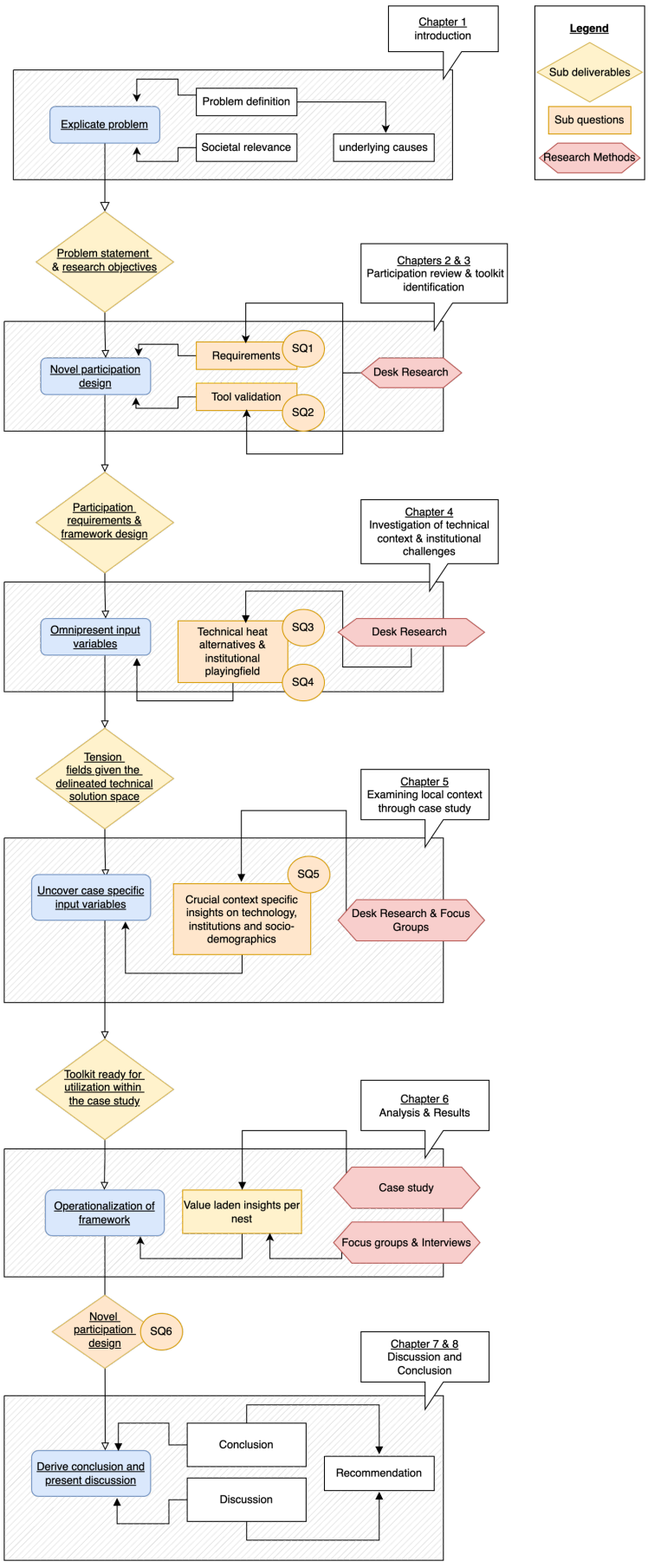

Figure 2: Research Flow Diagram

1.5 Scientific and societal relevance

This final section of the introduction will emphasise the relevance of this study in today's environment. First, the scientific relevance will be described, placing this research within its academic context. Concluding this chapter will be an explanation of the societal relevance of this study.

1.5.1 Scientific relevance

The scientific relevance of this thesis finds its roots in calls from the scientific community to enhance participation. As presented, and further elaborated upon in coming chapters, practical implications of participation are outdated and ineffective. As new concepts such as values, trust and social acceptance are to be considered, not merely informing publics and calling it a day. What has become clear is that those engaging in participation are lacking tangible toolkits to initiate in such novel participation. This is where an enhanced nested IAD framework comes into play. As this framework has been used in its traditional form, but has not been operationalized (as far as can be found) to serve as a supportive toolkit towards modern participation within the context of the (Dutch) heat transition. Thus, the scientific relevance of this thesis mostly lies in the question of whether an enhanced IAD framework can serve as a toolkit to support decision-making within the heat transition and what the operationalization of such a support system would entail in practise. Whether this theoretical instrument can support those initiating participation in gaining new insights or improved local heat transitions. Can this toolkit help increase local support through a better understanding of the local context and decisions to-be-made? Finally, this thesis will develop new insights regarding potential pathways for future research. As it will leave grounds upon which new research can be build.

1.5.2 Societal relevance

The societal relevance of this thesis is based upon a multitude of factors. For starters, the ever-growing importance and relevance of not only the energy transition but the urban heat transition within the Netherlands (and beyond). As countries worldwide are trying to meet their climate change targets. Furthermore, we are facing rising resource prices, geo-political tensions and a remaining unwanted dependency on certain fossil fuels. Every innovation or development towards more sustainable and potentially cheaper energy is of the utmost relevance to society today. Within the Netherlands, the next step in a country wide heat transition is the design of local implementation plans. This thesis aims to operationalize a toolkit to support participation, a major component of said implementation plans. Thus, being relevant to the Dutch heat transition and the way in which policymakers might interact with society. As it has become clear that municipalities now lack means to engage with local publics. Through the operationalized toolkit this thesis will present new insights which can be utilized in future implementation plans. Potentially influencing ways in which society partakes in the transition. Finally, lessons learned throughout this thesis, and its specific case study, can be (in)directly applied to other Dutch neighbourhoods. Depending on amongst other socio-demographics, even in other EU countries. Furthermore, the toolkit itself can be explored in contexts outside the heat transition if handles for participation are called for.

2

Properties for participation and local decision-making within the heat transition

The introduction of this research has provided insights into the Dutch heat transition and its many intricacies. One of the main take-aways from the first chapter is the notion that participation is key. However, the interpretation and implementation of participation with local decision-makers remains elusive. This chapter sets out to answer the first sub research question; *Which requirements should be placed upon novel participation approaches?* It will therefore focus on academic literature that has been written on the topic. First, to gain a deeper understanding of participation and community engagement. Second, to find pitfalls of "current" or traditional participation. Third, to identify prerequisites for novel or modern participation.

2.1 Participation in the Dutch heat transition

The energy transition can be described as a complex sociotechnical process in which the defining end goal is to implement a fruitful transition to sustainable energy systems (Cuppen et al., 2020). A substantial part of this transition is the heat transition, defined by the replacement of natural gas by sustainable forms of heating and infrastructures within the build environment. This transition is subject to both disputes and power struggles influencing the duration of implementation (Cuppen et al., 2020). Rodhouse et al. (2021) state that a necessity for creating support, thus enhancing speed and success of transitions by dealing with contention early on, is citizen inclusion. The research of Cuppen et al. underlines this statement by acknowledging that public engagement is crucial within energy transitions, for goals of either creating support or sustaining democracy.

Complexity of participation within the Dutch heat transition

As mentioned in the first chapter of this research Dutch municipalities have been given a leading role in the coordination of the heat transition. The main thought behind this governmental decision is the believe that municipalities are in a greater position to organize citizen engagement or participation through their reach on more local levels. This thought is in line with findings in academic literature when the aim is to enhance the speed and success of energy transitions. Since public inclusion and engagement is deemed critical for success and municipalities seem to be in better positions to enable engagement. However, despite the emphasis on the importance of engagement with local parties' municipalities have been given very little information, guidelines or legal tools to assist them in this considerable task (Rodhouse et al., 2021). The research of Rodhouse et al. concluded that thus far it has proven extremely tricky to actively engage local communities in all stages of the heat transition. Circling back to the nature of energy transitions, complex and sociotechnical processes as stated, this conclusion comes as no surprise. Local communities are very heterogeneous, not

only in socio-demographic but also in terms of geographic, resource availability and built quality to name a few. This already indicates that no local community will be the same, thus a tailor-made approach to engagement will always be required. On top of that, how should municipalities be able to arrange engagement with various local publics if they do not possess the tools and support necessary to achieve so. Finally, stakeholders and decision-makers do not only pertain to local communities, as Rodhouse et al. (2021) state that beside tenants, residents and homeowners untried forms of collaboration between other municipalities, provinces, grid operators, utility companies and technology providers are required. Even further complicating the process of engagement is the fact that all the stakeholders have different values, drivers and interests and all of them have their own view of how engagements should be properly organized.

Defining participation and its main argumentation

However crucial engagement is within energy transitions, it is not a magical term that is simply implemented and makes barriers faced disappear. Furthermore, engagement and participation seem to be terms used interchangeable within the context of energy transitions literature. However, they never pertain to a singular definition, leaving room for more complexity in this already challenging setting. To mitigate further complications, and since the exact nature of participation is dependent on the specific setting, the most generic definition is sought within academic literature. According to the International Association for Public Participation both terms generally adhere to the following definition:

"A process that involves the public in problem solving or decision making and uses public input to make decisions. It includes all aspects of identifying problems and opportunities, developing alternatives and making decisions." (IAP2, 2010)."

Thus, within the scope of this research both terms shall be used interchangeable in the general sense of the definition above. Moreover, besides the argument for increasing (social) acceptance, participation seems to enjoy two more globally noticed arguments within the academic energy transition context according to Spruit et al. (2020). The first is normative, every citizen has a democratic right to voice one's opinion. The second stems from the theory that participation will lead to more and better insights and thus better decision-making. These arguments once more underline that it seems like an attractive approach for policymakers. Therefore, the new 'Omgevingswet', on which elaboration shall be provided in later chapters of this research, will make the creation of participation procedures mandatory for development within the energy sector. This however still does not provide clear insights nor tools for what participation should entail within the energy transition and more specifically the urban heat transition in the Netherlands.

2.2 The traditional approach to participation

Participation is quite the broad concept with a rich history. Social or communal participation has been widely used by the International Health Organization as a policy concept since the early 60's (Rifkin & Kangere, 2002). From this moment the definition of participation ranges from organizing passive involvement, being on the receiving end of a program, to actively including people in decision-making regarding policies and activities (Piškur et al., 2014). In 1969 Sherry Arnstein introduced the ladder of citizen participation, one of the worlds prominently referenced participation models (Organizing engagement, 2020). This metaphorical ladder represents eight different "steps" or levels of participation, as can be seen

in figure 3. These steps are further divided into 3 categories of participation. According to Arnstein participation varies from manipulation, thus letting people believe that they are granted some form of power whilst they are being played, to citizen control, where citizens become those who govern (Arnstein, 1969). Where this depiction of participation might help to identify the level of engagement, it does not provide handles nor criteria upon which policymakers can base their participation policy. Thus, to combat the knowledge gaps identified earlier, more insight into engagement forms is required. Furthermore, to ensure that the wheel is not reinvented, recent literature within the context of the energy transition must be consulted.

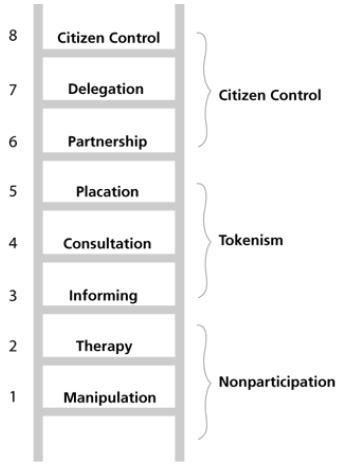

Figure 3: a ladder of citizen participation (Arnstein, 1969)

Understanding traditional participation

Van de Grift et al. (2020) state that, within policy and planning theory, energy technology planning has traditionally been influenced by top-down approaches. That same theory however states that participation from local communities is often considered critical, resulting in disapproval of dominant top-down decision-making methods. Since top-down decision-making approaches are characterized by a lack of involvement and influence from the receiving ends of policy, at best placing said approaches at the third level of Arnstein's ladder of citizen participation. Now that, both within literature as well as in practice, the importance of participation within the energy transition is underlined the dominant top-down approaches to engagement are slowly set aside. Making way for forms of decision-making via participation that dive deeper into empirically interesting concepts of community engagement (van de Grift et al., 2020). On the topic of decision-making within the energy transition Pesch et al. (2020) found that legitimate decisions are now often tested through the acceptance of local communities in which technological changes are to be made, in line with argumentation for participation as found in the first sub chapter. Traditional top-down approaches often simply do not enable policymakers to gauge the acceptance of technical changes within local communities before they are implemented. On both a national as well as a local level practice of top-down decision-making will leave those involved with energy projects chasing their tails. Since they will have to know how publics or communities interpret the impact of said projects without even knowing who or what these publics or communities are (Pesch, 2019). Resulting in educated guesses as to the legitimacy of their decisions.

The start of this chapter has provided the argumentation for the utilization of engagement approaches towards a successful heat transition. This same section however quickly highlights the complexity of this task. Furthermore, the ambiguity of participation and engagement leads to more questions, especially on the topic of what said approaches of engagement should entail for policy- or decision-makers. It has become clear that those navigating the heat transition should steer away from top-down decision-making. Thus, requiring a toolkit that allows them to enlist participation as a base for local tailor-made approaches. Therefore, the next section will dive into the pitfalls of traditional participation approaches to identify a set of criteria around which novel participation methods can be created.

2.3 Understanding the deficiencies of participation

It has become clear that no singular or standard approach to understanding and guiding the heat transition is appropriate. Within the dynamic and heterogeneous setting of this transition no public nor its context will be the same. When the local context, in which a technological change is to be implemented, is better understood reflections on and consequences of the impact of said change can be delt with better. However, as Pesch et al. (2020) stated, the voice of the local public is frequently forgotten. Since context-specific comments often do not fit the traditional structure of decision-makers. This is part of the problem of traditional approaches to policymaking and in terms ways to design participation. Expectations on the view of locals are created by policymakers without them knowing who or what the locals are exactly. Thus, the ways in which local publics are engaged are often based on guessed expectations.

Assumptions and decontextualization

Spruit et al. (2020) have pointed out that, when upfront images of the "types" of publics delt with are created, locals can feel falsely interpreted and undesired opposition can arise. Commonly used classifications of publics, such as "Not in my back yard" (NIMBY), are ineffective and generic, resulting in local communities feeling powerless by traditional engagement approaches (van de Grift et al., 2020). To put it differently, decontextualization of local values and viewpoints do not create a fence against incidents or arbitrariness (Pesch et al., 2020). Standardizing beliefs or frames of local stakeholders might thus just ensure that policymakers face more work or backlash during decision-making. The simplistic intent to include "local values" in traditional approaches to decision-making is problematic. Ligtvoet et al. (2016) researched the traditional view on pro-gas or pro-renewable frames of stakeholders and found that again such a simplistic differentiation is far from correct. The reality, even on the macro level of this study, is much more nuanced. Their study identified six "general" perspectives, each with their own driving factors. Thus far it can be concluded that the traditional "imagined publics", or assumed frameworks of local stakeholders, are based around inadequate assumptions. Rodhouse et al. (2021) underlines this conclusion and the problems that arise from it as pointed out above. Their research showcases a diversity of "imagined publics" within the governance of the Dutch heat transition. Novel frames identified include locals that are driven by diversity in participation or those who might be vulnerable and at risk.

To attain a representative insight into all the different stances of local publics presents another complex challenge. As noted by Pesch et al. (202) there are local actors who might not have means needed to enter traditional networks of representation and are thus vulnerable to being left out of decision-making process. In current approaches the dominant belief is to then take a neutral and objective stance. This however will result in another form of decontextualization, again risking the disregard of a multitude of local views on their transition. Ironically contributing to the feeling of misrepresentation and unfairness (Pesch et al., 2020). To conclude, a substantial shortcoming of traditional (top-down) engagement approaches is that generic presumptions of local publics lead to a variety of issues. As Pesch stated back in 2019 "there is no singular expression of the public and their stance", simple procedural approaches will therefore not help policymakers find one.

Invited participation, misrepresentation and the silent majority

At the stage in which engagement with local stakeholders is sought, more issues throughout literature are identified. Participation by locals is very often voluntary, this is usually done through a devoted or open invitation. As highlighted above there will be groups of local

residents who are vulnerable or who might not possess means to access such engagement windows. One can imagine that there is a fair chance invited participation is an entry for the misrepresentation of the local public. Pesch (2019) identified several pitfalls of invited or open participation. The first problem being that this approach to engagement invites a new mixture of public to the stage. This entails new dynamics that might not have existed before, in the arena of invited participation beliefs, stances or values of this group might be affected by the newfound dynamics. Secondly, as one can imagine, invited participation tends to attract only those within the community who are intrinsically motivated to voice their opinion. Spruit et al. (2020) underline this concern by concluding that this form of participation attracts those that often share a goal or have something at stake. This could again have the consequence of a community being depicted by a few of its enthusiasts or opponents, often those that are the most vocal (Pesch, 2019; Spruijt et al., 2020). Which in turn raises the question regarding the members of communities that are not present, driven by whichever beliefs or reasons that might be. This points out another issues that is to be delt within the heat transition (and the energy transition in general), how can decision-makers include the so called “silent majority”?

Values and the value of social conflict

Policymakers should account for more than just their interpretation of public wants, needs and technology guided (top-down) arguments to successfully guide the heat transition (Cuppen, 2018). As Correljé et al. (2015) stated; sociotechnical systems, in this case Dutch neighbourhoods, represent both public and social values. The heat transition inherently presents change to said sociotechnical systems and change can affect values (Correljé et al., 2015). Thus, values of local stakeholders, and possible changes in said values, should also be considered when engaging with the public. Furthermore, the heterogeneity of Dutch communities entails that changes affect residents differently. Per example, change could lead to the redistribution of risk, rights or responsibilities (Pesch et al, 2017a). In a more tangible form, change can affect residents to a different extent when regarding resources as income, time or even age. Underrepresenting these factors results in the fact that ethical connotations of change remain largely undiscovered. (Pesch et al., 2017a).

Cuppen et al. (2020) found that, within literature regarding participation within energy transitions set up by municipalities, local organizations or other entities, the focus does not stretch beyond invited participation. Thus far, “self-organised participation”, through for instance objection or social conflict is a concept that is hardly embraced within the scientific literature (Cuppen et al., 2020). Perhaps so, since the goal of participation is often to avoid conflict, which sounds logical. However, this might entail the emergence of a negative side effect dubbed the “boomerang effect” (Spruit et al., 2020). This effect brings itself to light when the roots of the conflict are not addressed because the intention of the engagement approach was to avoid the conflict in the first place. In the long run the “boomerang effect”, just as with preconceived notions of imagined publics, could do more harm than good. Instead of avoiding conflict in participation Cuppen (2018) suggest that there is a lot of value in conflict. This value could be extrapolated through a better understanding of the social conflict at hand, whereas participation should not be a tool to solve social conflict. Rather, embracing social conflict enables the conflict itself to become a form of participation (Cuppen, 2018). Invited participation must be coordinated by municipalities, local organizations or companies, effectively sustaining some form of top-down engagement. Social conflict however can be seen as a bottom-up approach to participation. This is inherent to the nature of social conflict; contestants mobilize naturally through their stance on the conflict.

2.4 Prerequisites for modern participation

Chapter 2.3 has presented this research with a variety of pitfalls when it comes to approaches of engagement, especially when regarding preconceived notions of local publics and invited participation. In summary Correljé et al. (2015) define the main problems to avoid as “technocratic and populist” pitfalls. Technocratic pitfalls pertain to excluding stances and sentiments of local publics by merely following scientific or technological knowledge regarding decision-making. Populist pitfalls result in the neglect of the complexity of values, technologies and interests at stake within the context of the heat transition by giving too much weight to voices from outside the institutionalised systems (Correljé et al., 2015).

Novel principles of departure for participation

Correljé et al. (2015) argue that the societally responsible changes call for the acknowledgement and involvement of a variety of stakeholders’ values. Different (moral) stances of local publics are to be taken as starting points when considering a shared design of a local heat transition. Pesch et al. (2020) underlines this statement by identifying that residents their reflections regarding technological change are also substantially based on moral considerations. Thus, moral stances should be considered when engaging with local publics. This could in turn lead to a better understanding of the issue or barrier faced by the local stakeholders. Spruit et al. (2020) also share the view on starting points of engagement, they however approach this slightly more generic by stating that expectations of locals involved should be considered first. Of course, once engaged the process could then start of by exploring (moral) stances in terms of expectations regarding their heat transition. This would lead to engagement in which values can be compared instead of being strung up by unjust stereotypes and assumptions.

In line with Dutch governmental designs for the urban heat transition, Pesch et al. (2020) advise that technological change within energy systems should be seen as a process that is local, contextual and conditional. This statement is also in agreement with earlier claims as to the need for local, tailor-made approaches to the urban heat transition. Spruit et al. (2020) have noticed the need for tailor-made approaches, and thus optimal insights into the local context, can be achieved through avoiding the need for constant agreement within participation processes. However, municipalities still miss toolkits for engagement and are often not as locally in touch as might be required. To provide guidelines for engagement within this local context Pesch et al. (2020) suggest that the focus should lie on direct and tangible barriers faced by local communities. To discover the acceptability of change for local publics participation should thus not decontextualize understandings of technology. All forms of engagement are to be kept “bite sized” and relevant to the local situation. Also, the threshold for involvement of local parties is to be kept at a minimum if the aim is to attract pro-environmental behaviour (Pesch et al., 2019), which is clearly the case within the context of local urban heat transitions. Finally, to ensure that everyone participating within the engagement process feels included and heard, every stance and value should be embraced and taken into consideration (Spruit et al., 2020). Again, this is in line with getting rid of presumed stereotypes on local publics and allowing the engagement process room for expression of expectations and values.

Embrace conflict and change

Ideally, engagement approaches acknowledge conflict and permit change (Spruit et al., 2020). That is, change which has been obtained through interaction with local stakeholders regarding the course of their heat transition. Participation should thus embrace controverses as a pool of knowledge. The scientific community has started to embrace this concept in the form of the value of social conflict within energy project related participation. Cuppen (2018) argues that merit of social conflict as a participation tool can be based on the same three pillars as participation itself is argued for by Spruit et al. (2020) in section 2.1. The normative argument is that the value of social conflict concerns democratic values, as it is one's right to voice one's concerns or disapproval. Secondly, the substantial argument entails that social conflict is a phenomenon which is laden with knowledge, it can lead to better insights into the local context. The final argument is based on an instrumental perspective which pertains that social conflict embodies a form of management. If engagement focuses on addressing conflict head on negative effects can be mitigated (Cuppen, 2018). Insights into the value of social conflict provides this research with even more handles for better engagement within the context of local urban heat transitions. Engagement should embrace social conflict, opening it up for discussion to gain better insights into contextual factors at play. This perspective can easily be combined with dialogue pertaining to (moral) stances, values and expectations of local stakeholders. Providing a clear starting point for participation with residents.

2.5 Conclusion

This chapter set out to answer the first sub research question underlying this thesis, namely:

Which requirements should be placed upon novel participation approaches?

To answer this research question chapters 2.1 and 2.2 first investigated the purpose of, and need for, participation within the heat transition. In short, to enable people to voice their opinion, to increase social acceptance and to enhance contextual insights. Of which the latter leads to better decision-making. However, the vagueness surrounding the exact nature of engagement approaches entailed insights into the complexity of participation. With critique on traditional top-down approaches acknowledged throughout the scientific community, chapter 2.3 set out to highlight common pitfalls surrounding these approaches. In short, the main pitfalls of traditional (open or invited) participation are listed in table 1.

Table 1: The main pitfalls of traditional participation as identified in chapter 2.2

1	Local publics and their values tend to be forgotten
2	Stances of publics are assumed and stereotyped, leading to decontextualization of local values and viewpoints
3	Traditional invited participation will not entail a representative display of the local context, the silent majority will be left out
4	Ethical connotations are most often lost
5	Aiming to avoid social conflict results in “boomerang effects”

With these problems identified, chapter 2.4 set out to identify the main requirements for modern participation approaches. This was done through a review of various academic research. The pinpointed pitfalls acted as a starting point towards requirement that would help mitigate shortcomings of traditional approaches. The main requirements, and therefore the answers to the first sub research question, are presented in table 2.

Table 2: The main requirements for modern participation as identified in chapter 2.3

1	Avoid “technocratic and populist” pitfalls
2	Acknowledge and involve a variety of stakeholders, including stances and values, relieving participation from assumed stereotypes
3	Utilize local expectations and (moral) stances as starting points for engagement
4	Focus on contextual, direct and tangible barriers faced by local communities
5	Thoroughly understand the decisions to be made
6	Embrace social conflict

Now that the requirements for modern participation are clear, this thesis will focus on the identification of a toolkit that can support decision- and or policymakers in engagement approaches that live up to standards set out.

3

Revisiting the IAD framework with new insights

This chapter will answer the second sub research question; *Can the operationalization of the value laden IAD framework support novel participation approaches?* As chapter 1 has underlined, the IAD framework seems to be a valid toolkit for the support of participation within the context of the urban energy transition. Annex A first argues that the IAD framework is the most suited of its kind for this specific research. Argumentation is given based on scientific research, utilization of various toolkits and insights from practise. Secondly, this chapter will uncover if the IAD framework can be enhanced to better fit this thesis. Finally, inputs for the operationalization of the IAD framework, as a toolkit for participation within the heat transition, are defined.

3.1 A Detailed view of the IAD framework

3.1.1 Learning from previous utilizations of the IAD framework

To avoid “reinventing the wheel” when looking into ways the IAD framework can be made even more compatible for assisting engagement, this section first dives into applied IAD research. For instance, in the work of Nigussie et al. (2018), where the framework is utilized to investigate how soil and water conservation measures can be made more effective and sustainable through operationalized participation. The IAD framework helped their research identify that participation is often organized in top-down fashions whilst it would be more effective and sustainable to do so bottoms-up. Molenveld & van Buuren (2019) studied the application of adaptive governance approaches to flood risk management in the Netherlands. The IAD framework was operationalized with a focus on rules, granting their research a more specified analysis via which they coped with a common critique.

Enhancement of the IAD framework
Another way the IAD framework is made more relevant and context specific is by enriching it with another theory. This approach is observed in the work of Lammers & Heldeweg (2016) and Milchram et al. (2019). Lammers & Heldeweg combine the IAD framework with an institutional legal theory to analyse smart grid technology implementation. Their enriched framework is applied to a case study of a Dutch smart grid project. In their case, to reduce the complexity in local decision making on smart grid implementation. Milchram and colleagues build on the IAD framework with theories of social learning and value perspectives to highlight the role and influence of values when considering transitions towards sustainable energy systems. Their research presents an analytical tool to identify embedded values in energy systems and the ways in which they shape communities and behaviour. A context specific adaptation of the IAD framework, which is especially relevant for this research when linking back to knowledge gaps identified in the first chapter.

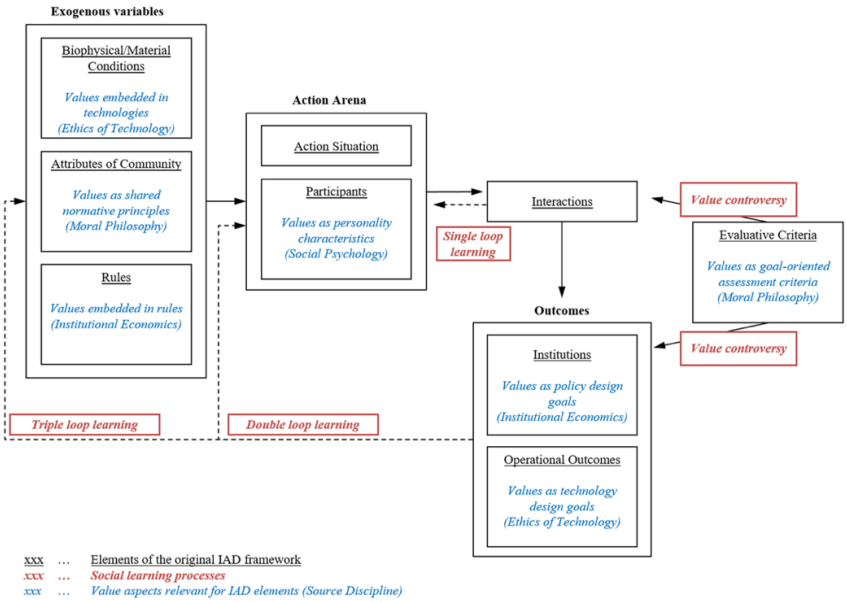

Figure 4: The IAD framework extended by social learning and the role of values (Milchram et al., 2019)

Milchram et al. (2019) suggest, as potential for future research, a practical application of the value enriched IAD framework as presented in figure 4. Furthermore, they specifically suggest this to be done with respect to a case study regarding change in energy systems. Lammers and Heldeweg (2016) show that a "specialized" IAD framework can reduce complexity and support decision making when operationalized on a case study. In line with calls for a more focused and contextual application of the IAD framework, Milchram et al. propose that a selection of value perspective(s) is applied to a selection of IAD elements. The case study itself will have to dictate the nature of said selections.

Reflecting on knowledge gaps identified in chapter 1, the continuation of their research is a great match for this research. Since both literature and practice call for "a deeper comprehension of stakeholder values, roles, customary interests and institutional agreements" within the urban energy transition. To gain said comprehension the application of the IAD framework requests case study data which can be acquired through interviews, questionnaires and focus groups. Furthermore, a detailed investigation into attributes of community and (in)formal rules can account for possible power dynamics within the case. Finally, researching the values embedded in technology can account for the value of information within renewable debates. Thus, the application of a focussed and case relevant framework as depicted in figure 4 can help investigate both the knowledge gaps as well as account for critique on the framework as presented throughout chapters 1 and 2.

Augmentation fit for this research

As can be observed in figure 4, Milchram et al. (2019) argue for different value-based theories throughout individual sections of their enhanced IAD framework. Thus, placing a dedicated focus of specific theory on each individual aspect of the IAD framework. In chapter 2 a call for the utilization of values throughout participation has been heard. Thus far, this is in line with the utilization of the value enhanced IAD framework of Milchram et al. (2019). Since this could support the process by living up to the novel standards for modern participation. However, as this research argues, the utilization of the IAD framework as a supporting tool towards modern participation is extremely novel. Especially within the context of a neighbourhood heat transition. Therefore, this research does not directly want to lie its focus on a single value

enhanced part of the IAD framework through the utilization of a single theory as suggested by Milchram et al. (2019). Luckily, this does not mean that a value enhanced IAD framework is no longer an option. But to avoid a too narrow focus too quickly in such a novel process, this research proposes an iteration on the works of Milchram and colleagues.

During their research Milchram et al. (2019) also argue for the utilization of the Schwartz value theory in energy related cases. Schwartz's value framework is known for the conceptualization of measurement of value and is widely adopted (Milchram et al., 2019). This plays well with the purpose of the IAD framework for this research, since it should help better understand the local context, allowing for any deviations of preconceived notions to be heard. What this research aims to avoid is creating a very specific toolkit that might be too curbed to be operationalized within every neighbourhood. The goal here is to create a "generic" toolkit that fits all requirements whilst not being too complex nor specific up to the point where is does not support participation. And incorporating the Schwartz value framework better helps finding different stakeholder's motivations and values (Milchram et al., 2019). Thus, especially when looking into the local community and its participants, Schwartz his theory can enhance the IAD framework for the purpose of this research. To better understand values at play the next chapter will review the Schwartz value theory. After the theory is better understood chapter 3.2 will place its relevant parts upon the IAD framework to enrich it.

3.1.2 Value theory for enhancing the IAD framework

The basics of Schwartz's value theory

To incorporate local stances and values in participation the concept of values first must be understood. This is where the Schwartz theory of basic values comes into play. According to Schwartz (2012) values can be framed based on six main characteristics, as displayed in table 3. According to Schwartz these features are characteristics of all values, varying in context specific importance and distinguished by the goals they might highlight. Schwartz's value theory contains ten broad values enriched by the characteristic's values might attain. These ten values are listed in table 4, including the defining goal of each value.

Table 3: The six main features of values

Value characteristics	**Description**
Beliefs	Values are beliefs in the sense that they are directly connected to one and another. Once certain values are enabled, they are loaded with feeling.
Desirable goals	Values link to goals since values can motivate actions. If an individual has several important values, then these will motivate them to achieve goals.
Exceeding actions or situations	Values can transcend specific actions or situations as they can be varying in relevance depending on the environment one is situated.
Serving as standards	However rarely conscious in everyday life, values guide the evaluation of actions, people and policies to name a few. Thus, values serve as criteria.
Ordered by importance	Individual's values are often constructed in an ordered fashion which characterize them and make them unique.
Multiple values guide actions	The tradeoff among relevant, competing values guides attitudes and behaviors (Schwartz, 2012).

Table 4: The ten basic values of the Schwartz value theory

Values	**Description**
Self-direction	Self-direction can be defined through autonomy and independence.
Stimulation	Stimulation values stem from the goal to sense excitement, challenges and new experiences
Hedonism	Hedonism is best articulated through pleasure, enjoyment and self-indulgence
Achievement	Achievement emphasizes the goal of showing competence measured up to (social) norms
Power	Power relates to a certain social status, prestige or superiority
Security	Security is "safety, harmony, and stability of society, of relationships, and of self" (Schwartz, 2012).
Conformity	Conformity is a value that shows itself through self-control or restriction, not wanting to upset or harm others or social norms.
Tradition	Tradition is the respect and acceptance towards customs that are given through certain religions or beliefs.
Benevolence	Benevolence relates to the value that one wants to maintain or stimulate the well-being of those around them.
Universalism	Universalism relates to the respect, admiration and protection of welfare regarding both humans and the environment.

The very basics of the Schwartz value theory have shown that there are not only ten general types of values, but that values can influence beliefs, goals and behaviour. This is especially relevant when investigating local publics and their stances. Once their "more important" sets of values are discovered their behaviour or goals can be easier accounted for. In the worst case this can at least help those guiding the local transition to take their values into account based on Schwartz's theory. Furthermore, according to Schwartz (2012) the theory does not only identify the ten common values but there are also structured dynamic relations between them. This is portrayed in figure 5, which shows that values can be structured as a circular dynamic. Where opposing values, as displayed within the circle, stand against each other in terms of personal motivation or belief. Furthermore, this figure shows a classification of value sets that "work or belong" together.

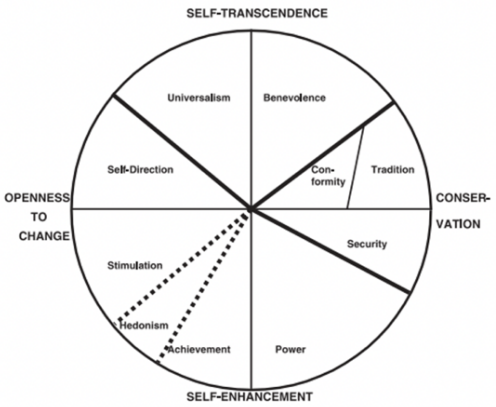

Figure 5: Circular motivational continuum of values (Schwartz, 2021)

Figure 5 shows that certain values can be grouped together, working alongside towards certain actions or motivations. Depending on the importance an individual adheres to certain values, “higher order” behaviour can be accounted for. Like when a person is open to change or might act very conservative. Important insights when trying to implement change within their life’s. And whilst individuals might highly differ in their “sets” of important values, across societies there is often a surprising consensus in the way its people structure the relative importance of the ten values. Schwartz noticed this phenomenon in his research, whilst validating his theory, and was able to create a pan-cultural baseline for the rating or structure of the ten values. This baseline presented in table 5, ranked from high to low value importance. This baseline is especially useful when comparing sample rankings of individuals. To find if certain values truly stand out, they will deviate from this baseline.

Table 5: Pan-cultural baseline of value ranking

1	Benevolence	*6*	Hedonism
2	Universalism	*7*	Achievement
3	Self-direction	*8*	Tradition
4	Security	*9*	Stimulation
5	Conformity	*10*	Power

It is therefore important to keep in mind that individual’s value preferences might differ when compared but when studying a society, or even a community, consensus regarding values can arise. Even more importance is that, if a personal has ranked a certain set of values highly, this does not automatically mean that one is more prone towards those values then other people. As they would have to differ from the baseline presented in table 5.

Values correlating to trust and environmental behaviour

Besides understanding individual’s their basic values and how these might motivate or steer them, Devos et al. (2002) found that a relation between values and trust in institutions exists. This is especially relevant for this research since institutions are, within this context, national and local governments or steering initiatives otherwise. Basically, any organization that can dictate, steer or support communities and households in the heat transition. Thus, if a direct link between locals, their values and trust towards institutions can be established engagement can be organized accordingly. Devos et al. (2002) define trust in institutions as “the faith or support people feel toward institutions. That they are competent and acts in responsible ways”. Their research found that people highly ranking the values security, conformity, tradition and power correlate positively with trust in institutions. On the other hand, individuals that rank self-direction, hedonism and universalism highly, correlate negatively with trust in institutions.

Another topic on which consensus has been found is that of value preferences and pro-environmental behaviour. Especially relevant when considering individual’s or community values within the context of the urban energy transition. One can imagine that people with a stronger pro-environmental orientation tend to support technology that is more sustainable and will be more open to change in terms of natural gas-free living. Those opposing these values should also be heard within participation approaches but might require different support. Throughout a study across 3 continents, it was found that self-transcendence related values, as further described in table 6, are important to identify when trying to predict pro-environmental behavior (Scultz & Zelezny, 1998). This same research found that self-enhancement related values often predict behaviour that results in a negative relation towards the environment. Prior (2016) & Bouman et al. (2018) underline the importance of self-

transcendence values when it comes to encountering sustainable behaviour. Again, self-enhancement was found to be a driver for the opposite behaviour. Since continents included were North America and Europe these statements are considered within this research. This is underlined by Agissova & Sautkina (2020), they found that values supporting pro-environmental behaviour in Amerika and the Netherlands are alike. However, these same values could stimulate the opposite behaviour in countries as China and Japan. Therefore, it is important to note that such relations are never absolute and should only be utilized in a supporting manner. They are not to be used as guides but as tools to quickly gain a better (somewhat general) insight into a specific context.

In conclusion, the ten basic human values as portrayed by the Schwartz value theory provide insights and handles into the essence of drivers behind human views and behaviour. More specifically, they can be used in understanding environmental behaviour and trust towards institutions. To utilize these insights, values need to be placed within the IAD framework as done by Milchram et al. (2019). How they are to be incorporated to support engagement through the operationalization of the IAD framework will be set out in the next chapter.

Table 6: A further detailed overview of value descriptors (Schultz & Zelezny, 1998)

Self-transcendence	***Self-enhancement***	***Openness***	***Openness***	***Conservation***	***Conservation***
Universalism	**Power**	**Self-direction**	**Hedonism**	**Tradition**	**Security**
Protecting environment	Social power	Creativity	Pleasure	Devout	Clean
World of beauty	Authority	Curious	Enjoying life	Humble	National security
Unity with nature	Wealth	Freedom		Moderate	Social order
Broad minded	Preserving public image	Choosing goals		Respect tradition	Family security
Benevolence	**Achievement**	**Stimulation**		**Conformity**	
Helpful	Successful	Daring		Politeness	
Honest	Capable	Varied life		Honouring elders	
Forgiving	Ambitious	Exciting life		Obedient	
Loyal	Influential			Self-discipline	

3.2 Inputs required for the operationalization of the IAD framework

Chapter 3.1 has proved this research with insights into the IAD framework, that it is the most suited of its kind for the purpose of its research and that the framework is suited to be enhanced by values, as called for in participation theory. The final section of 3.1 set out the value theory by Schwartz, which has highlighted the basic values that drive and motivate humans towards certain behaviour. This behaviour includes pro-environmental and trust aspects which are very relevant for this research. The question that now remains is that of which inputs are required

to operationalize the value laden IAD framework within the context of a neighbourhood heat transition. Furthermore, on which aspects of the framework should value theory be focused to assist novel participation. This chapter sets out to answer these questions.

Fundamental notions of the IAD framework

McGinnis (2011) notes that it is of importance to first explain some key concepts that are at the basis of the IAD framework, namely Institutions, Analysis and Development. Starting off with institutions, which pertain a different concept than the institutions mentioned in 3.1.2. Here institutions are defined as "human-constructed restrictions or chances in which individual choices take place" (McGinnis, 2011). Ostrom (2010) makes this concept slightly more tangible by relating to environments and arrangements that influence the context of individual choice making. Thus, institutions pertain to rules (formal or informal), laws, policies and markets but also to the influence of values, norms and characteristics of resources or communities. An analysis involves breaking down the institutional context and arrangements, to study their effects on outcomes of decision-making (McGinnis, 2011). Development is used in its most general definition, pertaining to the dynamic changes in institutions. Finally, it is important to understand that a framework is merely a tool though which the factors deemed critical can be identified and organized.

With these concepts at the roots of the IAD framework, it is time to further dive into its individual components. McGinnis (2011) provides an overview of the key elements which make up the IAD framework as can been seen in figure 1. Table 7 represents an interpretation of both the definitions used by Ostrom (2010) and McGinnis (2011).

Table 7: An overview of the key components of the IAD framework

Key components	**Description**
Biophysical conditions	These conditions describe the nature of the "good" which is relevant to the action situations. For this case the biophysical conditions mostly relate to technical alternatives for neighbourhoods in order to become natural gas-free. Important qualities include the subtractability (rivalry) and potential for exclusion from the good.
Attributes of community	This term embraces all aspects of the social and cultural context in which the action situation takes place. Key elements are amongst others trust, norms and values, social capital, social dynamics and traditions.
Rules-in-use	The rules that are in play link back to the definition of institutions. Thus, all constructs that constrain or provide opportunities by which individual choices are shaped. Relevant examples are policies, subsidies, rights and laws but also the informal rules pertaining to norms (social behavior).
Action situation	This crucial component can be seen as a "black box" in which choices are made. All components of the IAD framework (in)directly influence this "area" in which participants, thus the relevant stakeholders involved, make decisions. Participants can have different stances, status or power, information and expectations that are to be taken into account.
Interactions	Interactions take place between participants. As information flows participants learn or influence one and another regarding the decisions to be made.
Evaluative criteria	These are the criteria used by participants upon which outcomes are based to be satisfactory or not. Criteria can be efficiency, legitimacy or sustainability for example.
Outcomes	The outcomes, most generically defined in form of decisions, are shaped by both action situations as well as criteria placed upon said outcomes.

Through the descriptions presented in table 7, inputs required to operationalize the IAD framework are mostly the exogenous variables as shown in the IAD framework. These variables "encompass all aspects of the social, cultural, institutional and physical environment that sets the context in which the action situation takes place" (McGinnis, 2011). However, as argued in chapters one and three, there is also a need for a "nested" approach to action situations and the incorporation of values. These factors influence the input required in order operationalize the IAD framework. In general, the IAD framework differentiates between four levels or scopes. McGinnis (2011) explains that these levels are linked to different planes of actions situations and thus choice-making. The levels are based on operational, collective, constitutional and the meta-constitutional choice levels. The operational-choice level pertains to the contexts in which participant's choices directly impact concrete outcomes. The collective choice settings constructs institutions and policies that constrain or enable participants through collective decision-making. The constitutional nest is often the process of defining, legitimizing and constituting all relevant collective bodies (Ostrom, 2010; McGinnis, 2011). Finally, meta-constitutions regard factors that are often not considered affected by individual's decisions, for example long standing norms or culture. The levels are displayed in figure 6 as constructed by Ostrom (1999). These levels of analysis influence the ways by which the IAD framework is utilized as well as the inputs required for the operationalization.

Placing value theory within a nested design

Finally, this research needs to assess where the value theory by Schwartz should come into play, to enhance the IAD framework. As noted, and implemented by Milchram et al. (2019), different value theories match with different parts of the IAD framework. When looking back on Schwartz's value theory, a focus on individuals is found. On top of that pro-environmental behaviour and trust towards institutions are based on individuals' value preferences. Thus, looking at the IAD framework, the work of Schwartz should be mainly considered throughout the elements; attributes of community, interactions and evaluative criteria. In turn all these elements influence the action situations and thus invoke values into this arena. First, for the attributes of community since trust and values are large parts of this component, expanding on Ostrom's original tool. Secondly, since participants correspond with one and another, in interactions. Values can steer behaviour and influence the ways participants might interact with each other, values however can also influence the way information is absorbed. Finally, values serve as standards and thus act as evaluative criteria (Schwartz, 2012).

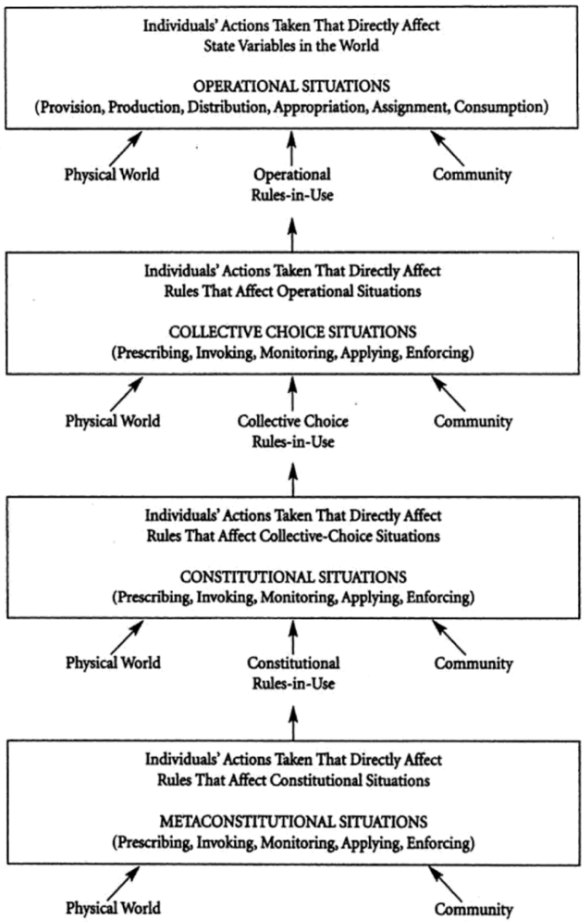

Figure 6: Levels of analysis through the IAD framework (Ostrom, 1999)

Returning to the inputs required, to operationalize the value laden IAD framework, the contextual factors stem from multiple levels of analysis. Throughout these levels Schwartz's value theory needs to be considered regarding attributes of community. Still, most of these inputs can be required through desk research. However, many elements of the IAD framework remain unprocessed through desk research only. Therefore, as argued for in chapter 1, this research will utilize interviews to gain a deeper insight in the relevant action situations, interactions, evaluative criteria and outcomes. This is also exactly the point from which the IAD framework will clearly act as a toolkit for participation. The inputs defined by contextual factors can be used as a basis, which will be built upon with knowledge of the local context through participation. Multiple rounds of interviews, local meetings and information can help shape insights into barriers faced by neighbourhoods in their transition towards natural gas-free homes. All this unfolds itself in figure 7 as presented below. A key difference with the levels portrayed in figure 6 is that this research argues for a more dynamic relationship between action situations. Since all levels (in)directly influence each other, it is argued that their positions towards one and another should portray this dynamic. The utilization of the framework as presented in section 6.1 will underline these arguments.

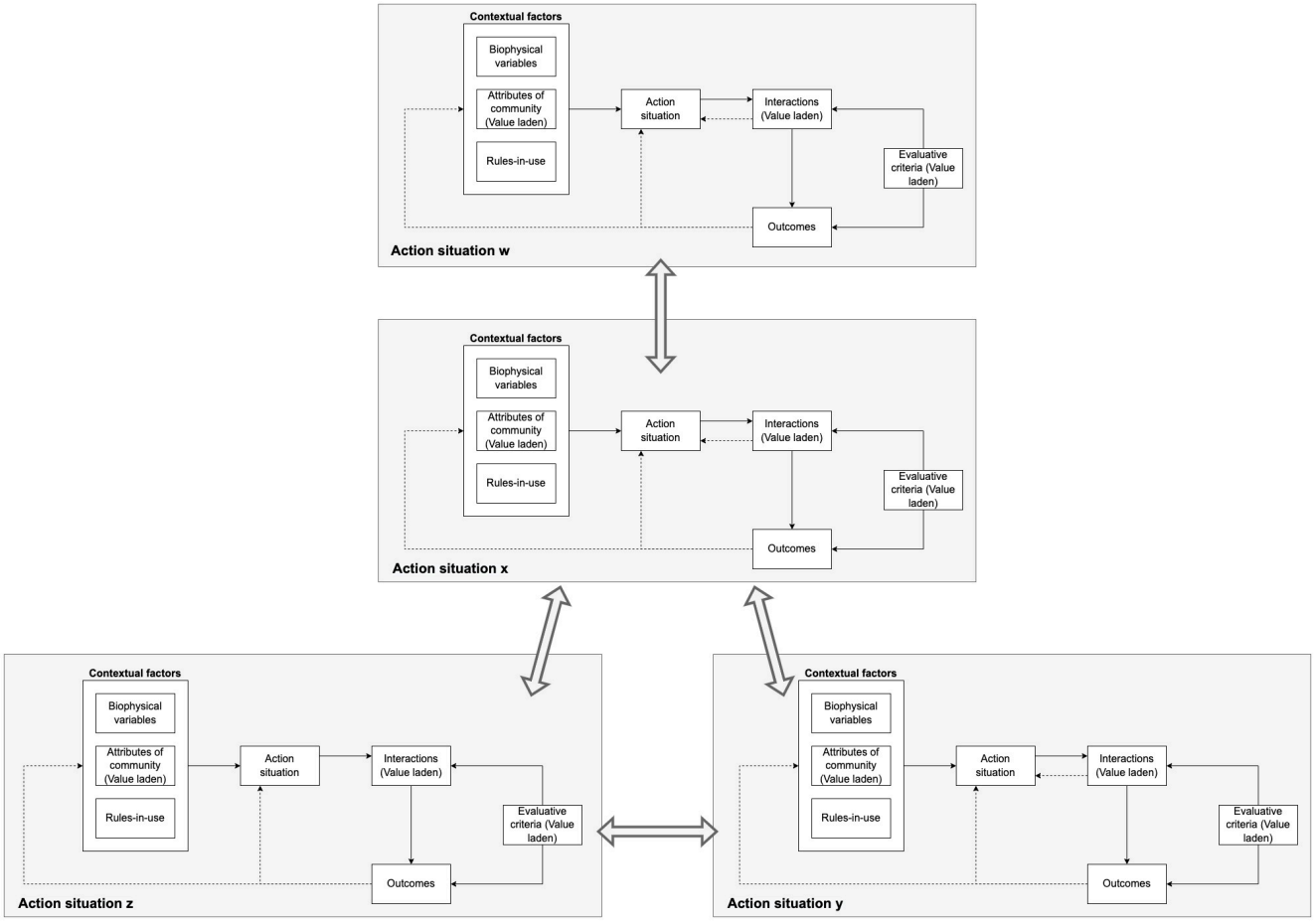

Figure 7: Dynamic levels of the value laden IAD framework

3.3 Conclusion

Now that the IAD framework has been confirmed as the most suited toolkit of its kind for this research, this section aims to verify if the potential of this framework can match the requirements for modern. To see if the value laden IAD framework can function as a toolkit for novel participation within the urban energy transition. As a reminder the requirements identified are stated below, as is the sub question to be answered:

1. Avoid “technocratic and populist” pitfalls
2. Acknowledge and involve a variety of stakeholders, including stances and values, relieving participation from assumed stereotypes
3. Utilize local expectations and (moral) stances as starting points for engagement
4. Focus on contextual, direct and tangible barriers faced by local communities
5. Thoroughly understand the decisions to be made
6. Embrace social conflict

Can the operationalization of the value laden IAD framework support novel participation approaches?

Whilst it remains dependant on its user, the framework does meet requirements set. First, since the IAD framework encompasses all contextual factors from characteristics of technology and resources to societal, cultural and institutional influences. It forces its users to steer away from both technocratic and populist pitfalls. The lens that the IAD framework provides ensures that more factors and values are accounted for than just scientific or democratic arguments. Secondly, by enhancing the framework with Schwartz’s value theory the word “value” has been given more body and consequent understanding than it just being a generic term that is frequently used. This notion alone provides the framework with more tools to better understand what values are, and more importantly how they can guide human behaviour. Furthermore, the framework ensures that participants involved in the action situation are identified, thus acknowledging all those that form the community. Through the full extent of this framework one will not only need to identify all stakeholders, but also understand them. Thus, supporting its user to avoid stereotypes. The fact that the operationalization must take place on multiple levels or action situations again underlines that more stakeholders will be accounted for. The third requirement is a bit trickier to answer. Yes, this framework will help identify expectations and stances, and this process already will entail participation. From this point onwards it is however up to those engaging to ensure that these factors are used throughout the process. The fourth question again is complex in nature. The framework will help unravel barriers faced by local communities. However, it does more than focus on the tangible. Ultimately though, through the IAD framework this requirement can be met. The fifth requirement is a simple one to answer. Decision-making lies at the heart of the IAD framework, in the form of the action situation. Especially when considering these action situations are analysed over multiple planes this requirement is met. Finally, does it allow participation to embrace social conflict. Again, the framework provides room for social conflict to be identified. Since it does not provide solutions, it does not aim to “solve” the conflict. In this sense the framework meets the final requirement. In conclusion, the value laden and nested IAD framework can support novel participation, it provides its users with a toolkit towards a deeper understanding of the decisions at hand. It will support its utilizer towards novel participation if operationalized as prescribed. However, it remains subject to its user. It is no guarantee for novel participation, nor will it provide a set of prescribed solutions.

4

The omnipresent context of the Dutch urban heat transition

The first half of this chapter is designed to conclude on sub research question three; *What is the technical context of the urban heat transition for Dutch neighbourhoods?* The second half of this chapter places its focus on sub research question four; *What challenges do the formal and informal institutions present the Dutch heat transition?* In answering both questions, elements required before engagement are brought to light. That is, information of essence throughout all layers or action situations of the analysis. This research argues that omnipresent data is mostly gathered through both the technical as well as the institutional context of the Dutch heat transition. Since these factors influence decisions on all levels of analysis.

4.1 Technical context of the Dutch urban heat transition

When researching options for households towards natural gas-free homes multiple sources provide step-by-step plans. These plans often start of very basic, with the “no-regret” type of solutions, things that can always be done to improve one’s home which won’t compete with possible technical solutions. In general, these plans are designed around the following general structure (Rijksoverheid, n.d.; Milieu Centraal; n.d.):

- Examine isolation values home
- Enhance isolation if required
- Examine and improve ventilation home
- Examine radiators
- Replace gas stoves with electrical cooking systems
- Replace boiler
- Replace central heating systems

Besides these steps households can always install solar panels and smart metering systems, solutions that help households become more sustainable but won’t compete with possible alternatives to natural gas (Milieu Centraal, n.d.). When considering the list presented above it is clear that the focus here lies on initial steps towards more sustainable homes, on improving the efficiency of homes. However, the final step is the most critical in this list, main to the transition when replacing natural gas for heating homes. “Replace central heating” can of course be done with the same mindset as the steps above, invest in a system that is more efficient but still uses natural gas. However, this step is a little more complex than it seems. The problem here can be summarized by the need for information. Since newly bought systems often last around 15 years, the one investing in said system will want to use it for its lifetime. In theory this should be possible, as the Netherlands aim to be natural gas-free by 2050. However, the investment in such a unit will not make sense if the timeline for an individual is suddenly sped up. The question if one can use the heating systems for its expected lifetime is up for debate, as it is dependent on several factors. Firstly, will natural gas be phased out sooner in one’s direct environment? Will policies be implemented why will make consuming

natural gas increasingly more difficult or expensive? Will municipalities plan other technical alternatives that might force owners to abandon their efficient heating installations sooner? All these factors come into play, thus the need for information, when considering upgrading one's heating system. Already the Dutch government has implemented a ruling which makes hybrid heat pumps, when replacing old central heating systems, mandatory for households from 2026 (Rijksoverheid, 2022). The other option is of course to replace systems that provide heating and domestic hot water (tap water via boiler) with sustainable alternatives, as suggested in the plan listed above. This then raises the question; Which alternatives are available and most suited for households in their own specific contexts? The following sub chapter will dive into this question.

4.1.1. Alternatives towards natural gas-free homes

In this chapter the technological options for replacing natural gas-based heating systems stand central. What options do homeowners have to replace their gas-based boilers for heating both space and tap water? The first main distinction between technological alternatives made within literature is that of collective versus individual solutions (Avest, 2020; Neves Cordeiro et al., 2019; RVO, 2017; de Jong, 2019; Cole, 2021). This first critical differentiation stems from multiple arguments. Avest (2020) argues that for rural parts of the Netherlands, thus environments with a sparse housing concentration, individual solutions are more fitting. This same research argues that collective solutions are ideal for urban areas. Cole (2021) argues that individual solutions are fitting for houses that are difficult to connect to networks, which are in play when considering collective solutions. Why is this the case? Efficient and effective collective solutions gain their benefits from densely built areas to which a high number of homes can be connected. These solutions are not only more efficient but also cheaper (and thus have a business case) when a relative compact network can connect a high number of households. Finally, a hybrid category or distinction of sorts exists representing technologies that can both be utilized in a collective or individual sense. This category is based on bio- or green gas, since in theory current (gas) networks and systems could be utilized for these solutions. Hydrogen is also included within this category since the infrastructure required can be seen as similar. These solutions are of course only viable if there is a (quasi) match between supply and demand. Thus, requiring a collective on the demand side in a certain environment to ensure a descent balance and therefore business case, another reason why these solutions have a collective nature. Table 8 presents an overview of technical alternatives based on literature research (Avest, 2020; Neves Cordeiro et al., 2019; RVO, 2017; de Jong, 2019; Cole, 2021). Several alternatives will have been left out due to their novelty.

Table 8: An overview of the main technological solutions that can replace natural gas-based heating systems

Category	**Solution**	**Description**
Collective solutions	High temperature heat networks (often referred to as "District Heating"	Heat networks consist out of a pipeline infrastructure through which water at a certain temperature flows. A heat source, commonly (natural gas-based) residual heat or biomass, is used to bring the water up to around 85 degrees Celsius. The high temperature water is then delivered to housing connected to the infrastructure.

	Mid to low temperature heat networks	Heat networks consist out of a pipeline infrastructure through which water at a certain temperature flows. A heat source, commonly aquathermal, geothermal, solarthermal or datacentres, is used to bring the water up to a range between 15 – 60 degrees Celsius (depending on the nature of the network). The mid to low temperature water is then delivered to housing connected to the infrastructure.
	Thermal energy storage	Thermal energy storage stocks thermal energy by heating or cooling a storage medium so that this energy can be utilized at a later point. This technology is commonly utilized in combination with other sustainable heating technologies.
	Pellet stoves (building complex)	Solid fuels which can be used as a heat source for residential heating, especially fitting for apartment complex's
Individual solutions	Heat pumps	Heat pumps convert heat from the outdoors (air, ground, water). They can be fully electric or hybrid (with the natural gas fuelled system only kicking in during peak loads). Heat pump systems can be used to heat space as well as tap water.
	Electrical heating systems or boilers	Electrical heating systems are units that can replace current central heating systems. They however also come as single boiler units, purely for heating tap water.
	Solar boilers	A solar boiler utilized solar energy towards heating home water supplies. Most commonly this unit "pre-heats" domestic water, thus reducing energy required to bring the water up to target temperatures.
	Pellet stoves	Solid fuels which can be used as a heat source for heating individual homes.
Hybrid solutions	Bio- or green gas	A methane-based gas produced through decomposition of organic fuels like agricultural waste. This gas can be used like natural gas is used currently.
	Hydrogen	Via an electrolyser water can be split into hydrogen and oxygen by means of an electric current. The hydrogen gas can then be burnt in dedicated hydrogen boilers in order to provide heating for homes.

Heating solutions for the urban built environment

Turning back to literature, especially focused on the Netherlands, it can be concluded that there are three solutions considered most potent. These are both high and low temperature heating networks for urban areas, and heat pumps for rural environments (Verhagen et al., 2021). Verhagen et al. (2021) found that their research is in line with Dutch national political views for replacing fossil-based heating systems. The research of Avest (2020) concludes alongside the same lines, as heat networks (either on their own or in combination with thermal energy storage) are deemed the most potent current solution for urban areas. Finally, Cole (2021) advises the Dutch government to focus on renewable electrification through heat pumps and heat networks, again in line with earlier findings. Their research found that the Dutch government has already set its sights on heat networks, mainly district heating. Beckman & van den Beukel (2019) expect that new heating systems in the built environment will be dominated by about 50% heating networks and 50% heat pumps (both electric and hybrid). To some this all might come as a surprise, there is little mention of hydrogen or biogas. According to research that is for good reasons. De Jong (2019) found that energy conversion values for biogas are too low. Furthermore, the sustainability of biogas is questioned in this research. Hieropgewekt and the Gemeente Amsterdam (n.d.) both agree that another key problem for

the use of biogas is the lack of supply. Cole (2021) concludes that hydrogen will only become available and affordable after 2030. Furthermore, the potential of hydrogen is arguably best utilized within the decarbonization of the (heavy) industry, as hydrogen can support high temperature processes (Cole, 2021; Gemeente Amsterdam; n.d.). Finally, both gasses seem to lack an infrastructure as of now. Even though the gas infrastructure is suited for both (theoretically), this infrastructure is this heavily utilized and there is no clear timeframe on when this could change.

This section has provided an introduction into alternatives for natural gas-based heating systems. However, the focus of this thesis lies on the heat transition within urban neighbourhoods. Therefore, the next section will zoom in on the solutions which are currently deemed to have the most potential, heat networks. Since these solutions are the most economical and sustainable within densely housed urban areas (Kim et al., 2019)

4.1.2. Heat networks for urban neighbourhoods

According to Liu et al. (2021) sustainable heating systems can be distinguished by three main factors; the heat source, the delivered heat temperature and whether it is an individual or collective solution. As argued for in the previous section this research will now focus on collective solutions know as heat networks. Networks that typically are made up out of pipes, displacing pressurized water at a certain temperature, from heat source (central or multiple decentral) to customer. Another key aspect to heating networks is to utilize heat sources that are near the designated customer area, as transporting heat over longer distances will result in higher losses (ten Haaft, 2020). This being, the classification of Liu et al. (2021) still holds. Heat networks can be divided into three main categories: high, medium and low temperature heat networks. The heat sources available per category are often directly linked to its temperature. The construction of heat networks basically entails the following process (Milieu Centraal, n.d.): First, digging and opening the streets. Second, the removal of gas connections and meters. Third, the installation of heat exchangers (60x40x20 cm), followed by a switch to electrical or induction cooking. Then, isolation and ventilation demands have to be met. Finally, if required a booster pump and upgraded radiators are installed.

High temperature district heating networks

Most of the current heat networks, better known as district heating (DH) systems, can be characterized by a central heat source such as co-produced heat of power plants (mostly gas-based) or biomass (Liu et al., 2021). They are also characterized by their high temperature, as mentioned often around 95 degrees Celsius. The rudimentary thought behind DH systems is to use heat resources that would otherwise be left unused (Werner, 2017). In the case of high temperature district heating (HTDH) this heat source is thus often co-produced (or waste) heat. The advantage of these HTDH systems, due to their high temperature, is that they are suited for all types of housing. From very well isolated homes (label A) all the way to old and poorly isolated housing (label G) (ECW, 2021). These high temperatures do come at a cost. In the Netherlands, most HTDT systems are still reliant (indirectly) on natural gas as a heat source (Milieu Centraal, n.d.), only increasing the dependency on fossil fuels (ten Haaft, 2020). The sustainability of biomass as a heat source is also up for debate (Wendel et al., 2022). Even if the sustainability of the source of HTDH systems is up for debate, they still allow for a reduction in CO_2-emission of up to 55% compared to regular boilers (Milieu Centraal, n.d.). 55% might sound like a lot at first, and according to Verhagen et al. (2021) the widespread implementation of HTDH networks has the potential to reach the 2030 climate goals (49% reduction of

CO_2 emissions). However, great commitment to this technological solution would significantly curb further possible reductions. Furthermore, as Liu et al. (2021) argue, the future design of sustainable heating systems in the Netherlands will require current systems to improve on at least three technological planes. These being saving energy, improving efficiency of systems and replacing natural gas with truly sustainable sources of heat. Inherent qualities of HTDH systems are currently relative high losses of heat, due to the high temperature within the networks, and their relationship with fossil fuels. According to Delmastro (2021) HTDH systems lose up to 30% before the delivery of heat. Consequently, HTDH does not adhere to design demands for future heating systems. Another problem HTDH systems might run into, especially those dependent on fossil fuels, is of an economical nature. As increasing amounts of marginal cost wind power will negatively affect the market position of coproduction plants (Østergaard & Andersen, 2018), plants that supply HTDH with heat.

Low temperature district heating networks

Lowering the temperature of heat networks thus plays a major role in increasing the energy efficiency of DH systems. A reduction in temperature does something more though, it most importantly allows for a better integration of sustainable heat sources (Leoni et al., 2020). Decentral sustainable heat sources like geothermal, aquathermal, solarthermal and residual heat (from for instance datacentres) do not occur naturally at high temperatures. Upgrading said heat sources to 95 degrees Celsius is not viable, thus they are only applicable for lower temperature networks. Lower temperatures also allow for a better integration with thermal energy storage solutions, as less losses and thus higher efficiency are again leading (Boesten, 2019; Leoni et al., 2020). Another advantage to combining LTDH with storage is an increase in flexibility and utilization of volatile renewables (Schmidt, et al., 2018). Verhagen et al. (2021) found that investment costs between HTDH & LTDH do not have to differ substantially and that LTDH can be economically viable. This is currently however only the case when LTDH systems are backed by governmental support schemes. In terms of potential for emission reduction, Verhagen et al. (2021) found that a combination of LTDH and heat pumps can reduce Dutch urban heating related CO_2-emissions by 90%. Thus, this combination is a future proof long-term alterative to natural gas. An important note here is that these LTDH systems do require a considerable capacity of sustainable heat sources. Luckily, Hoogervorst (2017) found that geothermal, aquathermal and residual heat have a combined potential heat supply far greater than the long-term demand for urban heat. Another advantage to LTDH is that these sustainable decentralized heat sources can be combined for feeding heat into LT systems. Sulzer et al. (2021) depict the development towards future DH systems in figure 8.

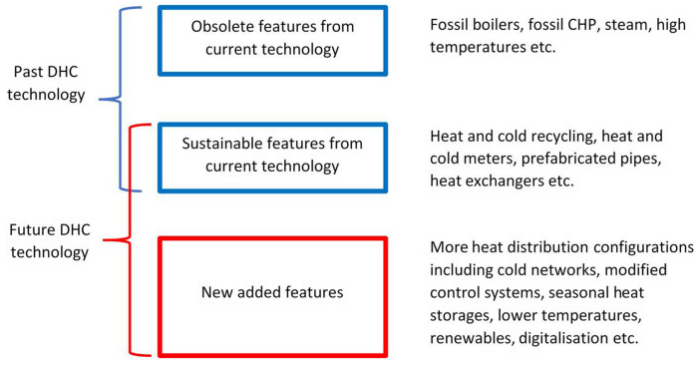

Figure 8: Development towards future DH (Sulzer et al., 2021)

The ECW (2021) first define the mid temperature heat networks as systems with a delivery temperature (at customer) of 55 to 75 degrees Celcius. These networks are suitable for housing with energy labels ranging from B to D, also at these temperatures tap water can be heated beyond Legionella risks. Mid temperature DH can be designed as either a lower temperature HTDH system or as a system in which sustainable low temperature sources are upgraded to delivery heats above the Legionella boundary. This same institution defines LTDH systems as networks with a delivery temperature between 30 and 55 degrees Celsius. Again, the advantage of these systems is that of lesser losses and the utilization of multiple decentral sustainable sources. These systems do have their downsides. As they are only of use in well isolated homes (label B and upwards) with lower temperature radiators and possible floor heating systems. Furthermore, LTDH systems deliver tap water heat below the Legionella threshold. This entails that these systems require an extra “booster pump” to upgrade the temperature for tap water beyond the legionella threshold. Besides higher isolation demands, radiator requirements and a potential installation of a booster pump the heat networks do not differ regarding changes on the customer side.

Stakeholders’ preferences for future district heating

Jansma et al. (2020) researched homeowner and tenant’s perspectives on the alternative technical solutions to natural gas-based heating. Participants mostly voiced their fondness of natural gas as a source for heat. Barriers raised by households concern mostly the sustainability, effects on comfort, long-term viability, installation (disturbance) and costs of alternatives. Concerns regarding sustainability are directed at HTDH, voicing the same argument as found in literature above. Effects on comfort, and disturbance relating installation, are essentially related to the quality of housing. If isolation values and radiators are sufficient, these barriers should be equal for both HT and LT networks. The long-term viability of HTDH has been challenged above, a clear preference for LT networks arose. The barrier of costs is different to assess at this point. As LTDH systems are very case specific, since they utilize decentralized sources available locally. Thus, this barrier will be investigated further within the case study of this research. Finally, a preference for collective versus individual solutions was researched by Jansma et al. (2020). Their research found that tenants clearly prefer collective solutions, homeowners did not seem to have a clear preference. it can therefore be said, with caution, that the nature of heat networks does not constitute a barrier in the urban environment. The research of Ma et al. (2020) also researched barriers towards newer, futureproof, DH systems. However, they found that stakeholders besides households and policymakers remained underrepresented. Thus, figure 9 shows the barriers of these stakeholders, such as experts, planners, heat suppliers or municipal workers, regarding urban DH systems.

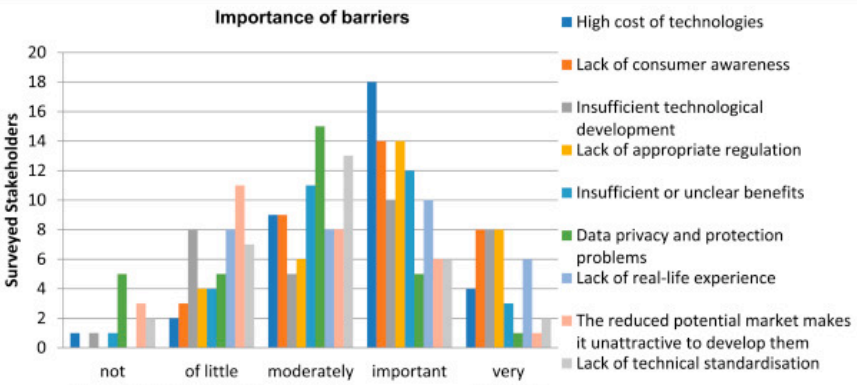

Figure 9: Stakeholder barriers to future district heating systems (Ma et al., 2020)

4.2 Institutional context of the Dutch urban heat transition

Throughout chapter 4.1 the technical alternatives for natural gas-based heating systems have been explored. The academic literature has directed this thesis on heat networks, as they are deemed the most potent technology in the Dutch urban heat transition. Technical DH alternatives have been outlined and compared on several planes. This chapter will focus on the institutional implications and challenges that are omnipresent, can be utilized as inputs for the IAD framework and have an (in)direct impact on the technical solutions found. This will start with an analysis of Dutch legislation that impacts the heat transition. Most of these laws and legislations are still being designed. However, taking them into consideration at this point is extremely relevant. The heat transition will span the coming 15-20 years at minimum. On top of this, engagement towards municipal implementation plans will slowly start taking of in the coming years, therefore remain relevant for many years to come. The second section will focus on the Dutch view on institutions by turning to Dutch, non-academic sources of information.

4.2.1 Legislations that will drive the heat transition

The gas law

The foundation of Dutch legislation regarding national and regional energy systems lies within the gas and electricity law. Most relevant to this research is the gas law. In short, the national gas law prescribes the structure and "rules of the game" for the transport and supply of natural gas within the Netherlands (Van de Worp, n.d.). For households the law entails that they are protected (in security of supply and against market abuse), enjoy a connection duty (they cannot be declined a gas connection in their home) and that tariffs are regulated. Amice Advocaten (2020) noticed that recent changes in the gas law have left citizens with a lot of unanswered questions. One of the main steps to support the heat transition namely entailed changes in the connection duty for grid (natural gas) mangers. As mandatory gas connections no longer apply to newly built housing. However, there are plenty of exceptions that are commonly used and abused by (indirectly) municipalities (Amice Advocaten, 2020), allowing new building to gain natural gas connections. All in all, this change has left households with pressing questions as; can we be forced of the natural gas grid? Who might pay for such a connection removal? What about contracting freedom? All very valid questions, especially when considering that this change in legislation, focusing on newly constructed houses, was only the first step.

According to Amice Advocaten (2020) multiple laws would have to be altered before current or older housing structures can be forced to leave natural gas behind. At his point the costs for the removal of gas connections would not lie with small consumers (households) (ACM, 2021). However, both Amice Advocaten (2020) and the PAW (n.d.) do see that steps are being taken towards municipalities having the legal right to, at some point in the future, disconnect households from the natural gas grid completely. Through experimental regulations within the bill for the heat law 2.0, the environmental law (which will be discussed shortly), the "bouwbesluit" or even via the climate agreement of Paris. Amice Advocaten (2020) have noted that the discussion on how to achieve such a law, and if this is even desired, has reached EU levels. According to the PAW (n.d.) municipalities will, at least, not decide on end dates of natural gas connections until there is tangible clarity on alternatives through their transition visions and implementation plans.

The heat law 2.0

As mentioned in the previous chapter one of the main alternatives for fossil fuel free heat in Dutch urban environments is district heating. The current heat law, covering heat networks and thermal energy storage, merely aims to protect consumers and regulate tariffs. This law has been fairly criticized over the years, as it lacks to support innovations and developments in the current context of the heat transition (Meijer, 2020). For this reason, the bill for a new heat law; the heat law 2.0, has been designed by the Dutch government. This law strives for the following main goals (Meijer, 2020):

1. Stimulate the growth of DH networks through new rules and regulations
2. Increase the transparency in heat tariff setting
3. Increase the requirements to ensure security of supply
4. Guarantee sustainability of the heat transition

The main relevant changes include municipalities gaining more authority, as they would be able to appoint “warmtekavels” (Meijer, 2020). These “warmtekavels” are neighborhood blocks which could be appointed a heat network and a utility company to supply heat to said network. The municipality would be empowered to pick a utility company which in turn would be responsible for the realization and exploitation of said warmtekavel. Van Vulpen (2021) displays this process through a simple flowchart, as depicted in figure 10. Participation organized by municipalities again stands central within the process of establishing warmtekavels. If this bill, in its current design, would become law than the only option for households to not be forced onto a district heating system lies in step 8 of figure 10. This opt-out option is design as a “yes or no” model (van Vulpen, 2021). Households will only be able to opt-out of a warmtekavel if they themselves can proof that another solution is equally or more favourable and sustainable to them. As one can imagine this would create quite the barrier for households to consider alternative solutions once they have been deemed part of a warmtekavel. Effectively “pushing or even forcing” households to commit to a district heating system. The heatlaw 2.0 would thus provide municipalities with more legal tools to disconnect households from their natural gas grid connection.

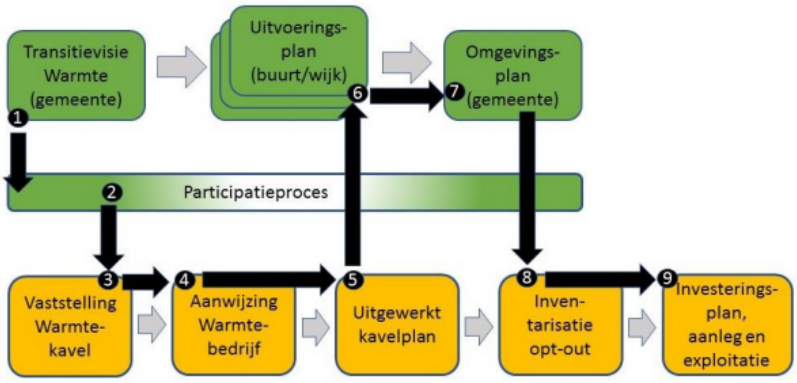

Figure 10: Establishment of "warmtekavels" by municipalities through the heat law 2.0 (van Vulpen, 2021)

Another major implication of the new heat law comes to light in the pricing structure of heat. Energie Samen (2020) shows that current heat prices are still linked to the price of natural gas, through the concept of “no more than usual”. This was originally designed to protect consumers from high heat prices, as gas used to be relatively cheap. However, this relationship with natural gas prices has entailed record high heat prices over the last year, very problematic for

households connected to district heating within the Netherlands. The new law aims to tackle this issue by basing heat prices on costs made throughout the processes. This would inherently challenge another critique commonly placed upon district heating and its pricing structure (Meijer, 2020), as the tariff setting now lacks in transparency. Prices are coupled to natural gas prices, but the actual costs made remain behind closed doors. A final main point to the new heat law 2.0 is to enable new forms of cooperation to exist. From joint venture for heat companies to enable a local initiative to become a market player. First for the complete realisation of warmtekavels, but also to allow local initiatives to act as their own “heat company”, since currently they would be seen as too small (in terms of heat supply/demand) to function within the heat market (Energie Samen, 2020).

At the end of 2021 the new heat bill should have been brought to the central government, on its way to being transformed into law. It did however not pass due to lack of support from all layers of decentralized Dutch governments (Sandee, 2021). The design of the Dutch heat transition has placed a lot of responsibilities on municipalities as argued for. Municipalities however do not feel that this bill would provide them with means necessary to carry out this crucial directing function and are now hesitant to work towards major projects defined in their transition visions. According to the report of Sandee (2021) the monopolistic nature of heat companies, which the cabinet insists on, are the main point of critique. As the bill would not allow room for other (local) initiatives, with monopolies looking up to operating periods of 20 to 30 years to be viable and secure supply. Another issue with these monopolistic heat companies is that protection and certain rights of customers would be lost. Local organizations join in on the critique noted above. As they call for a better-defined legal entity that would allow local initiatives or “warmteschappen” to exist on the market. An intended goal of the bill which was found very underrepresented and undeveloped. Furthermore, local initiatives call for better and more concretely designed financial supporting schemes to leave room for sustainable local initiatives to provide their own solutions for their heat transition (Energie Samen, 2020).

The environmental law

Finally, this research turns to the new “omgevingswet” or environmental law. A law which has been designed, challenged and accepted. Initially it was planned to go into effect earlier this year, however current coverage indicates that the law has been postponed until the start of 2023. The basic idea behind this new law is to merge 26 laws and regulations regarding spatial planning, housing, infrastructure, environment, water and nature into one act (van Vliet et al., n.d.). By bringing all these related, but different laws under one act the efficiency and clarity of related processes is to be enhanced. This new systematic motion should lead to a better and more sustainable Dutch living environment. Ironically, the law has been postponed since it was found too complex and confusing. Van Vliet et al. (n.d.) highlight the four main areas in which this law aims to improve:

1. Increase user-friendliness
2. Stimulate and support an integrated approach
3. Better decentralized administrative decision-making, lesser top-down structures
4. Accelerate decision-making processes

Within the context of this research the new environmental law is relevant on several planes. First, this law will enable crucial elements of municipalities transition visions to be set in stone, legally speaking. Since physical space is a hot commodity in the Netherlands, this law would enable municipalities to legally designate certain environments for their sustainable

development (van den Brand, 2021a). A pitfall to avoid here, as van den Brand (2021a) has noticed, is that all physical environments are quickly "claimed", leaving no room for flexibility or (innovative) initiatives. A second major implication of this new environmental law is that participation will become mandatory for all parties initiating projects that relate to the physical living environment. These parties will also be obliged to motivate their projects and means by which participation is to be achieved. The degree of participation, and if it adheres to requirements set, is then to be judged by the local relevant authorities. According to the IPLO (n.d.) Dutch municipalities will be free to design their participation policy by which projects are to be tested. This should not only include how participation should take place, but it also how participation is weighed within the decision-making process. Van den Brand (2021b) has already noticed municipalities struggling with the prospect of having to create these participation policies. The main reason behind the observed struggle is that municipalities lack budgets, lack experience and would rather receive a standardized checklist of sorts. Local initiatives will also have to adhere to standards set by their municipality, incorporating some form of participation within their projects. Luckily, the law should provide more chances for citizens to start their own energy related projects. For example, the law makes it easier to create local energy cooperatives (Stadszaken, n.d.), giving citizens the legal handles to act faster within the physical living environment.

Finally, legal handles for the transition can be found in subsidies. Subsidies are omnipresent within this transition. National and local policymakers influence which and how subsidies are designed, showcasing not only their vision but interpretation of what is crucial within this transition. For associations, companies, local initiatives and households' subsidies can make or break sustainable investments. A quick review of available and relevant subsidies can be found in annex B.

4.2.2 A gauge of the Dutch view on the urban heat transition

As mentioned, this section will focus on the Dutch view on institutions by turning to Dutch, non-academic sources of information. This will allow this research to reflect on institutions presented, uncovering the more practical implications of the current state of the heat transition. On top of that, it will provide insights into problems that might have not been brought to light through academic research only.

Financing the heat transition

First, one of the key barriers of any transition, namely financing, is worth looking into. According to Waterval (2022) one out of five Dutch homeowners cannot pay for sustainable measures in their homes, as most of these household lack financial means such as savings. Realistically, adopting extra dept in forms of loans will not be an option for these households, as they do not possess the financial room to realistically take up more obligations. This group mostly consists of the households that are substantially struck by the current high prices of gas and energy (Waterval, 2022). Van Reeken et al. (2022) underline these claims. Households are, on average, paying 20% more for their energy bill in the first quarter of this year compared to last year. The extreme increase of energy prices especially hit lower income households (van Reeken et al., 2022). On top of this, Waterval (2022) found that 90% of the group unable to invest in sustainability lives in housing with energy label C or lower. Let this just be the category of housing that would benefit greatly from investments to increase efficiency and decrease related emissions. A problematic situation, as the costs for natural gas-free living per house can add up to 24.000 euro's (Waterval, 2022), without realistic options for this group of Dutch

citizens to come by the means necessary to invest. When Waterval turned to the Dutch National bank for advice, they underlined those extra loans are not feasible, subsidies are lacking and that there is currently no ready-made solution to this problem.

And the problems do not seem to end there, as households that have already transitioned onto district heating face higher prices than those still connected to the gas grid. In response to this development local governments are calling onto heat suppliers to become more transparent, to explain why households can expect a 58% rise in heat prices during 2022 (van de Walle, 2022). Because the current tariff structure, as explained still linked to gas prices, and the tariff setting behind closed doors has resulted in increasing distrust towards heat companies. Not only with customers but also within municipalities. The fact that heat companies charge a quite secretive monthly fee has not only raised distrust, but it also uncovers the fact that for most of the heat bill there is no incentive to change customer behaviour towards saving (van de Walle, 2022). The ACM, relevant Dutch market authority, has investigated the situation and found that there is no abuse of tariff setting by heat companies found (NOS, 2022). They even warn that heat prices could increase by 67% during 2022 due to a lack in commodities and the effects of war. The ACM however asks heat suppliers not to raise their prices unnecessarily (NOS, 2022). The question remains as to when and how prices are raised without cause, as the current laws do not support tools to further benchmark this. As a response to this situation the 44 largest Dutch municipalities have requested that the tariff structure, as proposed in the heat law 2.0, is implemented as soon as possible (NU.nl, 2022)

Municipal barriers

Municipalities themselves are also struggling with the heat transition. Kraan (2022) found that municipalities lack budget, means and time to support homeowners in the Dutch heat transition. The research of Kraan (2022) found that 55% of municipalities already mention a lack of financial means as a bottleneck of this transition, on top of 48% of municipalities seeing current policies, measurements and solutions as being unaffordable for everyday households. Whilst municipalities might have delivered their visions for their local heat transitions, the means necessary to realize their visions or plans have not been delivered. Furthermore, the research of Kraan (2022) shows that 68% of municipalities is still investigating solutions mentioned in their visions, not knowing which might be implemented or not. A quote from a municipal policy officer touches upon the core of the problem; “As a municipality, we are expected to take on the implementation, while the funding has not yet been arranged. You can start with the neighbourhood approach, but if it turns out that you can't get funding, you must stop at some point” (Kraan, 2022). De Groot (2022) warns for another major problem that has been showing, as Dutch municipalities are becoming overworked. Each year another critical dossier is added onto the plates of municipalities, for instance youth care, the energy transition and soon the effects of the environmental law. Professor of Constitutional Law Douwe Jan Elzinga warns that this will soon become too much to bear for municipalities, as they lack the capacity to handle these complex dossiers (de Groot, 2022).

Recent developments might have provided municipalities with some room to breathe, as the Dutch government has decided to make (hybrid) heat pumps obligatory when replacing heating systems per 2026. The Dutch cabinet sees this as a transitioning solution towards completely natural gas-free households, a decision that might just reduce some of the recent pressure on municipalities (Van den Boom, 2022). However, multiple very practical problems must be faced by the cabinet to ensure a successful implementation of this legislation. First, there is the problem of the lead time on (hybrid) heat pumps. Households willing to order one today face

waiting times of at least 1-1,5 years before delivery and installation (van den Boom, 2022). If this problem is left unattended, one can imagine the consequences in a few years if all households are obliged to invest in such an installation. Furthermore, and circling back to earlier issues highlighted, these installations cost anywhere from 4.000 to 7.000 euros. Many Dutch households do not have the financial means to invest such a large sum of money, not even if the government plans to subsidize the first 30% of all heat pump purchases before 2030. Van de Hulsbeek (2022) underlines that municipalities, even though they find this decision “a step in the right direction”, foresee the same problems. Affordability and energy poverty remain key problems, with municipalities only left guessing as to whom might pay for such mandatory investments. One thing is for sure, municipalities lack financial means to support this design. On top of that, municipalities critique this decision as heat pumps are not always the most suited alternative, especially in urban environments (van de Hulsbeek, 2022).

Learning from the programme natural gas-free neighbourhoods

Finally, this chapter will dive into very concrete issues that the Dutch heat transition has already run into. This is analysed by looking at experiences gained through the PAW, the Dutch testing ground of the heat transition. Dignum et al. (2021) found that there are three main areas of learning from the PAW thus far. A lot of these points confirm earlier findings within this thesis. Underlining the complexity of this transition and the part that institutions play. The areas of learning are:

1. There is a lot of knowledge hidden within the PAW
    a. Detailed tailor-made approaches are required, even on building levels. Thus, standardization is difficult as local initiatives are often not fit for scaling
    b. Municipalities plan through lowest societal costs; this does necessarily lead to the best societal solutions. This point of view might lead to suppressing local initiatives and towards monopolies
    c. Transparency is required, a wide array of stakeholders utilized different data sets leading to different conclusions
    d. Most find the time schedule for this transition unrealistic
2. Sharing best practices is difficult
    a. Since most solutions need to be specifically tailored to local contexts
    b. Since local versus national views differ
3. There is a need for tangible choices on a national (governmental) level
    a. Local initiatives are constantly forced to look for workarounds since they are lacking support
    b. The current legal framework imposes limitations
        i. Tendering laws make local solutions more difficult
        ii. The heat law 2.0 is still not in effect, causing uncertainty and delay (on top of all previously identified problems in this chapter)
    c. Municipalities lack capacity
    d. The question of how to finance this transition is still up for debate
    e. A broadly accepted, tangible and integral story behind the heat transition is missing

4.3 Conclusion

This chapter has researched the omnipresent input variables of the Dutch urban heat transition. First, by diving into the feasible technical context of the heat transition. Secondly, by analysing the institutional aspects that influence all levels of decision-making. Which has led to answers on sub research questions three and four, starting with sub research question three:

What is the technical context of the urban heat transition for Dutch neighbourhoods?

The first conclusion that can be drawn is that, for the urban environment, heat networks are deemed the most potent technical solution. Generally, heat networks can be subdivided into two main categories: high temperature and low temperature district heating. Both solutions pertain to offer natural gas-free heating for urban housing in quite similar ways, as they utilize pipelines through which pressurized and heated water flows. However, the consequences per alternative differ substantially. First, HTDH utilizes central heat sources, as biomass or waste heat from fossil fuelled plants, which operate at high temperatures. This entails that dependence on fossil-fuels, or lesser sustainable sources, will not be mitigated. Furthermore, research shows that HTDH has the potential to help reach 2030 emission goals, but the reduction potential curbs drastically after 2030. The main benefit to this technology is that housing isolation requirements are low, not restricting direct implementation. Which is the opposite of LTDH systems, as these require high levels of isolation. Making direct implementation in current housing instantly more difficult. Furthermore, these LTDH systems are currently dependant on the right mix of financial incentives to be viable. However, these systems can utilize multiple decentralized sustainable heat sources such as aqua- or geothermal energy. This entails far greater potential in terms of emission reduction and it being future-proof. Moreover, by operating at lower temperatures substantially less losses occur compared to HTDH, making it more efficient and sustainable. Thus, both solutions enjoy their individual qualities which might make them better suited for certain local contexts.

Researching the institutions at play has presented this thesis with multiple tension fields and challenges which confront the Dutch urban heat transition. The main insights taken from chapter 4.2 are summarize below, as they answer sub research questions 4:

What challenges do the formal and informal institutions present the Dutch heat transition?

- Homeowners where initially placed as first and foremost decision-makers within the heat transition. However, municipalities are granted progressively more (legal) tools to force decisions onto households, without being able to financially support the consequences of their decisions
- Proposed national laws have caused uncertainty, disagreement and show inability to tackle the current issues of the heat transition
- Proposed policy aims to assure sustainability throughout the heat transition. However, a strong focus on HTDH systems might not allow for future emission goals to be met nor is there space for local initiatives to develop
- Again, participation is placed central throughout the institutional design, with municipalities now having to develop their own participation policy. However, tangible handles or guidelines for participation are not presented
- Municipalities are placed even more focally in the heat transition. However, they do not possess the resources to live up to expectations set

5

The neighbourhood heat transition – case study KNSM-eiland Amsterdam

Chapter 5 sets out to answer sub research question five; *Which context specific insights are crucial to consider before the operationalization of the IAD framework?* Thus, providing inputs and variables at play when diving deeper into the specific context of this research. As chapter four has provided the IAD framework with input on a more omnipresent level, factors that are at play throughout the entirety of the analysis, this chapter will focus purely on the case selected. This is done by first looking into the urban heat transition as seen by the municipality of Amsterdam, analysing the transition vision heat created by the municipality. Secondly, a dive into prior research and data regarding the transition of this specific case neighbourhood is presented. Annex C highlights the socio-demographics of the KNSM-eiland, the case neighbourhood, from which insights are utilized.

5.1 The municipality of Amsterdam

As shown throughout this research Dutch municipalities have been appointed a leading role within the heat transition. As directors of their local heat transitions, it is of great importance to analyse their plans. Even when this research focusses on a very local context. Especially since their visions will have to be further detailed into neighbourhood implementation plans. Thus, this section is dedicated to the transition vision heat of Amsterdam and impacts it has made thus far.

Transition vision heat Amsterdam

The transition vision starts of in similar fashion as this research, by identifying technological solutions for certain distinctive categories of housing. Figure 11 highlights that in Amsterdam 25% of emissions can be allocated to the built environment, table 9 shows the selected solutions to reduce these emissions for specific categories of the built environment (Geldhof et al., 2020). Figure 12 presents the main design of the municipalities heat transition as neighbourhoods are designated certain solutions.

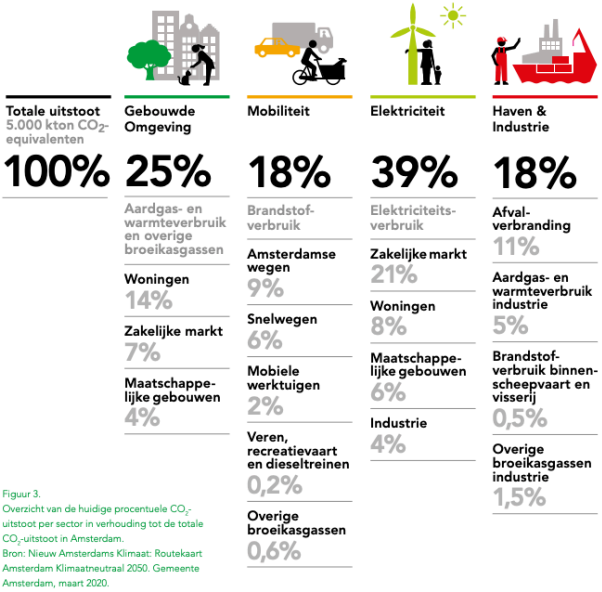

Figure 11: Amsterdam's emissions per sector (Geldhof et al., 2020)

Table 9: The selection of technical solutions by the municipality of Amsterdam (Geldhof et al., 2020)

Urban built environment type	***Technical solution***	***Notes***
Newly built environment	Either all-electric or district heating (combined with heat storage)	Regarding district heating, low temperature networks are preferred. However, the municipality states that high temperature networks are built if these speed up the transition
Historical city centre	Natural gas, in time replaced by green gas or hydrogen	Since the historical centre is composed of older buildings with low isolation levels gasses will be utilized. Either green gas or hydrogen will be implemented somewhere in the future
Office buildings and neighbourhoods	All-electric	Mainly focussed on the urban business-built environments of Amsterdam. This transition should happen at the most natural moment according to the municipality
Neighbourhoods	District heating (possibly combined with heat storage)	During the transition high temperature networks should be built. From 2040 onwards only mid- to low temperature networks are allowed.

Regarding the interpretation of both table 9 and figure 12 the municipality has voiced some key disclaimers. As Geldhof et al. (2020) state that the municipality has not set any technological options nor geographic borders (of neighbourhoods linked to solutions) in stone. Different solutions might still be possible depending on the local context. Luckily this is the case, otherwise it would have been a vision contrasting multiple earlier findings of this research with respect to the importance of a local context. Furthermore Geldhof et al. (2020) acknowledges that Vattenfall and Westpoort warmte are currently the only heat companies available, which might change in the future as local initiatives develop. A final disclaimer is that market structures are not addressed throughout the transition vision. Since a variety of ownership structures might be possible in the future, and the municipality wants to keep its options open (Geldhof et al., 2020). This is remarkable, seeing that future institutional aspects found weigh so heavily on the adaptation of the “rules-of-the-game” of the heat market and ownership designs.

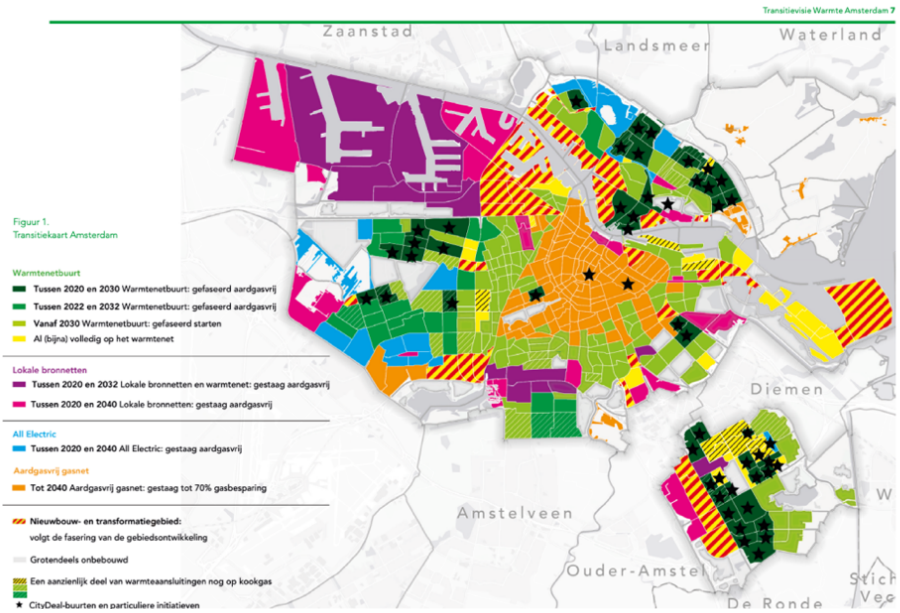

Figure 12: Map of the transition vision for the municipality of Amsterdam (Geldhof et al., 2020)

Now that the very core of the heat transition vision for Amsterdam is presented throughout figure 12, it is important to analyse the principles and arguments behind the preliminary plans. Since their line of reasoning might be more determent for plans then the actual preliminary design of the heat transition. Geldhof and colleagues (2020) name the following eight principles as guiding for the design of Amsterdam's heat transition:

1. Natural gas-free as building blocks for a sustainable Amsterdam
2. Cooperation towards a natural gas-free Amsterdam
3. Careful and transparent information supply
4. Realistic and plannable
5. Affordable
6. A reliable heat supply
7. Avoid unnecessary work
8. A liveable Amsterdam in transition

Within the scope of this research some of these principles are more relevant than others. The first principle entails that the heat transition is an inseparable part of the overarching energy transition. As such the heat transition should contribute to "higher order" sustainability goals, not just disconnecting households from the gas grid but also ensuring sustainability throughout the process. For instance, looking back at chapter 4, this could entail policymakers to steer away from solutions which increase fossil-fuel dependency. Or for decision-makers to embrace the most sustainable solutions to support the larger transition at play. However, as will be discussed within this chapter, this "ideal" is not always the case. The second and third principles have been thoroughly discussed within this research, as it pertains to participation within the heat transition. There is a determined need for better management and cooperation of local stakeholders. The fourth driver behind the vision pertains to realism and plannability. In line with this research, the technical solutions picked-out are those that are at a high enough "readiness" level so that they can be considered for implementation within the timeline of the transition. However, this pilar of realism and plannability will entail tension, as a strong focus on this alternative might steer the transition towards the more easy-to-implement solutions. Possibly undermining the need for a context specific focus, in which the best option is utilized (as will be set out in table 10). The fifth principle entails that choices for solutions are based on the "lowest social costs", which will be further delineated in table 10. A reliable heat supply, principle number six, implies a focus on the reliability of heat sources for now but also to assess if it is future proof. Principle seven aims to mitigate "unnecessary work" or in other words unnecessary time and money spend. The municipality aims to achieve this by having parties plan relatable activities at the same time. When focussing only on a neighbourhood this could be achieved by letting the installation of a heat network be timed parallel to other activities regarding streets being broken open for example. However, one would also expect this principle to tie in with numbers four, five and six. As creating a future proof heat supply from the get-go entails lesser costs and work in the long run. Finally, principle number eight is not that relevant to this research. As different heat networks will always cause some temporal discomfort within a neighbourhood, the degrees in which only vary slightly.

Now that the basic principles behind the design of Amsterdam's heat transition are explained it is time to focus on the decision-making criteria for the technological solutions presented in table 9. Geldhof and colleagues (2020) have stated that these decisions have been made according to the criteria presented in table 10.

Table 10: Decision-making criteria for technological alternatives as presented in the transition vision heat Amsterdam (Geldhof et al., 2020)

Decision-making criteria	***Explanation***
Lowest social costs	The solution for natural gas-free heating that ensures that the total social costs are the lowest receives preference
Existing neighbourhood infrastructure	Existing or planned infrastructure within a neighbourhood influences the choice for a certain heat solution
Availability heat sources	As discussed in this research, the closer the heat source is to the target neighbourhood the more efficiently it can be utilized
Sustainability	Heat alternatives that lead to lower CO_2-emissions and that relieve building from a dependence on fossil fuels should gain preference
Least disturbance	Heat alternatives that entail less disturbance to homes or neighbourhoods should receive preference over alternatives that lead to relatively more disturbance

The criteria, as presented in table 10, guide municipal decisions that have, and will be made. For this research it will be interesting to see if these criteria match those of households on the KNSM-eiland neighbourhood, as will be researched in the operationalization of the IAD framework (chapter 6 & 7). For now, a more detailed glance at the effects of these criteria on municipal decision-making is taken. First, how do these criteria influence the possibilities of the heat transition to enhance overall sustainability? Geldhof et al. (2020) presents a couple of key statements throughout the transition vision regarding this question. A first important statement is found in calculations regarding the future heat demand of Amsterdam. As Geldhof et al. (2020) state that there will be enough capacity of renewable heat sources to supply future demand, and that geo- and aqua-thermal will play a big part in said supply. In line with earlier findings, the municipality agrees that sustainable heat sources do need to be situated locally for them to be viable. More generally speaking, and again in line with academic findings, the municipality sees that sustainable district heating solutions present a local challenge that requires a locally tailored neighbourhood approach. And thus, that these sustainable heating solutions are, for urban environments, mid to low temperature DH networks heated by renewable sources. Secondly, the municipality speaks of transition periods or “phasing” measures to the transition. These can be identified in table 9 for several different build environments. The nature of these “phasing” solutions mainly pertain to the utilization of high temperature DH systems, generally called “stadswarmte” or “cityheat’ in Amsterdam. According to the municipality these HTDH solutions are to be used as a transition technology within the heat transition, eventually being transformed towards mid to low temperature networks. Even though the improvement of housing energy labels has a high priority, as a “no regret” solution, this apparently is not going fast enough. Since the argument for HTDH as a transition technology is that it is easily implemented, even for housing which has low energy labels and thus poor isolation. It can be questioned if this municipal statement is in line with their own guidelines and criteria for the heat transition in Amsterdam. Since building these less sustainable HTDH networks for an operational lifetime of ten years sounds like it conflicts with design principles one, five, six and seven (as presented earlier). This critique is parried by both the municipality and current heat companies (like Vattenfall) through statements regarding the evolution of HTDH. As these “stadswarmte” networks are deemed too slowly transform towards lower temperatures and renewable heat sources.

Retrofitting HTDH towards more sustainable LTDH

HTDH as a transition technology is a very interesting statement, as neither municipality nor heat company truly details how these HTDH "stadswarmte" networks will evolve towards lower temperatures and more sustainable heat sources. Nor do they imply if this would come with more investments required and more disturbance for neighbourhoods. Thus, being in contrast with even more design principles, namely transparency. A literature review into the transformation of HT to LT DH networks (or retrofitting) has provided this research with the following insights, summarized in table 11.

Table 11: Literature review on district heating retrofitting research

Academic source	**Conclusion research**
Averfalk et al. (2017)	Averfalk and colleagues highlight the complexity of retrofitting by identifying the three main areas that need to be addressed to lower current temperature levels in HTDH networks. First, all temperature errors, throughout the entire supply system, are to be eliminated to increase efficiency. Secondly, longer thermal lengths are required in every substation heat exchanger. Finally, temperature demand should be lowered. Thus, considerable measures are required on the consumer side of HTDH systems
Duran, P. (2020)	In short HTDH networks are designed according to a certain set supply & return temperature. This entails that the components such as pipe isolation, heat exchanger sizes, system mass flow and pump sizes are specifically calculated to fit the HTDH system. Changing this is no trivial task. Duran found that retrofitting technically is possible, by utilizing decentralized heat sources and placing extra heat pumps at each building. However, cost benefit analysis on such retrofitting have not (amongst others) been thoroughly done. Furthermore, this research was holistic, more detailed analysis are required
Geyer et al. (2021)	This research identifies a wide array of challenges that are currently faced by HTDH networks, most of the regarding sustainability, efficiency, decreasing heat demands, competition and volatile prices. On the topic of retrofitting this research names the main reason why HTDH networks are not and cannot utilize alternative, renewable energy sources; "Due to the required installation of heat pumps and the related investments, together with low coefficient of performance (COP) due to high temperature differences, the exploitation of these heat sources is often not reasonable" (Geyer et al., 2021). This is in essence what makes the retrofitting of such networks so complex and often not reasonable
Kleinertz & Gruber. (2022)	This research highlights another issue when considering retrofitting, namely that of heat companies being bound by contract of supply and connection. These would first need to be altered in order for HTDH networks to lower temperatures and to enable consumers to engage in the optimization of their heat supply
Pakere et al. (2018)	This research highlights that, if at some point feasible, retrofitting would still require buildings to adhere to LTDH standards to provide comfortable heat levels. Even if HTDH systems could be retrofitted so must the buildings. Isolation levels need to be high, radiators need to be upgraded and so on. This would thus lead up to multiple points of new (or delayed) investments required
Volkova et al. (2020)	Once HTDH networks are established in an urban neighbourhood it can become problematic to switch to LTDH. This research found that there are certain options to cascade heat via the "main" HTDH into newly installed LTDH networks. However, this does come at considerable additional investment and maintenance costs. Moreover, this would mean that HTDH networks would not be replaced by LTDH networks
Wendel et al. (2022)	First this research underlines that current HTDH networks are already facing the need to become more sustainable in order to meet decarbonization targets. It is found that due to the clear particularity of each HTDH system it is hard to even define a general target state and schedule for retrofitting or transformations. Wendel and colleagues conclude that said transformation is complex not only in technical but also in economical nature. Further sparking the debate if HTDH systems should be transformed or decommissioned. The research found that a transformation to mid temperature systems is extremely preferable over a full retrofitting to a LTDH network, especially for the system operator (in terms of a business case). Concluding, if the heat demand continues to decline, due to more efficient demand side management and measures, oversized heat pipes will result in more thermal loss, contradicting the need to make HTDH networks more efficient. Complex adaptation will then be required of which the technical and economic effects are not truly known

From table 11 a general conclusion can be drawn. This conclusion is that “simply” transforming HTDH networks to LTDH systems that utilize decentralized, sustainable heat sources is extremely complex. Furthermore, even though it seems technically possible, other aspects of such a business case will still require a lot more research. However much each research underlines the need for LTDH networks, each of them simultaneously underline the complexity of achieving this through retrofitting. Thus, straightforward claims from the municipality or heat companies such as “we will utilize sustainable heat sources in the future” are not so straightforward.

Practical implications of Stadswarmte

Table 12, consisting of findings from Dutch (news) articles, further highlights pitfalls of utilizing HTDH networks as a transition solution as it shines light on citizen concerns regarding this “solution”.

Table 12: Summary of Dutch articles on the views and pitfalls of HTDH as transition solution

Source	**Conclusion article**
Van Bezeij, A. (2019)	This article starts of by highlighting the risk of rushing towards the easy-to-implement HTDH networks, as this is a short-term approach to the current problems which leaves little attention for requirements we will face in the long-term. Natural gas as a (indirect) heat sources for HTDH increases dependence on fossil fuels and biomass or waste incineration stands in directly opposite to circularity (as a focus on either one would eliminate incentive for the other). Furthermore, the Netherlands is facing a lock-in due to “stadswarmte” based on the following arguments. First, there is no incentive for customer (demand) efficiency since most costs are subscription based. Secondly, there is no hard incentive to better isolate homes, postponing crucial investments. Thirdly, since households cannot switch suppliers, monopolies are created and finally refurbishment towards LTDH is not as straight forwards as assumed
Centen et al. (2020)	This article argues for both HTDH as well as LTDH. The main difference in argumentation is that pro HTDH arguments are often based on ease and speed of implementation. As argument pro LTDH are more based on sustainability and efficiency aspect. A crucial difference in point-of-view resulting in preferences for either technology
Gort & Naus. (2020)	This study agrees with the lock-in created by the Amsterdam’s “stadswarmte” as explained by van Bezeij (2019). It further expands the argumentation of the lock-in by highlighting agreements made between the municipality and the main heat companies, calculation methods used by the municipality, planning of more HTDH networks and formal regulation regarding building standards. As the municipality has “created a legal framework in which stadswarmte can thrive” (Gort & Naus, 2020). The lock-in of HTDH in Amsterdam has this research fearing, through a multi-level perspective analysis, that HTDH systems will remain dominant and will suffocate innovations for more sustainable heating solutions
Huygen et al. (2019)	This paper has researched what the Dutch can learn from the Danish regarding heat networks. In Denmark heat prices are determined as proposed in future Dutch laws. Furthermore, heat companies are not allowed profit and have municipalities and citizen in their boards (even multiple forms of ownership). This increases trust and transparency lowering barriers to DH networks. Finally, due to a lack of connection obligations and open networks competition is stimulated, which is seen as a key pilar of future DH systems. These points of learning tend to steer away from classic HTDH such as “stadswarmte”

Table 12 provides insight into a few major implications for the urban heat transition in Amsterdam. Learning towards future DH networks implies a need to steer clear of the classical “stadswarmte” networks within Amsterdam. Furthermore, pitfalls of HTDH and pro’s to LTDH are in line with argumentation found in the transition vision of the municipality of Amsterdam. However, current lock-ins indicate that the municipality of Amsterdam is facilitating a climate in which HTDH thrives and more sustainable LTDH networks do not. A remarkable

contradiction in theory versus reality. As Neves Cordeiro et al. (2019) state that the collaborative heat company between the municipality of Amsterdam and Vattenfall is sometimes at odds with policy frameworks of openness, sustainability and affordability. Their research further finds that agreements (in contracts) made between the municipality of Amsterdam and the heat companies have limited alternative heat supplies.

Then there is the pact between Vattenfall, the municipality of Amsterdam and large housing corporations known as the “City Deal Group” (Stuart et al., 2021). Stuart and colleagues (2021) highlight a particularly interesting field of tension in their following quote: “So connect and insulate? Landlords have an interest in minimising investment costs. Heat monopolist Vattenfall has an interest in connecting as many homes as possible to district heating. The city council wants to get rid of natural gas at a killer pace without a lot of complicated discussions. This is how the unholy alliance between the three parties came about”. The tone of this quote is to be taken with a pinch of salt; it does however highlight an interesting insight regarding the dominance of HTDH in Amsterdam. As the municipality is overworked and understaffed, they prefer the quick and easy solution to the current heat transition faced. Van Zoelen (2021) shows that Amsterdam is making haste with further connecting neighborhoods to “stadswarmte”, as more deals between housing corporations, the municipality and Vattenfall are being made. But then what about isolation? As presented throughout this research HTDH does not require high building insulation levels, however efficiency and sustainability would benefit from such measures. The sustainability councilwoman of Amsterdam argued against a minimum insulation requirement for building to be connected to district heating, as this would cause to much delay to the heat transition (Stuart et al., 2021). Again, an argument based on speed and ease of application and not so much on sustainability or efficiency. Furthermore, “stadswarmte” is not without controverse, as shown throughout this thesis but also highlighted by van Zoelen (2021). And for the municipality to connect more households to these HTDH networks at least 70% of tenants per housing complex must agree to said connection. Inserting another very important factor, and tension field, within the discussion surrounding the future of HTDH networks.

5.2 The KNSM-eiland Amsterdam

Chapter 5.1 started off by shedding light on the municipal design to the urban heat transition in Amsterdam, highlighting principles that have guided said design. Through the analysis argumentation for certain (technical) design choices have been highlighted and multiple tension planes were identified. Through reviewing both academic literature as well as Dutch articles, contradictions in the design principles have been identified. These start of on a more technical foundation, but upon further inspection these tensions have highlighted institutional and social aspects that can be considered when operationalizing these inputs. Chapter 5.2 will dive into previous research done by Resourcefully, urban energy transition consultancy, specific to the KNSM-eiland. The insights from this section again will be used in the analysis via the IAD framework. As will the socio-demographic data presented in annex C.

5.2.1 Resourcefully data on the local heat transition of the KNSM-eiland

As mentioned in the introduction of this chapter Resourcefully is a consultancy company specialized in the urban energy transition. Their provisional focus lies on an integral approach to clear energy, mobility and heat. This is embodied by their vision and mission statements; “Applied innovations, electric mobility and ICT are the key to successful urban transitions. In

which switching to local renewable energy is crucial to avoid future power failures". Resourcefully operates on three levels: neighbourhoods, regional/national and European. The intersection with this research lies on their neighbourhood level analysis. Especially through the company product which is known as their Neighbourhood Transition Dashboard. Said dashboard calculates and visualizes future neighbourhood specific developments to better understand local transition planning, choices and options for flexibility. The Resourcefully dashboard brings energy flows, such as the demand and supply of electricity and heat, into focus and translates technical data into clear key performance indicators (KPI's). Through these KPI's stakeholders are supported in making collaborative decisions regarding their future neighbourhood energy systems. As mentioned, the dashboard accounts for the (future) demand and (future) supply of heat, including technical solutions, on a neighbourhood level. This aspect of the dashboard is especially relevant for this research, as their KNSM-eiland transition dashboard can provide initial insights into the potential of (case-specific) local insights. Therefore, the remainder of this section will highlight the relevant technical and financial findings of the Resourcefully neighbourhood transition dashboard designed for the KNSM-eiland.

Data on the KNSM-eiland heat transition

First, it is relevant to scope the inputs utilized for the dashboard model. Calculations are based on the amount of electricity and heat required to enable future heat supply, mobility and household electricity in 2030 on the KNSM-eiland. Furthermore, the model considers the potential of electricity that can be generated through rooftop solar panels within the neighbourhood. Regarding the heat transition, two scenarios are calculated to compare with future implications of "business-as-usual", utilizing natural gas as a heat source. As noted throughout this research energy labels of buildings can be limiting or enabling towards choices for certain technical heat solutions. Figure 13 shows how old the buildings are on the KNSM-eiland, figure 14 provides an average energy label per building.

Figure 13: KNSM-eiland building age (Waternet, 2022)

Figure 14: KNSM-eiland average building energy labels (Resourcefully, 2022)

It can be stated that the relative new buildings have led to decent average energy labels on the KNSM-eiland (label B). This gives potential to lower temperature heating network solutions, as less isolation measures required results in a slightly easier implemented solution.

Furthermore, it entails that HTDH is not “needed”, in arguments regarding the ease of implementation for lower rated energy labels. For these reasons, and the many argued for throughout this thesis, the two heat scenarios researched and modelled are a mid-temperature DH network and a LTDH network. According to De Bruijn & Herder (2018) one heat source for mid to low temperature DH systems with a lot of potential within the Netherlands is thermal energy from surface water (TEO), a technology known as aquathermal. Their report shows that TEO has the potential to meet 40% of the total heat demand within the Dutch built environment. According to IF Technology (2016), TEO is especially suited for environments where a heat supply can be realised below 70 degrees Celsius. Furthermore, said environment would have to adhere to the following three criteria (IF Technology, 2016):

1. The heat demand area must be suitable for a heat grid
2. The intended body of water must be within a maximum distance of 5 kilometers
3. The subsurface of the intended heating area must be suitable for a thermal energy storage solution

First, the KNSM-eiland is a densely populated urban area, suitable for the utilization of a DH technology. Secondly, figure 15 shows that a body of water directly surrounds the KNSM-eiland. Furthermore, this body has a heat capacity of 5 – 25 Gj/m^2/year (Waternet, 2022), enough to match the local heat demand until at least 2040 (see figure 16). Thirdly, Waternet (2022) has presented that a thermal energy storage solution within the neighbourhood is feasible. In conclusion, the KNSM-eiland is deemed fit for a TEO solution with operating temperatures below 70 degrees Celsius.

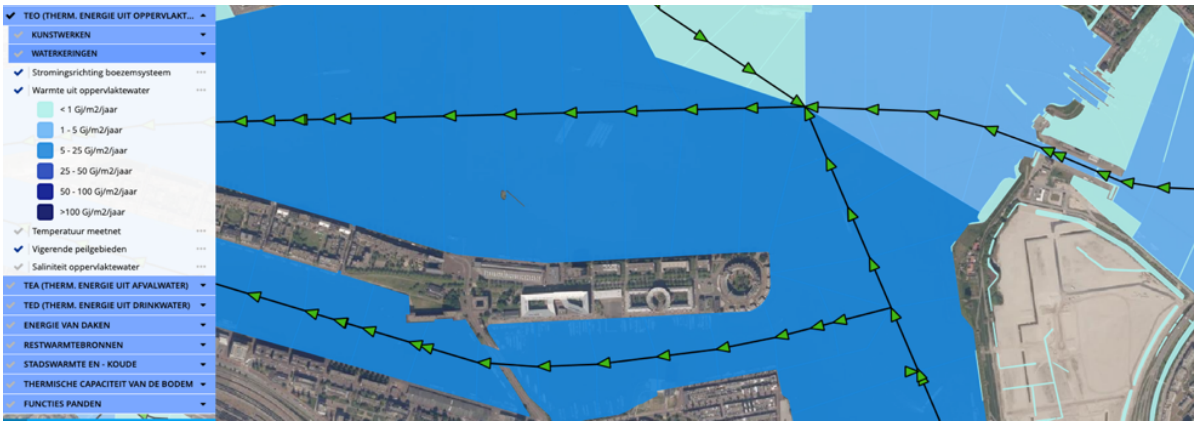

Figure 15: Water body, including heat capacity, surrounding the KNSM-eiland (Waternet, 2022)

Figure 16: Heat demand KNSM-eiland per building 2040 (Waternet, 2022)

The conclusion presented above is underlined by Resourcefully, as their heat scenarios are based on a 70-degree TEO network and a 20-degree TEO “source” network. The second scenario utilizes heat pumps per building to upgrade the heat to 55-degrees for domestic use. Also, booster pumps are implemented for upgrading tap water to mitigate Legionella risks.

Figure 17, taken from Resourcefully's model, presents in green which buildings on the KNSM-eiland are currently suited for both TEO networks, based on a preliminary building study.

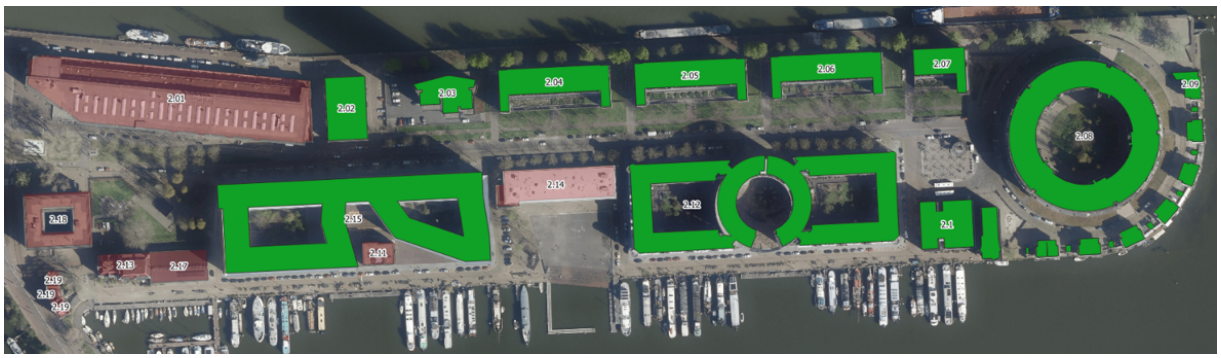

Figure 17: KNSM-eiland buildings currently suited for mid and low TEO networks (Resourcefully, 2022)

For the context of this research, figure 18 presents the most important preliminary results of the KNSM-eiland neighbourhood transition dashboard by Resourcefully (2022). As finances are always considered to be a major barrier towards feasibility. This figure presents the total cost per household per year for the 3 scenarios considered (including natural gas). In blue the financing costs are presented, in black maintenance costs and in green the energy costs. Figure 19 gives a detailed insight into the yearly cost breakdown of the most sustainable scenario, the low temperature TEO "source" network. For further insights into the model behind these results this thesis refers to the Resourcefully KNSM-eiland dashboard itself.

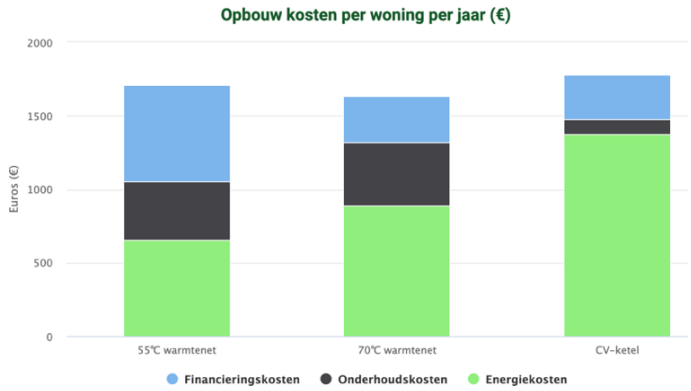

Figure 18: Cost structure per year per heat solution scenario KNSM-eiland (Resourcefully, 2022)

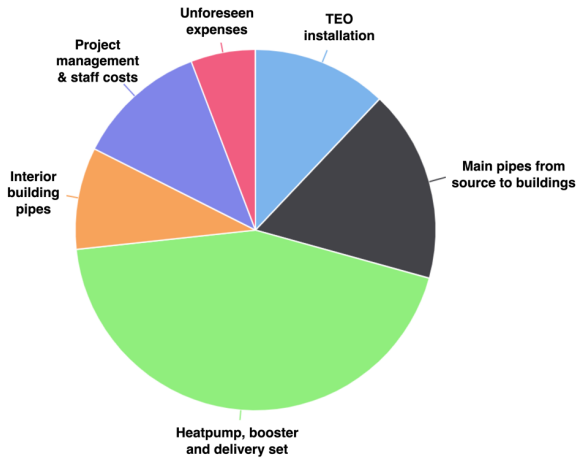

Figure 19: Cost breakdown structure KNSM-eiland low temp TEO (Resourcefully, 2022)

Resourcefully, through their dashboard analysis, present the following recommendations (technical and financial) for the heat transition on the KNSM-eiland (Resourcefully, 2022):

1. Through a combination of efficient heating, emission-free mobility and local energy production the KNSM-eiland can decrease it's co_2-emissions by 80% in 2030
2. The heat transition is feasible and affordable, especially through the utilization of a low-temperature TEO network. As most buildings appear to be isolated sufficiently. Buildings that require more measures taken could start off with a mid-temperature TEO network and slowly transition towards lower temperatures
3. The low-temperature network can supply cooling, without further investments

Finally, not considered by Resourcefully in their dashboard but nevertheless very relevant for the KNSM-eiland and municipality, is the option of a HTDH ("stadswarmte"). Figure 20 shows that surrounding neighbourhoods have already transitioned towards stadswarmte, indicating that the infrastructure is already partly present.

Figure 20: HTDH networks surrounding the KNSM-eiland (Waternet, 2022)

5.3 Conclusion

The case study of the KNSM-eiland stood central throughout this chapter. First by investigating the urban heat transition as seen by the municipality of Amsterdam, analysing their transition vision heat. It was found that some of the municipalities design principles stand in opposite to their policy and thus “reality”. Their vision does strive for a sustainable and locally organized heat transition, aiming for tailor-made approaches. However, the reality of the municipality is based far more on speed and ease of implementation, less so on sustainability and the very local context of neighbourhoods. The lack in “true” sustainable heating is to be made up by utilizing stadswarmte as a transition technology. Retrofitting these networks towards lower temperatures and more sustainable heat sources around 2030.

The second part of this chapter took a dive into prior research and data regarding the transition of the case neighbourhood. It has provided data on the feasibility and affordability of TEO networks on the KNSM-eiland per 2030. As TEO is deemed cheaper than further natural gas utilization and the most sustainable alternative considered in general. Finally, socio-demographics in annex C have shown that the KNSM-eiland is densely populated by inhabitants mostly over the age of 45, with a relative preference towards “sustainable political parties”. Furthermore, the average household is relatively small, in line with older inhabitants living without children. Lastly, a significant share of housing is owned by corporations. Now, how do these findings tie in with sub research question five:

Which context specific insights are crucial to consider before the operationalization of the IAD framework?

This is where the technical arguments seem to clash with the institutional ones, better said a more practical reality seems to unfold itself within this chapter. However important sustainability might be for many stakeholders, the municipality is relying on previous bonds formed to roll-out stadswarmte in a very high tempo. Being at odds with their policy framework, this lock-in entails that stadswarmte is currently thriving. Whereas LTDH networks and upgrading isolation levels in housing remain underrepresented. And not completely alien, as heat supply through stadswarmte remains the solution with the highest ease of implementation, aligning goals of the municipality with heat companies and housing corporations. However, academic findings highlight that transforming stadswarmte into LTDH networks is quite the task. One that is covered in insecurities currently not pertained by policymakers nor heat companies. As current stadswarmte networks are not simply fit for sustainable heat sources. On top of that, a sustainable and affordable alternative has presented itself for the KNSM-eiland; low-temperature TEO networks. In line with design criteria of a neighbourhood tailor-made approach, highly sustainable and theoretically cheaper than current heating.

Thus, the practical reality of the municipality is in tension with the prospect of a custom and local solution. Both adhering to different criteria, the question remains that of which criteria will weigh heavier? Not to forget, households of the KNSM-eiland remain crucial decision-makers. It is therefore of importance to uncover, through participation, what their stance is on this quandary. This question is to be brought into the operationalization of the IAD framework. As the focus of the analysis will shift towards residents of the KNSM-eiland and their vision for the heat transition. Here, the IAD framework will be a novelty toolkit to support engagement and help uncover what really matters to those at the receiving end of policy.

6

Analysis of the KNSM-eiland through the IAD framework

This chapter will present the analysis of this thesis, preparing chapter 7 for answering sub research question six; *How should participation approaches be designed once supported by the IAD framework?* In short, chapter 2 researched the current state of participation and uncovered requirements for novel participatory forms. Chapter 3 found that the IAD framework, enhanced through value theory, presents itself to be a very suitable toolkit to support said novel participatory approaches. Finally, chapters 4 and 5 have uncovered both omnipresent and case-contextual inputs to be utilized in the operationalization of the framework.

Now throughout this thesis it has become clear that a narrower focus on local households is required in the Dutch (neighbourhood) heat transition. This chapter will do so by operationalizing the IAD framework on the case study as presented in the previous chapter. Section 6.1 will first elaborate on the design of the dynamic and nested structure of the IAD framework fit for this transition. Then, in 6.2, the analysis of the KNSM-eiland through the IAD framework will commence.

6.1 Towards a case specific IAD framework design

6.1.1 Design of a nested, dynamic IAD framework as toolkit

Section 3.2 of this thesis already indicated the dynamic shape the nested IAD framework should take within the context of this research. This structure has been presented in figure 7. Throughout the research it has become clear that the Dutch heat transition has been generally designed into a certain structure. This structure finds its roots in policy stemming from EU and even global planes (climate agreements). The Dutch national government takes these policy designs into their own, whether this being on a legal or voluntary basis. However, the national government has certain leeway to which extent they adopt policy or form their own. For this research, especially since these policy planes do not fall into the scope, the design levels mentioned above will be seen as one decision-making plane or nest. Furthermore, this top decision-making plane (“nest one”) will not be further utilized in the analysis, as the most relevant influences of this nest find their way into the municipal nest (as it is dynamic).

Focussing on the key stakeholders
The regional/municipal nest is nest number two in the tailored design of the IAD framework. First regional energy strategies were set out in the Netherlands, which have been handles for municipalities to which they have formed their transition visions. It has become very clear that, through national level government, municipalities are positioned as the directors of their local heat transitions. However, as seen throughout the institutional omnipresent factors at play, municipalities present feedback to national level government by which policies and laws are

further shaped. Again, indicating a dynamic relation between policymaking planes or nests. What has become clear is that municipalities interact with other layers of decision-making. Nest three therefore consist out of “Neighbourhood associations”. This nest can be interpreted as a cluster of collective decision-making groups within the same plane. The nest includes associations of owners, the highest-ranking decision-making groups per building or complex. Furthermore, this automatically includes housing corporations, as they form parts of ownership associations as presented in section 5.2.2. Another key insight from this section is the energy commission which is very active on the KNSM-eiland. Since this entity also intends to translate the voice of local households within the heat transition, and informs both households and owners’ associations, this stakeholder is included in nest three. Finally, heat companies are included (to perhaps a lesser extend) within this nest, as they engage with the collectives. Which leaves the analysis with the last crucial category of stakeholders, households. Decision-making dynamics of households take place in nest four. The dynamic relationships here are argued as follows; municipalities engage with both neighbourhood associations, corporations as well as households. Households attend meetings by associations or are even part of neighbourhood associations as owners. This last dynamic also works the other way around, as activities such as meeting are organized with the aim of participating with households. According to Bernoster & Giebels (2018) the start of the process surrounding a neighbourhood heat transition should always include the following stakeholders:

- Regional governing
- The relevant municipality
- Housing corporations
- Heat companies
- Residents or end-user

Reflecting on the structure of the nests, as argued above, all the key stakeholders mentioned are included in the design. Furthermore, the argumentation is visualized in figure 21, the framework design for this thesis.

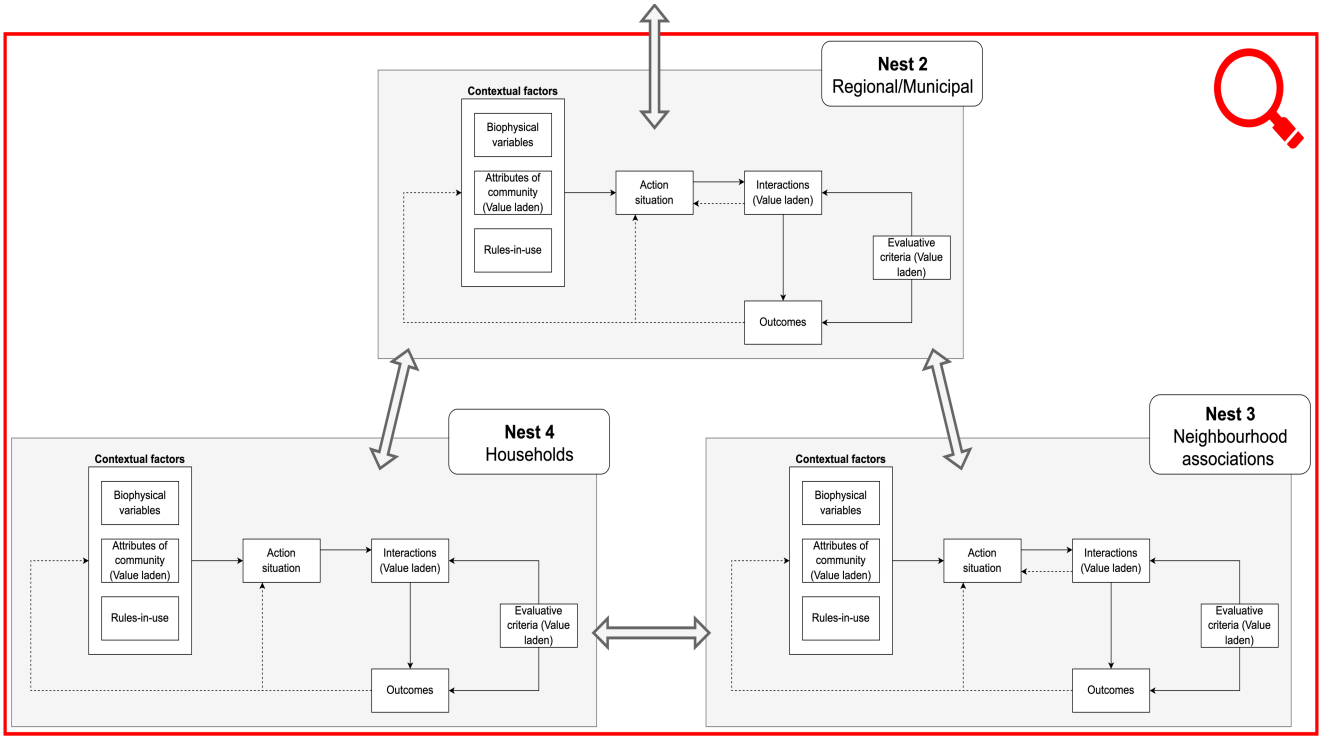

Figure 21: Focused, nested value laden IAD framework dynamics

6.1.2 Infusing participation into the framework

Through chapters 4 and 5 a lot of input for the utilization of the toolkit, presented in figure 21, is uncovered. Now, engagement with local stakeholders is required to identify local values, dynamics and insights which simply cannot be uncovered through text. And this is exactly where the IAD framework becomes a supporting toolkit to participation. Its utilization has presented several tension fields already (referring to conclusions of chapters 4 and 5), which can be transformed as knowledge going into engagement. Now it will further serve as a guiding principle for participation, as mainly the following factors are yet to be discovered for nests three and four:

- A deeper understanding of the attributes of community (value laden)
- The main action situations at hand
- A deeper understanding of the nature of interactions (value laden)
- The evaluative criteria which decision-makers value (value laden)

Engagement handles from practise
A few relevant pointers for engagement have been given throughout heat-transition specific articles. These handles will be considered when aiming to uncover the factors mentioned above. A statement which might seem obvious but touches the core purpose of participation is that of van Galen (2021): “Proper participation within the decision-making process has to ensure that input from society is considered, that any initiatives from society are treated the same as government initiatives, and that participation takes place transparently”. This thesis might not dictate policy; however, participants are to be always taken seriously and the process of gaining contextual insights should always be transparent. Stichting !Woon has structured several important notions regarding participation to be considered per type of stakeholder. These notions are presented in table 13, structured per type of decision-maker.

Table 13: Key considerations for participation with different stakeholders within the heat transition (!Woon, 2022)

Stakeholder type	**Key considerations**
Household of any type	First consider if one wants to be actively involved. Then consider the following, why now in my neighbourhood? What alternatives have already been considered? To what extend has research been done? How can households participate? What does the decision-making process entail? How are solutions organized? What are the costs? Is it sustainable? What are my rights?
Tenants	Landlords/lesser will have to bring proposals towards the tenants, which initially starts with meetings between tenant representatives and the corporation. It is thus of importance that the representatives are active and inform all tenants. As tenants being pro-active can have its merits
(Homeowner within) Owner’s association	Is the association active? Then it is of importance to ensure that all members are included within the process and that this process takes place as transparent as possible. Through informing all members the chances for acceptance towards certain choices is increased. Is the association inactive? Try to organize as much as possible, start creating momentum
(Homeowner within) Mixed owner’s association	Ensure that there is collaboration between both private owners, tenants and their housing corporation to avoid unnecessary or potentially dividing work. Remember that support is key, as 70% of tenants must agree with corporations before association decisions can be made

Finally, an article by Buurkracht (2022) presents several recommendations for creating momentum and acceptance towards natural gas-free neighbourhoods through participation.

Again, fairness and transparency are mentioned. Furthermore, as entity engaging in participation it is crucial to choose one's position carefully. Understand barriers faced and provide perspective, whilst differentiating between owners, tenants and overarching organisations. For the purpose of this thesis, it is thus important to understand participants their position (also the degree to which they can make decisions, as owner or tenant). On top of that, the "neutral" position of researcher should also be made clear, as the researcher is not associated with future developments. A final handle for engagement is that trust is crucial (Buurkracht, 2022).

Planning and designing engagement

Now, how should undiscovered factors mentioned be come upon? And how are the key considerations taken into this process? First, a focus is portrayed on nest three. This nest in practice comes together through meetings. Whether this being half yearly owners' associations meetings or open events with the purpose of informing or decision-making. Time constraints on this thesis entail that the researcher cannot be easily placed within half yearly owners' meetings, however open information events on the heat transition are frequent and accessible. Furthermore, through Resourcefully's connections it has proven possible to access invites for the more scoped meetings. They are organized by housing corporations, heat companies, owners' associations and more frequently the energy commission of the neighbourhood. Thus, to gain insights into the third nest of the dynamic IAD framework the researcher will join these meetings to observe and even engage when possible. As argued for, this form of participation has proven to know certain disadvantages. These have been presented in chapter 2 of this thesis. However, the focus on this nest lies more on the dynamics and decision-making process surrounding the collectives between municipality and households. Therefore, an analysis on this plane can prove very valuable.

Analysing dynamics in nest four requires more preparation. When circling back to the pitfalls of traditional (open or invited) participation certain problems have been brought to light. A quick reminder on the drawbacks of said participation, as it leads to decontextualization, wrongful representation of the entire community, underrepresentation of values and viewpoints and mitigation of conflict. Which is also why a thorough analysis of the fourth nest is of importance to this thesis. The requirements to novel participation as presented in chapter 2 should be utilized into the design of the engagement process. Thus, engagement with households is to avoid "technocratic and socialist" pitfalls, acknowledge the uniqueness of households, uncover local expectations and values, keep it tangible, understand key decisions to be made and do not steer away from sources of conflict. To be clear, the last requirement does not entail that participation should lead to conflict in conversation, it entails that the researcher learns to understand the source of conflict to make it a discussable subject.

Section 1.4.2 of this research already touched upon the method to be utilized to gather observational data, namely through (semi-structured) interviews. However, as discussed on multiple instances, conversing only with those attending open or invited meetings will result in decontextualization and a misrepresentation of the complete neighbourhood. Analysis on nest three will already provide insights that those enthusiastic or opposing (either way motivated to attend meetings) certain themes pertain. Thus, the analysis of the fourth nest should steer interviews away from the spheres of the third nest and focus on households that might not attend meetings or have strong opinions on the matter of their local heat transition. To engage with said households' engagement processes must be designed differently. This all starts with the environment in which households are approached, furthermore the way they are

approached is of importance. As planning interviews through the neighbourhood energy commission might again lead to conversations with those already invested in the transition. The same goes for approaching individuals before or after neighbourhood meetings regarding the heat transition. Ideally, residents of the KNSM-eiland are interviewed in their own, natural environment. This way there are no preconceived expectations, no conditions other than the fact that they are living within the neighbourhood. This would ensure a familiar environment which can stimulate open conversation. This research achieves so through a spontaneous approach of engagement. Namely, roaming the KNSM-eiland throughout the day, mostly between 12:00 and 18:00, simply approaching residents on the streets or outside their homes. Once contact has been made a request for an interview, of around 30 minutes, is proposed to the residents.

To engage in interviews further preparation is needed, as this research involves gathering data from human subjects. To mitigate and acknowledge potential risks, a data management plan was produced. Furthermore, an informed consent form was created (annex E). This form first explains the goal of this research. Secondly, agreement is given by the participant through this form for the utilization of anonymized data. The interviewee does so by acknowledging the voluntary nature of the interview, the potential and minimized risks and the fact that it will be publicized. Finally, a meeting with Udo Pesch was held. Due to his strong multidisciplinary background in (amongst others) philosophy and policy science, plus an academic focus on democratization of infrastructures. Most notably within the context of the energy transition. Through this meeting the following general design was created for the (semi-structured) interviews:

1. Explain that the only precondition for participation is living on the KNSM-eiland, there is absolutely no need for (technical) knowledge regarding the heat transition
2. Ask for
    a. Type of decision-maker (homeowner, tenant)
    b. A short background description
3. Mainly try to hear residents their stories, uncover what lies behind their stories
4. Aim for a natural interview that is not scripted, only use the following “checklist”, with main points of interest, as a guide
    a. Knowledge on the heat transition
    b. Knowledge on local initiatives and status of local transition
    c. Actively participation or not, and for which reasons
    d. Levels of inclusion and commitment to their transition
    e. Views on their neighbourhood heat transition and the values that are in play
    f. Trust in the process, trust in decision-making or policymaking entities (nests 1,2 and 3)
    g. (tangible) Barriers faced

Finally, the extraction of guiding principles or values, as discussed in chapter 3, can be made more quantitative through a questionnaire. As chapter 3 has elaborated Schwartz’s value theory can be apply for this very purpose through the Schwartz value survey. A survey designed by Schwartz in which respondents are asked to “rate the importance of each value item "as a guiding principle in MY life" (Schwartz, 2012). The results of said survey can then be analyzed and translated back to the basic values in life as discussed by Schwartz. The problem with the Schwartz’s value survey is that it can be very time consuming, as respondents are asked to rate 57 values. This is argued to be less fitting for the purpose of this thesis. As

interviews are already likely to take up a significant amount of time from those volunteering. Presenting a long survey could results in a lower willingness to participate. Lindeman & Verkasalo (2005) faced the same downside to the Schwartz value survey, as they found the need to develop a shorter version. Their version was dubbed the Short Schwartz's Value Survey (SSVS), which can be found in annex E. Through reliability and validity examinations across multiple studies it was proven to be equally effective to the original (Lindeman & Verkasalo, 2005). Nowadays many scholars have adopted the SSVS in their academic research to measure human values according to the Schwartz value theory (Macmillan, 2012; Demi et al., 2021; Koskela & Karppinen, 2021; Losifyan & Arina, 2021). For utilization within this research, it had to be translated to Dutch. This was done through cross-comparison with, amongst others, a recognized German version by Boer (2014). The version of the SSVS created for the purpose of this research is added in annex E. This SSVS is to be presented to participants after the interview has been conducted.

6.2 Towards the operationalization of the IAD framework on the KNSM-eiland

This section of the research will present the information which has been gathered through observations, engagement and interviews in nests two, three and four. The IAD framework has been utilized as a toolkit towards a well-balanced upfront know-how of the (local) context. Now it serves as handles towards the gathering of crucial data which could not be come upon through previous methods practised. This section will focus heavily on nests three and four since municipal data has been thoroughly collected already.

6.2.1 Insights gained through partial participation into nest 3

First, the insights presented throughout this section are directly linked to nest three. Annex D shows all summaries of meetings attended, plus other forms through which data has been gathered. These have served as the foundation for this section. In general, this section will be divided into two major topics, namely reflections on parties initiating participation as well as those "receiving" participation. Within this nest engagement has often taken place through the construct known as open (or invited) participation. Within this research engagement in nest three has mostly been in the form of open meetings hosted by the local energy commission. In these meetings speakers represented the energy commission, the municipality, heat companies, housing corporations and owners' associations. Those welcomed have been participants (inhabitants) ranging from the general district, the KNSM-eiland up to those living within a specific complex. Further delineation has been made between the more general meetings, open to all inhabitants, or those aimed at community representatives (owners associations, tenant commissions). As mentioned, the specifics are summarized in Annex D.

Learning from those initiating participation

The first insights gathered pertain to those initiating in participation, frontrunners of the energy commission or "local initiative". The commission has hosted mainly two types of meetings. Those more generally informative on their work and progress for the local heat transition of the KNSM-eiland (the more "open" participation), and those tailored to specific participants where more detailed or concrete topics are handled. This second meeting format, even though everyone remains welcome, is designed to those representing publics within the neighbourhood (invited participation). During both, often little time is dedicated to the nature

and expertise of the commission itself. The goal of the energy commission, on the contrary, is very clear. As their process principles revolve around the understanding that heat networks will enter everyone's lives. However, the nature of the networks, the source of heat and the suitability to the neighbourhood are presented as key. With commission criteria such as sustainability, affordability and ownership/control. Through their presentations it is eminent that their focus lies on TEO. As water bodies are nearby, it's a renewable source of heat and it lowers dependency on other energy sources and their fluctuating prices. Thus, better suiting their criteria then for instance stadswarmte. So, the "why?" regarding the choice for a focus on TEO is presented in a clear and understandable manner. Often supported by research presented through Resourcefully or Waternet. Furthermore, together with these companies, the preliminary TEO analyses are presented. As shown in chapter 5.2.1, these analyses mostly pertain to the technical and financial feasibility of TEO on the KNSM-eiland. In more detail, possible TEO configurations are presented throughout multiple instances. To support these results, and to further give body to the preliminary results on TEO, separate research through commission members assessing the building quality and spatial planning of several KNSM complexes exists. This research has mostly focussed on isolation levels and potential space for LTDH installations within buildings, providing further local context to earlier research. Finally, the commission itself has done some research into the institutional side of TEO, as organization and operation to this regard might prove to be a significant barrier. In the end, all indications for the potential of TEO on the KNSM-eiland remain very positive, a highly impressive set of preliminary research through local experts and voluntary scholars, organized by voluntary members of the community.

It can be stated that these informative engagement meetings are designed with the following leading participative principles in mind:

- To provide an arena in which those participating can (further) form opinions and ask questions
- To provide an arena in which tailored information can be provided to those participating
- To gauge the stance of neighbourhood inhabitants on TEO and stadswarmte
- To communally discuss how the community of the KNSM-eiland can further organize itself within this heat transition
- To communally discuss how potential TEO systems are to be organized and operated (institutional aspects/barriers to the solution)
    - As a local energy initiative or outsourced to varying degrees
- To gauge and create local support, to create urgency and momentum
- To create support towards future practises run by associations or commissions within this nest

The aim presented above still applies to the more tailored meetings, however meetings with members of owners' association aim to reach more tangible milestones. Thus, within these meetings the aim lies more heavily on finding local support towards future communal organization (as a standalone KNSM-eiland entity), the supply of information towards all households and further studies on heat networks (especially TEO). Detailed information on these meeting types can be found throughout annex D5, D6, D7, D9 and D10. Said meetings often start in a similar fashion as those described above, a short introduction and then straight into (technical) preliminary research done on the potential of TEO and the current state of housing. The main insights gained throughout these meetings will be presented in the

following. As mentioned within these meetings, from those starting engagement, there is a strong preference towards TEO systems. Through observation it has become clear that the main challenges currently faced can be presented in the following short form:

- How should the heat transition on the KNSM-eiland be organized
- What is the best way to give every local a voice in this transition
- How are inhabitants “reached and taught” on the subject
- How should a potential LTDH system be regulated and operated, which parties bear responsibilities

During these meetings significant progress regarding the first challenge has been made. As those attending, representatives of owners’ associations throughout the KNSM-eiland, agreed to form a steering committee for the heat transition on the KNSM-eiland. This agreement has been reinforced through the signing of a declaration of intention. Progress that effectively shifts work from the energy commission towards an even more local entity. The energy commission will remain in a strong supporting role not only due to their expertise, but also for their institutional value. As they are a legal entity which can engage with the municipality towards subsidies and other resources. By creating such a steering commission, decision-making weight is added to the entity, as owners’ associations are the area in which final decision-makers debate on future investment regarding their heat transitions. Another major advantage of a steering group supported by the energy commission is that households, across the entire neighbourhood, are reached easier. Making future participation and thereby local support for choices towards natural gas-free living more effective. In other words, an entity that can better handle other barriers that are to be faced as mentioned above. However, not only communication with households is required within this neighbourhood transition. As those guiding decisions per building or complex will also have to communicate with each other, especially since this urban environment calls for collective solutions. A steering group will help the effort of communication, this however is only a start. As each building differs in size, quality, decision-making processes, communication, investments (past and future) and resources. Not to mention the many different viewpoints of all individual households.

Finally, a third type of meeting within this plane was observed. These meetings, being organized by or together with the commission, were mainly focussed on specific complexes and their inhabitants. With speakers mainly from housing corporations, heat companies, the municipality or mixed owners’ associations. It became clear that this category of meetings addresses very tangible and “urgent” topics. As the heat transition within these meetings was of importance through the need to replace FGO’s within the relevant complex. Where the other categories of meetings have a strong focus on TEO, the alternatives presented throughout this category consisted of either investing in new FGO’s or connecting to stadswarmte. Whereas the immanent need to replace the FGO’s worked in favour for a connection to stadswarmte, also when confronted with other alternatives. A few factors within these presentations proved to be key:

- New FGO investments result in a need for FGO, and thus natural-gas, utilization of around 15 more years. Such a renewed and long-term commitment to natural gas was deemed unwanted
- The municipality supports housing corporations and heat companies in the fast-paced deployment of stadswarmte

- The prospects of increasingly more sustainable stadswarmte towards the future
- The lack of utilization of TEO in the close environment. Arguing that TEO is not a viable option due to the time pressure presented with the replacements of the FGO's
- The housing corporation's large share within mixed owners' associations

The main insight gained through these meetings however is that the replacement of the FGO's, or any other tangible problem faced by households, entails much more interest and commitment towards such meetings than for instance the fact that natural gas is to be phased out before 2040. A very practical problem within buildings thus creates "real" urgency amongst decision-makers. This truer form of urgency however is polarizing, as it results in fast interest and commitment on the one hand but also in decision-makers feeling pressured towards certain solutions on the other. The polarizing effect of perhaps unexpected and sudden urgency can be further reviewed throughout summaries D2, D3 and D4 of annex D. It is clear though that, as noted in chapter 5.1 of this thesis, large housing corporations and the municipality share certain goals. In this case those goals have resulted in a sudden and strong campaign towards stadswarmte. The polarizing effect of this campaign did not only present itself through meetings attended, but it has also later been brought to public in an article by van Zoelen (2022) in the newspaper het Parool. As certain homeowners within the mixed owners' association have united against the plans of the housing corporation to connect over 300 appartements (in a single complex) to stadswarmte on the KNSM-eiland. In this specific case the housing corporation owns around 57% of the appartements within the complex, giving them a very strong influence in decision-making. Many homeowners are thus troubled by their aim to connect the complex to stadswarmte. Not only legal questions remain, but many homeowners also live on small pensions or have high mortgages and are thus not willing to invest connection fees of at least 10.000 euro's per household (Van Zoelen, 2022). "It feels unfair and forced", a quote from many homeowners unhappy with this expression of power (Van Zoelen, 2022). Another point of criticism, which will be touched upon further within the next subchapter, is the way in which the housing corporation has approached its tenants towards their initial 70% tenant agreement vote. As voting options merely contained either new FGO's or stadswarmte, with tenants being swayed through the promise of new electrical stovetops and cookware.

Learning from those "receiving" participation

This expression of polarization amongst households has presented a first look into the insights gained of those receiving engagement. However, the way in which all nest three engagement processes have unfolded itself thus far have led to more insights. As meeting structures or content do have a noticeable effect on participants. The first major one of which is the effect of invited (or open) participation. As described throughout chapter 2.2 this form of traditional participation tends to decontextualize the stances and values of local publics. And it has been observed that those attending the meetings are intrinsically motivated though either a strong opinion pro or against topics being discussed. In this study this phenomenon has thus presented itself through inhabitants attending being either very pro sustainability and engaged within the heat transition or those opposing changes presented, clearly not willing to currently invest resources in this transition. Furthermore, only those motivated enough in some form will attend these meetings, risking a wrongful reflection of the community on the KNSM-eiland. Leaving the silent majority of locals unheard and therefore making it hard to consider them in future processes and decision-making, as these are designed on the go. A second major observation is the great difference in knowledge and information between those participating.

Varying from those having technical or academic career background, which allows an easier understanding of the more in-depth analysis, to those still unclear as to why natural gas is to be phased out. This substantial variation amongst participants leads to a wide array of questions. However, as most of those attending has a strong opinion on technical alternatives, the third major observation has presented itself evidently throughout meetings. Namely, the manifestation of the technocratic pitfall, where discussions are basically fed through only technical or (quasi) factual statements. The nature of the meetings, not only the characteristics of those attending but also the contents of the presentations, will have certainly acted as a pedestal for this phenomenon. As information presented tended to become very technical or in-depth very quickly. Especially with an already strong focus on TEO (or stadswarmte). Thus, leaving those participating with a plethora of related questions as opening for discussion. An overview of the most relevant, and recurring, questions is presented in table 14. As can be observed this also includes other relevant questions, not directly caused through technocratic pitfalls but certainly related to the second major observation.

Table 14: Reoccurring questions from participants throughout nest 3

Is my apartment insulated well enough?	What insulation levels are required for LT versus HT DH systems	Where do pipes go? Where exactly will they run though our complex?	Will this result in a need to structurally alter my apartment?
How many and which individual systems are required to install when utilizing LT versus HT systems in my home?	How many and which collective systems are required to install when utilizing LT versus HT systems in my complex?	Is there even space for such the required installations through appartements and complexes?	What are the possible risks of noise pollution through installations? And what about vibrations?
How would installation and operation hinder our daily lives? How long would the building phase take?	What is the impact on the comfort of living when comparing TEO to stadswarmte? Can TEO even heat my house when I need it to? Will this lower temperature impact my showers?	Is TEO a proven and ready technology? Are there many applications of this system already? Is it used in cities?	Why are no other alternatives mentioned? What about solar panels, individual heat pumps? Why are we not talking about hydrogen, geothermal or solarthermal?
What are the costs per building, per household?	What are the financial risks?	What amount of money will be required over a given period? How long is this period? Upfront versus spread investment costs?	Why not stadswarmte? Isn't it cheaper, easier? It is sustainable right? But do we lose our freedom of choice?
On which sources or grounds are the models presented based?	How are we even supposed to organize such a transition with the complete neighbourhood? Owners' associations by themselves are busy enough.	Why are we already talking about this? This transition is still 20 years away.	Why do we have to stop using natural gas? It is not that bad for the environment, right?
Do we even need to make decisions now?	Why don't we just wait until there is more certainty? It could be that technologies become cheaper or that better alternatives arise?	Can we be forced of natural gas?	It is our final decision, right? Since we must pay?

Examining those entering in engagement, studying their remarks and questions, has brought great insights into the dynamics of decision-making and engagement in nest three. Everyone

involved within this nest has an opinion on what to do, which is often based on their own knowledge levels. This in combination with the way participation is structured often leads to niche discussions, heavily focussed on (technical or financial) details. The greatest takeaway is perhaps that everyone is an expert when it comes to their heat transition, and with right so. As households are constantly deemed to bear responsibility for their heat transition, they are the final decision-makers. This results in the fact that those already engaged want to voice their opinion, they want to be heard. Which often leads to niche discussions, discussions to which answers are simply not available yet. However, if too many choices are already made, or too much research is done without consent, participants will feel left out or even betrayed. This goes for local initiatives but even more so for housing corporations, the municipality and owners' associations. As it is supposed to be the final call of households. A very dynamic field of tension which is to be managed with care.

6.2.2 Participation in nest 4

The insights presented throughout this section are based on interviews held with households from nest four. Annex F shows the summaries of all interviews. As presented, the interviews have been designed along a certain, non-binding, structure. One structured or planned aspect to these interviews was to let participants complete the SSVS. This however proved to be more difficult than expected, even though the translation and design of the Dutch SSVS was optimized for this thesis. It became apparent, after observing reactions and reviewing the SSVS sheets of five interviewees, that utilizing the SSVS did not work. The SSVS sheets were all filled out incorrectly. A suspected result of an "on the spot and casual" approach to interviews, which already took up a lot of free time of volunteers. Adding to this, the contrast between a (almost) non-structured interview and the SSVS appeared to throw participants of, visibly struggling to understand what to do and why this is of relevance. As a result of these observations the SSVS sheets were no longer utilized for the remainder of the interviews. As the researcher did not want to increase barriers to conversation, make those participating feel "put on the spot" and end up with non-representative results. The theory by Schwartz however remained as a handle throughout conversation.

An expected effect of the design to participation within this nest is that of residents kindly refusing to participate in conversation. It can be stated that this happened often, which does not mean that there is nothing to be learned from those not wanting to participate. Annex F14 sets out these reoccurring events, the main reasons for decline are presented below:

- "I have no knowledge on the subject"
- "I'm not interested in the subject"
- "This transition is still such a long way off"
- "I know nothing about the transition"
- "I can't say anything useful on the subject"
- "This is something I don't have to engage in at this point"
- "This transition does not worry me now, maybe in ten years"

These arguments could potentially show that people are afraid to engage in conversation on the topic due to their lack of knowledge or interest. Whilst this could be extremely relevant to them, even without certain up-front knowledge. Of course, many other factors come into play when asking people to sacrifice free time for an interview. Thus, this statement is to be taken lightly.

Insights gained from residents of the KNSM-eiland

Overall, 13 residents of the KNSM-eiland have engaged in participation through interviews. Interviewees vary in gender, age, period of residency within the neighborhood and decision-maker type. The main insights per interviewee can be found in table 15, more extensive notes on each interview are presented throughout annex F.

Table 15: Overview of insights gained per participant through interviews in nest 4

Participant	**Decision-making type**	**Interest in transition**	**Knowledge of transition**	**Opinion on transition**	**Trust towards**	**Leading values**	**Sense of urgency**	**Willingness to participate**
1 – male senior, residency 12 years	Homeowner, owners' association	Little	Little to none, has heard about stadswarmte	Very neutral, as this participant feels too old to form an opinion on the matter. Stadswarmte is perceived as polarized.	Local parties that have proven expertise, no trust in municipality	Achievement, conformity and benevolence	None, the transition lies too far in the future to be actively engaged in it	Very low at this point in time
2 – female senior, residency 12 years	Homeowner, owners' association	None	None	The heat transition should be left with those that have the relevant knowledge	If their expertise's are proven, both local parties and governmental entities are trusted	Achievement, tradition and benevolence	None, too old to be worried about this transition	Only when final decisions are to be made, those impacting their home
3 – female senior, residency 15 years	Homeowner/tenant, housing corporation + mixed owners' association	A great deal	None	Leave natural gas behind as soon as possible, via sustainable initiatives guided by trust	Local entities, high distrust towards housing corporation and little trust in municipality	Self-direction, benevolence and universalism	A great deal, mostly through pressure of FGO replacement	Extremely high
4 – female adult, residency 18 years	Tenant, housing corporation	Limited to solar and wind	Substantial	Extremely complex, sceptical since so many stakeholders are entitled to opinions and influence	If proven to be capable, local entities. Little trust in housing corporation and municipality (top-down decision-making)	Benevolence and universalism	Urgency nor momentum is present at this point	Very low at this point in time
5 – female senior, residency 7 years	Homeowner, owners' association	A great deal	Substantial	The transition is of key importance, however "is it useful for me"?	Local entities, has little trust in top-down decision-making (municipality)	Hedonism and universalism	Non-existent	Engagement will come when urgency is felt

6 – male senior, residency 30 years	Tenant, housing corporation	Little to none	Little to none	Will form opinion when all information is available, however housing corporation will decide in the end	Larger entities (government and multinationals), little trust in local initiatives due to lack in professionalism and expertise	Tradition, achievement and security	None, as this topic will become relevant maybe 10/15 years	Perhaps in 10 years, if the housing corporation initiates
7 – male senior, residency 20 years	Tenant, housing corporation	A great deal	Substantial	The sooner the better, the more sustainable the better. As it is important for future generations, but also for us now	United communities supported by professionals, very little trust in housing corporations and municipality	Benevolence, universalism, conformity and tradition	A great deal, mostly through social and environmental principles	Extremely high
8 – female adult, residency 10+ years	Tenant, housing corporation + mixed owners' association	Little	Little	Should have been a simple and quick top-down decision. Currently voted for stadswarmte	Housing corporation and (national) government	Tradition, conformity and security	High, through replacement of FGO's and geo-politics	When confronted with decision-making
9 – male adult, residency 2/3 years	Homeowner, owners' association	Little to none	Some	80% of decision-making is based on finances, thus requires a complete package of information before an opinion is formed. Autonomy throughout the transition is key	Decision-making through owners' association, bottom-up. Little trust in top-down decision-making by municipality	Self-direction and achievement	None, future disconnection of natural gas is a given. However, this will become relevant in 10/15 years	Will start engaging when a detailed and tailored (financial and technical) overview of alternatives is presented

10 – female senior, residency 25 years	Homeowner, owners' association	A great deal	Some	"We need to leave natural gas behind as soon as possible, tomorrow is essentially too late". Stadswarmte, not as sustainable as preferred but currently the best option we have.	Owner's association supported by local commissions with knowledge. Democracy is key, therefore lesser trust towards municipal top-down decision-making	Universalism and benevolence	A great deal, fuelled by social, geo-political and environmental principles and developments. Realistically her complex will start in 10/15 years, as FGO's have been replaced recently	Engages in various sustainable processes. Will engage with decision-making in heat transition when the owners' association considers it.
11 – female adult, residency 6 years	Tenant, housing corporation	Little	Little to none	Decision-making does not truly lie with tenants, but with the housing corporation. Thus, a rather neutral view on the transition	Both local entities as well as corporations working with municipality. "Fine if an alternative is selected for us"	Conformity	Little to none, "only if actual decisions are to be made, then true urgency presents itself". Although the geo-political situation is becoming pressing it still doesn't hit close to home	Once initiated by housing corporation then willing to participate
12 – female (young) adult, residency 3 years	Homeowner, mixed owners' association	Little to none	Little to none	The transition is to be designed realistically, future-prove, affordable to everyone within society and by young professionals	Local initiatives or entities of young professionals with technical and social expertise. No trust in (national) government nor municipality	Benevolence, self-direction and universalism	Little to none, the current geo-political effects might have created some. However, this is not merely enough to lead to active engagement	Will start engaging when a detailed and tailored (financial and technical) overview of plans is presented
13 – female senior, residency 30 years	Tenant, housing corporation + mixed owners' association	A great deal	Substantial	Should be as sustainable as possible. However, has a realistic view and voted pro stadswarmte. An alternative that is easiest implement in the complex urban environment, has potential to become more sustainable	Housing corporation (decision-making) and heat company (to make stadwarmte more sustainable)	Universalism and tradition	Through the need to replace FGO's. Otherwise, would have rather seen more time taken to research the most sustainable options	High

Without further analysis some key observations can already been drawn from the interviews summarized above. The first major one is that little to no urgency exists amongst participants regarding their heat transition. Only truly when confronted with practical issues, replacement of FGO's, urgency arises. The heat transition itself still seems to be intangible for most participants, it is a concept which is perceived to only become relevant in 10 to 15 years, not at this very moment. Even though participants seem to frequent socio-political situations and higher gas prices as motivations towards sustainable heating, this alone is often more reason to lower the central heating temperature or put on some extra clothes in the winter. The argumentation behind the transition, in the sense of sustainability, is often understood however does not lead to urgency. Secondly, participants throughout this nest reacted positively when being informed or updated on their local heat transition and possible future scenario's. They however rarely posed questions. A third major observation is that those owning housing are often more reluctant to form strong opinions on their possible transition and thus decision-making. As they require a "complete" package of information, on all alternatives considered. This should include financial, technical, legal, organizational and environmental comparative analysis. Those renting property from housing corporations often quickly admit that they feel not to be in a position of power when regarding decision-making, accepting the hierarchy. A final major observation at this point is that most participants would prefer local decision-making, their trust lies heavily with local entities. Especially when compared with trust towards the municipality, as this often is very low. The main reasoning behind this preference is that of which entity is better enabled to understand local values and needs, as "by and for the neighbourhood" seems to be an impactful consideration. This does not directly entail that local entities automatically gain full social support and trust when discussing decision-making for their local transition. As there appears to be a great need for professional and expert validation by local entities before households would truly place trust.

6.2.3 Insights gained into nest 2

Most input for this part of the analysis has already been gathered through chapters 3, 4 and 5 of this research. However, the municipality of Amsterdam is currently rolling out a program of webinars and courses for owners' associations boards on how to sustainably transition their housing and how to communicate with households. This program is further utilized towards collectives such as a local energy commission to support them in their work. Insights into the process behind this program can shed more light on the dynamic relation between nest two and three and on forms of engagement the municipality encourages. Therefore, an interview was held with a municipal project leader on the topic. Through this interview additional data was collected, the core of which will be presented now.

At first the municipality steered away from owners' associations within their heat transition engagement policy. However, it was quickly found that, because around 50% of Amsterdam's housing is governed through owners' associations, this course should be changed. A major advantage to participating with these associations is the fact that their governance has been mostly established through deeds of division. Furthermore, since 2018 financial savings for the "multi-year maintenance plan" of associations has been made mandatory, easing financial plans to be constructed for their transitions. The municipalities' main goal of the program is to provide them with independently constructed information, support them in creating social support and show them what has already been done. The information packages, through

workshops, consist mainly out of analysis on building state, energetic analysis, how to lower energy needs and how to finance this transition.

The municipality found that owners' associations often consist out of relatively older inhabitants with sound careers, resulting in groups with a high knowledge level and plenty of interest in technology and finance. Often leading to discussions which this research has referred to as "technocratic pitfalls". On the bright side, within these groups there are always some "frontrunners", willing to invest time into their heat transition. The municipality found that such frontrunners should be supported in their work. The first step in their work however should always be to ask for mandate from the association, to invest time and effort into their research regarding the transition. In short, according to the municipality, the work should directly relate to current or expected problems within the housing facility. This with the goal of keeping the transition urgent, tangible and relatable, creating the most potential for acceptance and support. As seen in data presented above, a great instance of this argument was found in the case of a building debating the replacement of their FGO. However, it could also be leaking windows, outdated heating installations or planned building maintenance. As the reduction of costs on the "operational" (such as maintenance) building level are found to be great incentives. Once locally initiated research has started it is of key importance to keep all inhabitants up to date. This can be through communal meetings, in which it is of importance to embrace the social side to discussions. To avoid mentioned technocratic pitfalls and to allow attendee's to be heard. As it was found that the psychological aspect to this transition is just as important as the technical or financial. But what about those not motivated to attend said meetings? One way to deal with this according to the municipality is to simply go "door by door" and engage in conversation with inhabitants. Also, try to initiate a "soundboard' group consistent out of residents who might be more critical or better enabled to voice the entire community to further develop acceptance. Finally, creating momentum, urgency and social acceptance is of great importance but it remains very challenging.

6.3 Conclusion

In short, utilizing the IAD framework has led to engagement with focus groups, (ex) professionals and interviews with households. This process has completed the data required for the operationalization of the proposed toolkit. The main take-aways from this chapter can be summarized as follows:

- Three layers of analysis are deemed crucial; municipal, local collectives and households
- Engagement with households is designed outside of nest three activities, through a semi structured and spontaneous approach
- Only households intrinsically motivated attend nest three, risking decontextualization regarding decision-making in this nest
- Nest three participation is information dense, making way for technocratic pitfalls
- True urgency amongst households does not stem from sustainable argumentation
    - As for most in nests three and four this transition is only relevant when FGO's need replacing
- Trust is highly important. In nest four little trust for municipalities exists, trust towards local initiatives is placed when competence is proven

7

Results gained through operationalization

This chapter will answer sub research question six; *How should participation approaches be designed once supported by the IAD framework?* Now that all insights and data have been gathered, the final analysis, through the IAD framework as presented in figure 21, can be conducted. The analysis will take place on each individual nest, whereas nest consistency will be discussed in the conclusion. Per nest, the different subparts that make up the IAD framework will be considered. Then, before conclusions are made, the artifact designed throughout this thesis will be presented. Finally, conclusions will be presented by which a participation approach tailor-made to the KNSM-eiland heat transition is handed.

7.1 Completing the IAD framework

7.1.1 Neighbourhood association decision-making throughout nest 3

Biophysical conditions
These conditions relate to the good most dominant within this nest. As shown in chapter 3, table 7, for this case the conditions are focussed on technical alternatives within the delineation of the neighbourhood KNSM-eiland. Within this nest the dominant conditions are therefore domestic heat, bound through either stadswarmte or TEO. Stadswarmte is easier to implement and therefore attractive to housing corporations, furthermore the solution is linked through deals with municipality and heat companies. For households stadswarmte is often seen as less desired since it pertains lesser sustainable qualities. Furthermore, the monopolistic and top-down qualities of stadswarmte are often challenges by those attending this nest. It should however be noted that households do find this solution more reliable compared to its competition, as it is widely utilized and therefore trusted in a technical sense. Owners' associations comprise of households in attendance and share similar thoughts on the biophysical conditions to the heat transition. A noted difference is that opinions of household's voice through owners' associations tend to be more conservative regarding either stadswarmte or TEO. They do not wish to be "forced" onto stadswarmte, but at the same time are very risk averse towards TEO. They, even when acknowledging preliminary studies and benefits on TEO, wish independent feasibility studies on the alternative before truly "choosing a side". The energy commission distinctly strives for TEO, as it is a solution that utilizes local resources, is most sustainable and future-proof. Furthermore, its organization and operational qualities present more choice of freedom for its final users. This final remark also has its roots in barriers that the commission is perceiving, as the institutional side to TEO is very complex and immature. The initial technical side however has been covered in extend, it also being a side to TEO that will further have to be researched by independent entities, thus not causing further worries for the commission itself.

Attributes of community (value laden)

Mainly, the attributes of community within this nest can be delineated through four major groups: the energy commission, the housing corporations, owners' associations and households. The energy commission is an entity comprised of skilled volunteers with relevant backgrounds, highly educated individuals. They share core values since they want to guide the local heat transition as best as possible, transparently and with their community as end users in mind. Hereby they receive trust, as those attending their meetings do not feel exploited. Housing corporations are large and complex entities represented by those often following certain "guidelines or policy". They are no experts within this context and thus have a focus on practical matters at hand. Their goal is mainly to ensure affordable (social) housing within their complexes. Leaving decision-making across a whole neighbourhood lower on their agenda's. Within the community they enjoy lesser trust, as strong bonds with municipality and heat companies presents them to be less in touch with the community. Owners' associations are comprised out of those owning housing within a given building, entities perceived as trusted as they are democratic and consist of locals. Compared to their "normal activities", the heat transition is extremely complex. Given this context their knowledge levels vary enormously. Representatives attending are often interested in the transition, willing to discuss and learn. Of course, there are also those opposing change to their housing, as often they do not see urgency nor reason to invest resources. This division in motivation also goes for residents attending, those not carrying any other responsibilities or agenda's then just engaging or learning. Most attendees are encouraged through intrinsic environmental motivation, wanting to participate to install changes for the better. Also, values regarding trust, fairness, and equality are often central. Thus, the basic values universalism and benevolence are identified here, in line with previous research. Again, there are also residents that do not want change at this point, more so motivated by values relating to influence and autonomy. Often those with lesser faith in entities such as the energy commission. In general, residents attending have formed a strong opinion on which course to set for their heat transition.

Rules-in-use

Most relevant are the rules that pertain to decision-making within the neighbourhood. Meetings organized by the energy commission do adhere to certain informal rules, as these meetings are led by those "in charge". Meaning that discussions can be steered or overruled, but in principle everyone can voice their opinion and no consequential decisions are made. Except for decisions on voluntary basis, such as the formation of a "steering group", or applications for subsidies. In the end, the most important rules are those active in the decision-making areas of housing corporations and their tenants and owners' associations. Housing corporations need a 70% vote from their tenants to implement major changes regarding the heat transition. If they are part of a mixed owner's association their proposals can then be brought into this arena. Within owners' associations often a 2/3rd majority of votes is required.

Interactions (value laden)

Interactions between those engaged within this nest mostly take place through meetings organized, as presented in annex D. After meetings further interaction tends to take place via email. Besides these meetings, entities involved meet individually. For instance, commissions meet once a month and owners' associations tend to come together twice a year. Finally, interaction from entity to individual takes place. As the energy commission frequently updates those engaged through newsletters and their website. Housing corporations, however minimal interaction has been observed, inform their tenants on plans, decision-making or consequences of plans.

Action situation
As explained throughout this thesis the action situation lies at the core of the framework. It is an construct in which individuals (acting on behave of their own or an entity of sorts) observe and gain information, select actions and participate in decision-making towards certain goals (McGinnis, 2011). The action situation central to this nest is that of organizing and gaining decision-making support for either TEO or stadswarmte. It has become clear that, initiated by either energy commission or housing corporations, a great variety in participants exists in this action situation. Not only through their motivation for participating, as pitfalls of open or invited participation to have been identified, but also through variety in knowledge levels. Combined with strong opinions, as per consequence of traditional participation, this leads to a wide variety of discussions. Especially strengthened through the design of presentations and their content, as they tend to be very in-depth, technical and packed with information. Resulting in discussions regarding technology, costs and (structural) implementation risks. These discussions are difficult to manage, since they have their roots in the information presented however are often impossible to solve. This is because in-depth questions on financing, organization or technicalities simply cannot be answered in this preliminary stage of research and engagement. To provide answers to most discussions' independent feasibility studies (into mainly TEO) would be required. Furthermore, these discussions tend to be counterproductive regarding progress within this action situation.

It has become clear that support and momentum in decision-making relies on the "true" urgency felt by participants. Those attending, driven by their motivations, certainly feel urgency. However, this urgency has led to a need to be informed and participate. The urgency within this nest, regarding participants, is aimed not perse at progressive decision-making. Not unless very "real" and practical problems linked to their heat transition present itself, problems such as FGO replacement. When discussing these problems, true urgency was felt by those participating. However, even then those attending would not present a true reflection of the KNSM-eiland, as pitfalls of traditional participation still show itself. Leaving those initiating engagement struggling with the question of how the heat transition on the KNSM-eiland should be further organized, aiming for engagement beyond traditional senses.

Evaluative criteria (value laden)
The energy commission values criteria such as sustainability, organizational freedom, utilization of local resources, participation and social support. Housing corporations value costs, ease of implementation and operation and the scalability of solutions. They prefer solutions that require minimal contextual adaptation. Through questions asked, as presented in table 14, representatives of owners' associations and inhabitants especially evaluate through criteria as costs per household, (structural) alterations required, noise pollution, disturbance, construction time, comfort of living, factual argumentation alternative, implications organization and operations and timeframe of transition.

Outcomes
When looking at complexes in which FGO replacement is a pressing topic, the main outcomes are in line with wishes from housing corporations, namely agreement (by majority) towards the installation of stadswarmte. Mainly since this technical solution is readily available, takes away risks from those initiating and overall has the highest ease of implementation. Furthermore, it can be decided upon for a single building complex, as infrastructure is already near the KNSM-eiland. So, only agreement within a building is needed. And with high ownership percentages of corporations the decision-making process quickly becomes less complicated. Although, as

mentioned in section 6.2 this route has been extremely polarizing and is surely not concluded yet. As opposing homeowners within the buildings are not keen on being forced onto stadswarmte.

When zooming in on the decision-making meetings with the most general of content (open participation), no outcomes in the sense of “linear progress” are observed. In this decision-making area the technocratic pitfalls are dominant, leaving those participating actively in discussion, wanting more concrete information packages. These outcomes have trickled into the decision-making area of those involved on a more in-depth level, such as meetings between the energy commission and representatives of owners’ associations. The main tangible outcome here has been the creation of a steering group, several individuals per owners’ associating representing a substantial amount of the KNSM-eiland in their heat transition. These meetings are described in more detail in Annex D6 and D9. This outcome is partly the result of several factors which have been observed. Starting off with the lack of urgency, support and overall engagement of all local inhabitants, felt by this group of “frontrunners”. As mentioned, and further elaborated upon in the next subchapter, the average resident of the KNSM-eiland is not yet concerned with their heat transition. A second outcome here is the fact that it is extremely difficult to find the right “package” of information to present. Especially considering all the different knowledge levels of those involved within this nest. As touched upon before, the current information packages are often very focussed on technical and financial components, leaving room for dominant technocratic pitfalls to further spread. This has resulted in a newfound focus on gaining social support, urgency and momentum. A focus on how to reach those that do not partake within this nest and how to organize decision-making over the entirety of the community. The steering group will be relied on heavily regarding this task, as they can better reach and engage within their own building. Acting as middlemen in future decision-making processes. Furthermore, the need for independent feasibility studies is heard and will be acted upon. Also allowing this nest to shift towards participation build around more social constructs. Since the answers to all burning technocratic questions will be provided through such independent feasibility studies.

7.1.2 Household decision-making throughout nest 4

Biophysical conditions
As in nest three, the goods most dominant were expected to be stadswarmte and TEO. However mostly recognized these goods are, they are not per definition dominant. Most households throughout this nest have at least some basic knowledge on stadswarmte, TEO on the other hand some have only heard of. Once engaged and informed on the basic qualities of both technical alternatives (supported by the infographic, see 7.2), opinions are formed to some extent. It can be stated that this observation is the result of a dominant low sense of interest and urgency within both homeowners and tenants across the KNSM-eiland. Thus, making it more difficult to assess their stance on the biophysical conditions at play, which is a result by itself. As mostly natural gas-based heating (through central heating systems) will remain the dominant condition for the coming 10 to 15 years according to interviewees.

As stated, opinions on future technical alternatives were formed during engagement non the less. To start off with those owning a house in the neighbourhood. The first and most dominant insight that presented itself within this group is that homeowners aren’t too eager to form a strong opinion on alternatives. Partly since there is little urgency, but most referenced was the need for a complete package of information, as mentioned in 7.1.2. Some homeowners do not

want to be either pro stadswarmte or TEO at this point since they belief other technologies will have time to develop and become more viable, alternatives such as hydrogen. Another crucial aspect to this stance is the fact that they want information on financing, risks, comfort and operations before deciding which alternative is best for their household or building. Information that is not yet (completely) available, making it a non-relevant point of discussion. Here the first major deviation in comparison to tenants is formed, as homeowners are going to be investing directly into their own property, their own house. This decision-making process thus bears more weight for this group, as they do not want to rush their decisions if there is no need to do so. Again, no pressure to engage in their transition is felt by this group since natural gas is perceived to remain dominant for quite some time. With this comes another consequential insight. As homeowners will preference the more long-term sustainable solutions, not purely because this is better for the environment. They also preference this quality in solutions as they are not keen on continually reconstructing their homes and heating solutions. Finally, a key insight is that homeowners want to decide on technological solutions via their democratic owner's association's structure. They do not want to be forced towards a certain alternative; they truly want to decide for themselves. Which makes stadswarmte less attractive to most, since this technology has strong ties with municipalities and their plans to quickly get neighbourhoods off natural gas. TEO in turn might become more attractive via this stance, as this technology offers more (organizational/operational) freedom to those utilizing. However promising TEO might sound for most homeowners, there is too little information and tangible performance (utilization in other neighbourhoods for instance) on the technology that most will lie in wait for its development to form an opinion.

In comparison to homeowners, tenants are relatively quicker in forming their opinion on the biophysical conditions relevant. There are basically three main stances amongst engaged tenants. And it is of importance to note that they have/will be confronted with stadswarmte since their housing corporations prefer this alternative. The first stance concerns those that are ok with stadswarmte, purely from a practical perspective. The housing corporation will take care of all installation work, often providing new cookware. Thus, minimal effort and change for those renting. The second stance of tenants start their argumentation off along the same lines, however sustainability plays a bigger part in their opinion forming process. They acknowledge the pros of stadswarmte, their preference is however negatively impacted by the lesser sustainable qualities of the solution. Resulting in two outcomes; either being ok with stadswarmte due to promises of increased sustainability in the future or ending up favouring TEO. The final stance of tenants is that of being completely anti stadswamte, and more pro TEO. Not only because they belief stadswarmte to be a short-term, non-sustainable solution. But more so since they have the feeling of being forced towards a certain alternative by municipality and housing corporation. This often comes in combination with a very high distrust towards both entities, as will be discussed under the next element of this analysis.

Attributes of community (value laden)

Let's start with attributes shared by both those owning a house as those renting. As mentioned, those engaged mostly have a low sense of urgency and interest in their transition at present. Secondly, it has become very clear, through utilization of the IAD framework, that trust plays a grand role in the local perception of the heat transition. Furthermore, households participating generally share the same stance when it comes to "who to trust with their heat transition". As trust in entities such as the national government, but more so the municipality and housing corporations, is very low. Presenting an immense tension field when reflecting on the large scheme of the heat transition. Remember, municipalities are positioned as lead directors of

neighbourhood transitions throughout the country. On top of that, the municipality of Amsterdam clearly shares visions and goals with that of housing corporations, unfolding them as ideal partners. Painfully, those engaged would rather have their transition directed through local initiatives. A key insight here however is that local initiatives do have to prove their expertise to locals, as this is often mentioned as a barrier towards “full” trust. This stance is observed even stronger amongst homeowners. Thus, if local initiatives were to convince residents of the KNSM-eiland with the fact that they are competent professionals, they would enjoy the trust of a community in guiding their neighbourhood transition. Leaving the municipality better off by engaging with said local initiatives, working together and supporting them when required.

Attributes shared by those owning a house have become clear throughout this analysis. As the importance of investing in one’s own home has led to a more retaining stance. Requiring clear informational overviews on alternatives before opinions are truly formed. Again, tenants seem to deviate from this stance. As another quality of this part of the community has been identified. That is, that often this group of locals feel like their influence on the transition is slim. In other words, they find that the decision-making capabilities do not truly lie with them. As housing corporations will often have the first and final say in their perception. Leaving them more open to solutions presented, without truly forming a strong opinion. Or this process is perceived as forced, resulting in an even stronger aversion towards the entity and technical alternative.

Finally, amongst homeowners it has become clear that achievement, benevolence and universalism are the generally dominant values. Achievement here mostly reflects the need for expertise and professionalism when regarding their heat transition, in those taking “charge”. Also reflecting the fact that homeowners require “scientific” information packages so that they can decide for themselves which alternative is preferred. Benevolence and universalism, as explained throughout this thesis, reflect pro-environmental values and behaviour. As most homeowners do prefer the most sustainable solution, they seem willing to sacrifice on other criteria as costs. However, this can only truly be observed at the point in which this group is investing. The same goes for tenants, again benevolence and universalism are dominant values. In this case the interpretation should be altered, as tenants will not directly have to invest in a technological solution. Thus, it is perhaps easier to say that the solution should be the one most sustainable, even if for instance the operations are more complicated (responsibilities stand with housing corporations). Two other values stand out when considering tenants; tradition and conformity. Both finding their expression in the fact that tenants are ok with the idea that housing corporations have the most influence, that their decision-making “weight” is little. As housing corporations have traditionally taken care of their housing, they have (in their perception) always been shot callers. Furthermore, most tenants won’t protest this process. This is confirmed by value theory presented in this research, as tradition and conformity positively correlate with trust towards institutions. Of course, this is no resolute claim, as only two of four value indicators are found. It does however underline the argumentation presented. Especially when considering values dominant with homeowners, as none of the positively correlating values for trust in institutions (such as the municipality) are identified here.

Rules-in-use

In short, the most important rules again are those active in the decision-making areas of housing corporations and their tenants, and within owners’ associations. Housing corporations need a 70% vote from their tenants to implement major changes regarding the heat transition.

If they are part of a mixed owner's association their proposals, then can be brought into this arena. Within owners' associations often a 2/3rd majority of votes is required. Besides the coming laws and legislation, see chapter 4, no other (in)formal relevant rules are at play as of this stage.

Interactions (value laden)
A first important notion, especially compared to nest three, is that most participants do not engage in interaction spheres as presented throughout nest three. Thus, regarding their heat transition, most households do not attend meetings organized in nest three. Those that are interested or engaged enough will interact with friends or neighbours regarding the subject, however this is a minority. Homeowners will attend their half annual owners' associations' meetings, may this be with a healthy reluctance. However, far more pressing items will be discussed during these meetings. As noted often only those subjects that require (relatively) direct decision-making are treated. Leaving, due to a lack of urgency, the heat transition very low on the priority list. As no homeowner has mentioned this topic to have been discussed in said meetings. The exception being when the FGO's are up for replacement, as thoroughly covered. Another form of interaction takes place via leaflets, informational letters or the local paper. Housing corporations often utilize these means to inform their tenants on topics such as the replacement of the FGO's. Often only naming stadswarmte or new FGO's as the technological solution. Those interested enough can contact their housing corporation, but in practise it seems that most accept this process as is. Both homeowners and tenants can receive information from the energy commission and interact with them. Those receiving the local newspaper will be updated on their progress occasionally. Those subscribed to their digital newsletter will be taken along in more detail. Again, this will only reach those engaged enough to subscribe. Often the group that also attends the meetings on the topic. It was found that, in general, more homeowners are aware of the existence and work of the energy commission. Tenants more generally aren't informed on their work.

Action situation
Within this nest the action situation is somewhat of a strange beast, as almost no urgency exists amongst most participants. "In 10 to 15 years we will form our opinion on the matter, then all information will be available" was the most heard statement under homeowners. Only when they truly must start the decision-making process, then the action situation will become apparent. The same goes for most tenants, as again sustainable, geo-political and social arguments often are not enough to kickstart engagement within their heat transition. True urgency has only been observed through the matter of FGO replacement in certain buildings. Tenants are confronted with the situation through their housing corporations and homeowners will face decisions in their owners' association meetings. Only when the transition becomes as tangible as the replacement of FGO's urgency is present, engagement rises and decision-making starts afoot.

Thus, urgency must be created for most of the KNSM-eiland before a desired action situation will unfold itself. Engaging with the why, what and where instead of a hefty amount of scientific or financial information. Another factor, as learned from the FGO cases observed as well as theory, is of key importance. Tangible processes, barriers or problems within households, buildings or complexes are to be utilized. Since other forms of argumentation only seem to be affective as support or development in said tangible matters. Per example, one might utilize outdated window frames, leaking walls or ceilings as a catalyst to enhance isolation levels. Thus, combining a practical reality with a future natural gas-free existence. Finally, informal

engagement, as this study utilized, was very well received by all participants. Showcasing through interviews which could take up to 90 minutes. Residents with little initial motivation or knowledge do enjoy learning and talking about the heat transition. This informal process seems to be, however time consuming, much more effective than broadcasting bulks of information.

Evaluative criteria (value laden)
When it comes to evaluative criteria within this nest most have been touched upon. Compared to nest three there are less criteria to consider, being a result of lesser (intrinsic) investment and engagement. The generally known criteria, and shared by both homeowners and tenants, are costs, sustainability, locally (with expertise) organized and a democratic process. The last one being the least obvious, as residents seem to share a need of a democratic process surrounding decision-making. Homeowners further evaluate according to the question of whether all alternatives have been considered, the degrees of freedom certain alternatives entail, the reliability and future proofness of alternatives and the comfort of living. Tenants in contrast seem to value (social) fairness, natural gas independence and social acceptance more.

Outcomes
Again, since no need for decision-making is being felt, the outcome remains that little residents are engaged with the topic of their local transition. Which in turn entails that (social) acceptance for possible technical alternatives remains low. There is only a tangible need for the validation of capability in local initiatives, as they are willing to let said initiatives work on their transition. However. The most noted outcome is often disguised as a question, namely “when will this become relevant for me?”. As residents’ belief that their heat source will remain natural gas for the coming 10 to 15 years. The problem that arises here is that this might not be the case, especially considering upcoming legal handles for the municipality. If urgency and thereby engagement are not realized within the coming years residents might decide on too little too late. As there will be a serious risk of being forced onto an alternative without having the required time and resources to process counter alternatives. Now for some this might not be a problem. However, since trust levels in the municipality are low, it is expected that this will create a lot of tension. And the same goes for those renting a home. If they do not start to voice concerns with their corporation, it might be a done deal when they receive information on the matter. However, this is expected to present lesser resistance as tenants within the neighbourhood are not extremely averse to stadswarmte. The process of decision-making that surrounds it however is delicate.

7.1.3 Regional and municipal decision-making throughout nest 2

Biophysical conditions
When reflecting on the analysis throughout chapters four and five, it has become clear that there is a dominant biophysical condition throughout this nest. High temperature district heating networks, or stadswarmte, is a technical alternative clearly favoured within this nest. As the main qualities of ease of implementation, standardization, operations and responsibility structures make this technical alternative the most attractive choice for the municipality of Amsterdam. Especially when considering their ambitious plans regarding the rate at which this heat transition should take place. Furthermore, it has been found that certain collaboration structures are in place with like-minded businesses, making this technical alternative even more attractive. Another promise which increases the appeal of the alternative is that stadswarmte will utilize more sustainable heat sources from 2030 onwards. This claim however

has been identified as a risk for the municipality. As argumentation on the “how” seems to lack. Research on the subject has presented that retrofitting will entail quite the challenge. More “novel” alternatives such as TEO would line up better with the values highlighted throughout the municipality’s vision. However, said alternatives would require untried forms of collaboration which seem too time consuming at this point.

Attributes of community (value laden)
The first major insight gained throughout analysis is that this community is lacking resources. Not only financially, but also when regarding the workloads, staff, time and expertise. As novel legislations will require the municipality to develop processes, especially for required participation, that have been untried up until this point. Even more so when highlighting that said processes do not come with standardized playbooks, they will have to build them from the ground up. Furthermore, this community differs from nests three and four as they are either policymakers or those implementing said policy. They are not nearly as intrinsically connected to the heat transition as those in the nests below. Which entails this transition is approached more so as a business than it being a process laden with emotions or values. This does not mean that the municipality doesn’t operates around certain values. As made clear throughout this thesis, a more practical reality has unfolded itself throughout this nest. Ease of implementation, scalability and pleasing formed partnerships are values that remain dominant. When relating this to Schwartz’s theory, benevolence and universalism lose ground to values as tradition, power (although being “placed or forced” upon this nest) and achievement. Since the municipality is subject to the traditional bureaucratic structure of policymaking and governing. Which in turn has projected this orchestrating role onto them, coming with enhanced power to realize said policy. Which in turn is in line with achievement, as the municipality strives mostly towards reaching their objectives. Transforming neighbourhoods towards natural gas-free households as quickly as possible.

Rules-in-use
As with any municipality, this nest is subject to certain operating structures projected onto them by higher governments. Influencing the ways in which they operate. Furthermore, as parties are voted into council, their operations are also influenced by those voting, the people of Amsterdam. Whilst governments might project more formal rules on operations, reflecting the wishes of the public imposes more informal rules. When discrepancies arise between values projected to the public and values found throughout operations, levels of trust are likely to decline. This phenomenon has been identified throughout nest four.

Beside these “traditional” (in)formal rules in use, for every given situation the municipality operates in, chapter four has identified very relevant rules that will go into effect soon. A short summary highlights the following impacts these new formal rules will entail. First, changes in the gas law will likely allow municipalities legal power to disconnect households from the gas grid. Second, the new heat law 2.0 will grant municipalities the handles to assign “warmtekavels”, neighbourhoods with dedicated transition designs (heat networks) operated by heat companies assigned by municipality. Finally, the new “omgevingswet” or environmental law will make participation throughout transition processes mandatory. Furthermore, it will entail that the municipality has to create its own participation policy. According to which participation processes can be assessed and weighted.

Interactions (value laden)
Within the scope of this research some interaction between with nests three and four has been analysed. It has become clear that the municipality interacts with heat companies and housing corporations. As deduced, these parties share similar goals and can support each other in reaching them. Their needs seem to align with the values most highly regarded by the municipality. However, interaction between the energy commission and the municipality has also taken place. Not only through sharing plans and receiving feedback from the municipality, but also in a more official manner. Namely, applying to certain subsidies for their local energy transition. Even though the visions and goals of both parties appear to differ greatly when regarding the heat transition, positive feedback was given by the municipality. This is partly because such entities are already engaging in participation, a process that will become mandatory for everyone (including municipality). Thus, seeing local entities engage in this process sets foundations for a municipality. A more novel feat of interaction was found during an interview with a member of the municipality. This interview highlighted the start of a new course, as the municipality is shifting its engagement focus towards owners' associations. These novice interactions currently place the municipality in a supporting role, trying to assist owners' associations with their heat transition. As they provide tangible handles for associations to set out their own practical roadmap towards becoming natural gas-free.

Action situation
The action situation that has unfolded itself in this nest is based around the practical reality of the municipality. As mentioned, however progressive the municipalities transition vision might sketch the heat transition, most of this is lost to pragmatic and quicker solutions. Thus, the main action situation within this nest is transforming housing towards natural gas-free neighbourhoods as quickly as possible. Mainly focussing on the achieving the goal of doing so before 2040. Via the coming implementation plans, and with support from (legal) handles, the municipality aims to set this roadmap in stone. This is to be done considering limiting resources. A balance between desired and realistic goals in which stadswarmte prevails, not only dominant through technical qualities but also through organizational factors and stakeholder relationships. This consequently has resulted in a struggle to find engagement and social support from residents. As proclaimed visions are felt lost in said practical reality, trust in this institution appears to be low.

Evaluative criteria (value laden)
The obvious criteria: ease of implementation, scalability, organizational and operational structures have been thoroughly covered throughout this research. However, the analysis has brought to light three other criteria which the municipality holds high. These criteria however have not been prioritized and are slowly developing themselves into barriers. The criteria referred to here are participation, (social) acceptance and sustainability. As mentioned, participation will become an even greater topic through the mandatory policy the municipality will have to instate. Whilst this is practically a given, expertise and handles towards household participation are still lacking. To create the desired (social) acceptance for their implementations plans participation will remain crucial. It is not that the municipality is not aware of this fact, their current course is more so the result of lacking resources and prioritization. The same can be said for sustainability, as one of the main pillars in this heat transition extremely crucial. As pointed out opting for HTDH is surely the less sustainable option, however understandable under the circumstances. Nevertheless, the municipality still wants and must reach certain sustainability targets, which might just become more difficult through their current course.

Outcomes
Thus far, a fast passed roll-out of stadswarmte has been the result of this nests main action situation. This development however has some other consequential outcomes. First, a struggle to engage and create (social) acceptance amongst households on the KNSM-eiland. This outcome stems from the tension field between households presented as crucial and final decision-makers and the municipality developing implementation plans. Created through the directing role the municipality has been assigned within this transition. A large responsibility, having to achieve this feat with less than desired resources. In turn households feel unheard, especially since they were proclaimed to be final decision-makers for their own heat transition. Homeowners and tenants alike do not want to be forced onto a certain alternative, nor do they feel the urgency the municipality feels at this stage. Whilst households might not have a (legal) reason to stop the municipality from deciding which alternative is best suited for them, the municipality in turn might not want to force all decision-making and lose (social) support for their plans.

7.2 Artifact design

Throughout the operationalization of the IAD framework certain insights regarding participation have been brought to light. To not only adopt insights found, but to also put them into practise, an artefact has been designed during the analysis. According to Correljé & Künneke (2020) artifacts constitute certain structures within nested socio-technical systems. Artifacts can be tangible as well as intangible, comprising of different technical and institutional features reaching from social conventions to technological solutions (Correljé & Künneke, 2020). As artifacts can structure and support human behavioral processes this thesis will present an artifact in the form of an infographic, with the aim to support participation processes throughout nests two, three and four.

First, through simplistic presentation it aims to quickly inform all types of locals, without any prior knowledge required. Information included within the infographic is mostly based on knowledge acquired by using the IAD framework. Furthermore, the analysis has brought insights into which information packages to prioritize, to find truly “relevant” information for all those engaged. Its target is to create a more equal playing field in which knowledge levels of those participating match up. Secondly, it aims to steer conversation or discussion towards the essential elements of choices faced, mitigating technocratic pitfalls. Finally, it seeks to inform households in such a manner that engagement and urgency is stimulated.

The infographic has been utilized as a tool throughout analysis on nests three and four. As can be found in the annex summaries relating to both nests, the artefact has been received with positive comments. In nest three is has evolved from an information dense flowchart towards a compact and pure infographic. Constant feedback from frontrunners in this nest was utilized to further develop the infographic, as its development can be found in annex G. Eventually those initiating engagement within this nest found it to be a very valuable tool. As it has been published on several websites, in the local newspaper and through subscription-based newsletters. It will even be printed on a leaflet, delivered to household mailboxes on the KNSM-eiland and utilized in a subsidy application. Finally, it has been used as a tool to quickly sketch the current processes the energy commission has gone through in communication with the municipality, also receiving positive feedback from this nest.

Participation with nest four presented the chance for the infographic to be utilized first hand. Not only did households find the artefact to be very insightful through its simplicity, it supported conversation towards deeper insights. Especially when engaging with those that portray lesser interest or knowledge in the heat transition, it has been a tool from which conversation could further evolve. The infographic is presented below in figure 22, as it is in annex G5. First this infographic was designed specifically for the KNSM-eiland. Later, it was concluded that it is relevant to the whole area of the Oosterlijk Havengebied in Amsterdam.

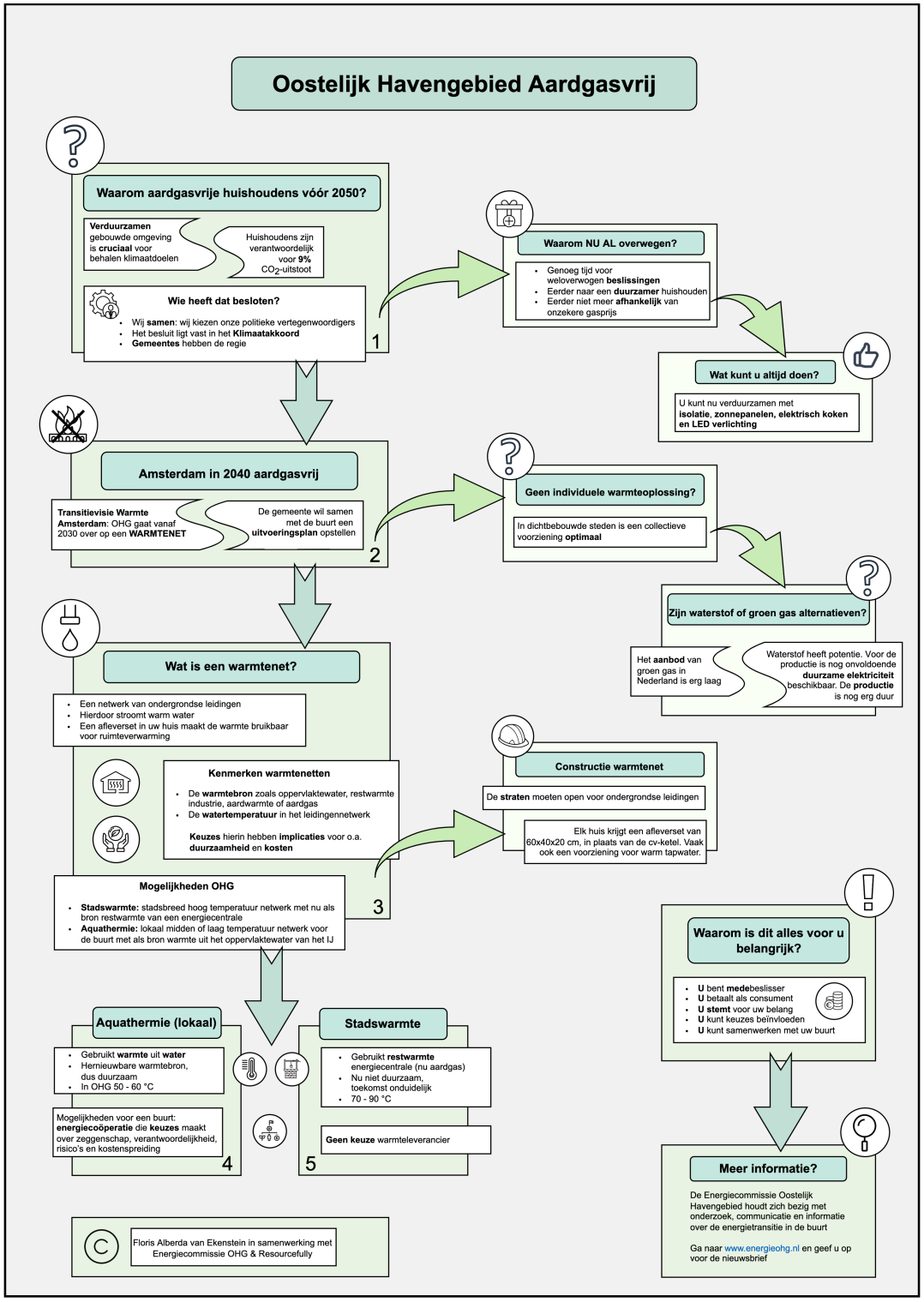

Figure 22: Infographic Oostelijk Havengebied natural gas-free

7.3 Conclusion

This section will first conclude on the operationalization of the framework per nest. Starting off with key insights gained in nest three. Followed by conclusions on nest four and ending with verdicts of the analysis on a municipal plane. Finally, these insights gained will be used towards answering sub research question 6.

Local collective entities
Regarding nest three, the following conclusions can be drawn. First, it has become clear that finding the right process to communication is a challenge, especially with so many diverse stakeholders involved. As pitfalls to open participation unfold itself, the challenge lies in presenting the right package of information at the right time. Not only to steer away from technocratic pitfalls, but also to attract those dubbed the silent majority, to create social acceptance. Starting off by taking a step back could be very useful. Basing the process towards participation around the bare bones of the matter, through questions or thoughts such as:

- Why do we need to discuss this transition now?
- Why are certain choices being made? Which choices are we facing? What choices will still present itself?
- What can we influence as a community?
- Are we starting off on the same page? As a community but more so as an entity engaging the community
- Start engagement through topics that can be discussed, for which more information is not “truly” required at a certain time
    - What is relevant? For those engaging as well as those receiving
    - What is tangible?

Use these thoughts as initial pillars towards participation, as it will help to keep information and conversation away from going too in-depth (technically, financially etc.) too quickly. Furthermore, this will aid in uncovering local stances, values and forming tailor-made approaches to further participation. As local preferences might become clearer, tangible barriers can be brought to light. The same goes for the utilization of the artifact as presented in chapter 6.2. It has shown that an infographic of sorts can help to keep participation away from pitfalls whilst enabling a more level playing field from which discussions benefit. Second, factors such as demarcation and responsibility should not be underestimated. Not only regarding the consequences of choices for certain technological solutions, but also those of leadings roles within this transition and a further delineation within the neighbourhood. As priorities and qualities of buildings can vary to great amounts. This will aid in a negotiation though the observed tension field of choices made by local experts versus choices made by the community collectively. Finally, utilizing these handles will allow for a more optimal continuation of work. As it will help uncover stances and values of those involved and work towards requirements for future research (viability studies amongst others). Mitigating the risk of investing resources into detailed work too early in the process, ending up with unwanted or unnecessary information.

Households
When circling back to the analysis on the plane of households, the following conclusions can be drawn. First, homeowners will engage in decision-making once they feel that there is a need to. At that point they will require a (scientific) package of information to compare all alternatives.

Alternatives not considered are to be argued for. Once this is available costs, sustainability, comfort, reliability, future proofness and organizational freedom will be weighed. Then it is of importance for homeowners that decision-making is done in a democratic manner, through their owners' association. The process of gathering information and leading their transition is trusted with local initiatives. If they prove themselves capable experts. Tenants are not that concerned with comparing "hard" data on technical alternatives, as they are generally more guided by values relating to (social) fairness, independence of natural gas and social acceptance. Of course, costs do play a part. However, the main (direct) investments lie with the housing corporation, so these weigh less heavy compared to homeowners. The only perceived issue with the evaluative criteria of tenants is the fact that tenants do not truly feel as if they have a say in decision-making. Tenants engaged often "accept" the fact that their housing corporation is the first and final decision maker. Thus, they will easier accept courses of action set out by their housing corporation.

However, currently most homeowners and tenants do not feel any urgency towards their heat transition. Unless faced by very tangible and time sensitive problems such as FGO replacement, most participants see the transition becoming relevant in 10 to 15 years. This entails that their course of action, up until a few years shy of this expectancy, will be to remain utilizing natural gas. Argumentation purely based on pro-environmental or geo-political issues does not seem to be enough to kickstart urgency and thus engagement. A practical and tangible catalyst is required to involve this silent majority in the decision-making surrounding their heat transition. This can be supported by redesigning the current process of participation. Again, steering away from pure (in-depth) information supplies and focussing more on the essence of participation. Including in this redesign a more informal approach towards the silent majority. Households might not realize that their current stance is a delicate one, as municipalities gain more handles to orchestrate neighbourhood transitions. Households should thus be motivated to engage sooner than later, since they will still be able to influence the course of their transition. This is especially important due to the perceived tension field between the leading role of municipalities and local distrust towards this entity.

The municipality

This tension field is equally observed in the operationalization within the second nest. Stemming from the fast-paced and "forced" roll-out of stadswarmte in neighbourhoods throughout Amsterdam. This choice can be seen as the result of the directing role the municipality has been assigned to within this transition. Consequently, the municipality has mainly directed its focus on achieving targets set-out, ensuring that Amsterdam is natural gas-free before 2040. Stadswarmte seems to best suit this process as it contains qualities sought after by the municipality whilst allowing for bonds made to be honoured. Furthermore, it is less demanding of the already lacking resources the municipality has at its disposal. Within this plane of analysis, the tension field has unfolded itself in a struggle to engage and create (social) acceptance amongst households on the KNSM-eiland, as trust is low. Households feel unheard, especially since they were proclaimed to be final decision-makers for their own heat transition. They value their decision-making structures dearly, so besides feeling unheard they surely do not want to be forced onto alternatives. However, developing legal handles, through new laws discussed, might leave households without a choice. This phenomenon is predicted not to benefit the municipality, as forcing all decision-making could entail even less (social) support for their plans. Thus, within this plane a shift in focus should take place, a shift towards suppressed criteria and values that do exist within municipal processes. A start is being made through shifting participation towards owners' associations. This however is only a step in the

right direction, as households still seem to have little trust in the municipality. (social) Acceptance of the implementation plans is to be enlarged through other forms of participation, which will be highlighted in the final section of this conclusion. This will also help with the final pilar in this transition that deserves more focus, sustainability. A focus away from standardization and towards novel collaboration with local initiates is advised. Finally, as for sustainability, it has become clear that more research is required into the retrofitting of stadswarmte. Claiming this technology will simply be more sustainable in 2030, without further expounding said process, is not enough. As academic research has pointed out several barriers which make this process much more complex than it is currently portrayed. In doing so, the implications of said retrofitting for households, financially and otherwise, should be entangled. Since tenants currently are persuaded by this claim, problems will arise if retrofitting does not live up to its simplistic expectations in 2030.

7.3.1 Recommendations

Now this research can turn towards concluding on sub research question six:

How should participation approaches be designed once supported by the IAD framework?

Though the operationalization of the IAD framework across multiple planes of the heat transition on the KNSM-eiland the following advice can be presented. When considering the process of participation, nest consistency is key. In other words, there is a need to seek alignment between the plane's operating within the complex setting of a neighbourhood heat transition. It has become clear that the dynamic relationships between nests can be utilized in a way that would benefit all parties involved. As stakeholder stances, values and needs might differ greatly, a design is identified which could help satisfy those involved. This design is portrayed in figure 23.

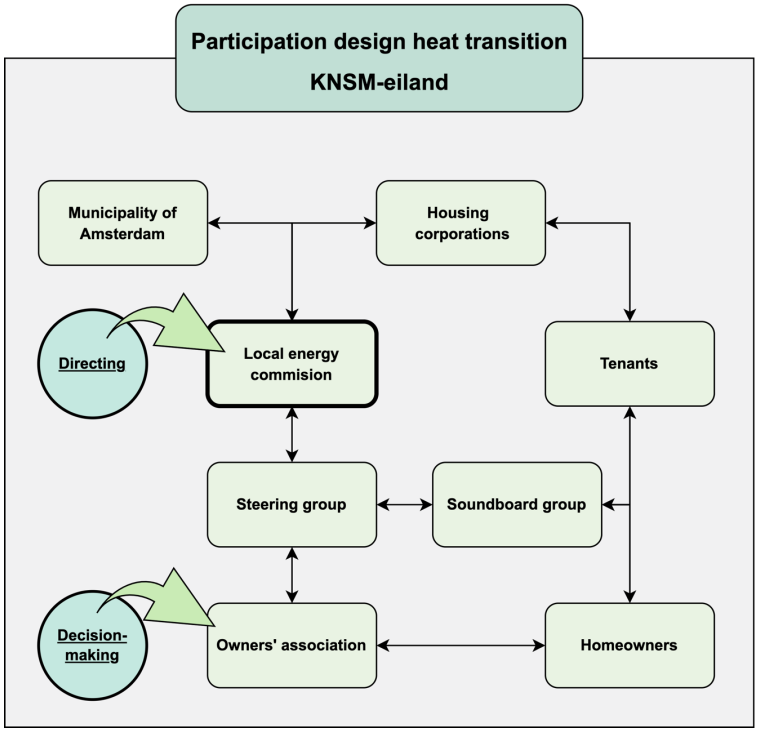

Figure 23: Participation design stemming from framework operationalization for the KNSM-eiland

The first reasoning behind this design is that it utilizes not only desired states of collaboration, but also current processes in which stakeholders have pronounced their trust. Let us start at the heart of this design, the energy commission. A group of professional frontrunners that aims to realize a heat transition best suited to the inhabitants of its neighbourhood. As they seek to create a tailor-made implementation plan, constructed through constant participation with locals, it falls in line with wishes from the municipal plane. However, as concluded, the municipality itself lacks means to perform such a detail local process at this time. Close collaboration between the municipality and the energy commission can thus benefit the municipality greatly, tackling barriers they face at this point. If the energy commission is positioned as the orchestrator of this local transition, supported and overseen by the municipality, benefits are also identified for the energy commission itself. As they will not have to compete with standardized municipal designs backed by legal handles. Furthermore, communication regarding subsidies or other forms of support will potentially be arranged more effective.

Positioning the energy commission in the centre of this design tackles another barrier identified, namely that of trust. Households lack trust in municipalities and require prove of competence from local initiatives. With the municipality backing the local initiative more expertise can be brought in quicker. Alongside the fact that the local initiative will still have to reaffirm their competence towards households, this structure is likely to enjoy most local trust. Another design factor that would be in line with the value forms pronounced, is the continuing utilization of the steering group. A collective of different owners' association representatives acting as a (communicative) middlemen of sorts. Since homeowners value the democratic decision-making nature of their association greatly, decision from and proposals to (between homeowners and the architects of the transition) can be aligned by this group of representatives. This would still leave final decisions of homeowners within their association, whilst this steering group can most easily align homeowner stances with heat transition proposals.

Ensuring values from tenants are met is realized through a closer collaboration between energy commission and housing corporations. If corporations would allow the commission to take "lead", sustainability and trust values are met for tenants. As they currently feel in a position lacking decision-making power but do entrust the design of their heat transition to local initiatives. This would also tackle a barrier for corporations regarding tailor-made local solutions. As the proposals, if viable, will be designed by the energy commission. Another way in which tenants and homeowners alike can be voiced is through the construction of a soundboard group. A collective of KNSM-eiland residents, without conditions as to knowledge levels and sorts. This collective would be in contact with the steering group to voice possible concerns or enthusiasm before feedback is delivered to the energy commission. As noticed through the interview with a municipal professional, the construction of such a soundboard group can be extremely beneficial to the participation process on a neighbourhood level. Finally, this design still allows the municipality and housing corporations to work tightly together, enabling them to voice shared opinion to the central entity at any time.

8

Discussion and Conclusion

This thesis has set out to support decision-making processes throughout the Dutch urban heat transition. To achieve this feat, a contextual interpretation of the IAD framework has led to the novel design of a value laden and nested iteration on the work of Ostrom. A framework in which decision-making through participation stands central. This framework has been operationalized within the context of a Dutch neighbourhood heat transition, through the case study of the KNSM-eiland. An analysis which has led to various omnipresent and contextual insights. A process which has allowed this research to answer sub research questions set out.

This chapter will first reflect on the research done throughout this thesis. It aims to do so via a critical discussion on the interpretation of results and the significance of the research in its context. The discussion will lead up towards answering sub research question 7, *how does the value laden IAD framework perform within the context of this research?* The second half of this chapter will provide structured insights towards a conclusion on the main research question of this thesis:

"How can decision-making throughout urban heat transitions of Dutch neighbourhoods be guided?"

8.1 Discussion

This section will provide a critical discussion on the interpretation and significance of findings presented. First, this section reviews the research results gained through the utilization of the framework. Reflecting on case-related performance in comparison to academic theory. The discussion here structured in such a fashion that it will answer sub research question 7, *how does the value laden IAD framework perform within the context of this research?* Secondly, a section dedicated to the implication of the results is presented, delineated between practical implications for both policymakers and local initiatives. Finally, this section concludes on the limitations of this research.

8.1.1 Reflection on the results

Before reflecting, it is important to review against which scientific foundations the results must be held. This research first set out to uncover the pitfalls of traditional participation and the requirements for novel participation. Chapter two has presented key insights into the matter. Secondly, chapter three set out to argue that a nested IAD framework is fit for the purpose of acting as a toolkit towards novel participation within the context of a local heat transition. This chapter concluded that, theoretically, the IAD framework is fit for this specific purpose. An important annotation here is that meeting certain requirement is dependent on the interpretation by its user. As the IAD framework remains a more general tool to help reduce the complexity of decision-making. Outcomes remain depend on the way an operator utilizes the toolkit. Therefore, different researchers could find different results when analysing the

same socio-technical system. There is not one correct way of using it, which is to be kept in mind when reviewing the results. Furthermore, this chapter identified that the framework could be enhanced through value theory during operationalization. As this is proclaimed to be beneficial for its use when aiming to enhance decision-making through participation.

Comparing participation theory to practise

Throughout nest three of the analysis participation approaches are designed and implemented. In both nests three and four the results of said participation have been analysed. It was found that mainly the local initiative embraces participation and is actively engaged with the concept. Furthermore, this research was able to quickly identify pillars of traditional participation, as it consisted mostly of open or invited participation through informational meetings. The consequential results of this participation process can be compared to pitfalls identified in literature. The first pitfall has been found in practise, as values other than technocratic, tend to be neglected. Leading to the so-called technocratic pitfall, where engagement seems to be dominated by discussion on in-depth technical or financial data. These discussions have been proven to be far from fruitful, as concrete answers are hardly available throughout this stage of participation. This has manifested itself in engagement centred around questions or statements that take discussions beyond useful insights. As he said, she said, engagement at this point does not lead anywhere. Of course, the basis for said technocratic discussion has highlighted criteria and stances valued by those participating. Providing useful insights into what is deemed important by those attending. Thus, stating that this should be completely mitigated is unadvised. As this too could lead to a “boomerang effect” identified in theory.

Engagement throughout nest four, supported by the operationalization of the IAD framework, resulted in a more institutional and value-based focus. As participation here has led to insights regarding trust, motivation, urgency and evaluative criteria. Thus, once participation is steered towards “forgotten” values, different insights indeed are found. This does not mean that technocratic arguments however are not less important, as mentioned it is all about a balance. In contrast to theory this research would argue that both inserts to participation are useful and required. Although the technocratic discussion is arguably easier to engage in once the participation process has evolved towards more concrete decision-making. Within the scope of this analysis local publics do not seem to be forgotten, however this pitfall is better reflected through an identified silent majority being left out. As theory is more focussed on processes on a grander policymaking frame, the utilization of a nested IAD framework has brought forth that indeed a silent majority is not involved in participation processes. This is especially reflected through the fact that only those intrinsically motivated attend nest three, observing a majority of nest four to remain unengaged. Again, information packed approaches to engagement will not work with this group, as found through the analysis on nest four.

The approach taken within this research has proven to be fruitful. A major annotation to be made here is that one does not “simply” engage with the silent majority. It is helpful to know those participating do not represent the entire neighbourhood. But including this silent majority is extremely intensive and time consuming, thus for practical applications by local initiatives less preferred. This ties in with ethical connotations that should be considered. Again, theory concludes that these factors tend to be overlooked during traditional participation. This research agrees with this notion, especially through compliance, validity and difference in knowledge levels. These factors do directly relate to the silent majority missing out on participation. As entities tend to base decision-making on the stances of those involved. The difficulty with this is again the struggle to involve all those that are not motivated. Should

decision-making be delayed or stalled since not everyone can or wants to be involved? Again, a balance should be struck, practise is not as black and white as theory desires it to be.

A point which can be improved upon is the ethical connotation of background and knowledge. Within the case study neighbourhood, a high percentage of academics was involved. This has led to those enjoying lesser upfront information or insights to feel uncomfortable asking questions or attending. Steering participation away from in-depth information and more towards its bare bones has proven to be very useful regarding this connotation. A final major ethical connotation is reflected in the tension field omnipresent throughout the analysis. Namely that of a municipality being placed as director of local neighbourhood transitions, soon backed through legal handles, versus the households that have been portrayed as final decision-makers. Is it fair to "force" households onto technological solutions which they might not prefer? The practical reality however highlights a counter question; can the transition be achieved within the timeframe set without such major top-down decision-making?

An enhanced IAD framework, fit for purpose

Now for a reflection on academic conclusions throughout chapter three. Was the IAD framework able to satisfy requirements from theory, and did they prove to be of value? Throughout this reflection sub research question 7, *how does the value laden IAD framework perform within the context of this research?*, is mainly answered. As limitations of this research will provide the remaining context for this question.

First, namely technocratic pitfalls have been identified in traditional participation observed. The utilization of the IAD framework has resulted in insights to help steer away from this notion, especially through the infographic and a more casual approach to participation (engaging on the streets). This has provided the research with insights otherwise left unobtained. So, theory has been useful in practise. Of course, one could argue that this has not per se been the direct result of using the IAD framework. Realistically, there would be many ways to uncover said insights. However, the goal has never been to prove that the IAD framework provides the "one" solution towards supporting participation and decision-making. Secondly, through the nested structure of the IAD framework, including the value focus, participation has been "relieved" from stereotypes. Relieved is concluded in brackets since the nested structure has allowed the analysis to look beyond the spheres in which participation is currently most dominant. As a broader view has entailed insights gained from those who's stances that might have otherwise been assumed. Stereotypes such as NIMBY did not exist within this case to begin with, again since theory stems from a higher-level perspective than a neighbourhood level analysis. So, is relieving stereotypes relevant on this level of analysis? The research would argue that it is more so beneficial to ensure all layers of a neighbourhood are analysed.

Now, a requirement that prescribes a focus on tangible and contextual barriers. People develop "true" urgency when barriers hit this close to home. However, these barriers must be uncovered first. Thus thirdly, in practise this prerequisite entails research into potential or upcoming barriers first, after which they can be utilized. Another potential issue with this very potent requirement is that there won't be such tangible barriers available all the time. Reflecting on a complex in which the FGO's have recently been upgraded, entailing a new life span of 10 to 15 years. If the timeframe of the need to transition falls before this, households will be reluctant to engage since it would entail financial losses. A valuable tool in the overall toolkit, but not always as applicable. Fourth, thoroughly understanding decisions to be made. This theoretical criterion has presented the research to fully utilize the IAD framework. And this has proven to

be very useful. As the analysis found that action situations at hand, throughout different nests, are out of alignment. Acting on either one alone proves to entail resistance from other nests, entailing counter effective processes. Fifth, embracing social conflict. Technocratic discussions are to be mitigated beyond a certain point, there is no use in completely embracing them. Once values have been extracted, they should be avoided until actual answers can be given and the discussions can be concluded. Households not wanting to be engaged now are difficult to embrace. One can only try so hard to create urgency at a given point in time. This research has recommended steps to increase urgency however, although it is not argued that this entails embracing a lack of urgency. As it is more the result of different qualities of the analysis.

Finally, value-enhancement through the value theory of Schwartz has proven to be partly effective. Mostly due to its generic nature, linking well with the design of the IAD framework. As the researcher was able to qualitatively link values to household behaviour. These values then ended up matching with indicators from theory. Furthermore, including this in the lens through which the transition is analysed forced the user to regard for these factors. However, the IAD framework has led to participation that was necessarily casual. This resulted in a mismatch or even aversion towards the more quantitative SSVS. As it consequently was too complex for those participating to grasp or value. To prove its full potential, a supporting quantitative analysis through the SSVS is required. As will be further discussed in 8.2.3.

8.1.2 Implication of the results

Implications for policymakers
Let us start by reviewing the implication of the main ethical connotation presented. Namely that of the power position in which policymakers are placed. On a national plane, this connotation has entailed that, even though households are made out to be final decisionmakers and of the utmost importance, municipalities are being granted more and more capabilities to control local heat transitions. Which results in households feeling unheard or powerless, leading to lower trust towards not only national government but municipalities. Even though said municipalities cannot directly influence the targets and handles provided. Making it harder to find engagement and (social) acceptance for their implementation plans. Calls from society to adjust future legislation are reaffirmed throughout this research and should not be taken lightly by policymakers. Furthermore, municipals inadequate resources are expected to lead to an inability to develop tailor-made plans for neighbourhoods. Resulting in the fact that municipalities will have to utilize turn-key technical solutions to meet heat goals. Again, a process which will be received with decreasing trust and little acceptance. The results of chapter 7 do come with recommendations that could help battle this catch 22, however this would also have great implications for policymakers. As municipalities would have to redesign their role within the heat transition where possible.

If local initiatives are engaged with their transition, like those found in the case study, the municipality could benefit from taking on a more supervising and supporting role. This would entail that municipalities are going to have to grant said initiatives the trust and support needed to realise their transition. Of course, there are many risks involved with the strategy, as hefty responsibilities are redistributed. Municipalities will still want to achieve goals set out, whilst the goals can only be met if local parties realize their transition in an acceptable and timely fashion. Thus, municipalities will have to take on a more “project management” role within neighbourhood transitions. However, since transition visions are already made, and implementation plans are underway, the question arises if this is viable and even wanted for

municipalities. It is argued that these visions are general enough so that they can act as supporting plans. Again, the designed approach of chapter 7 is not feasible nor even desired for each neighbourhood. If possible, the construct or idea is one that should at least be considered to mitigate barriers faced by the municipality of Amsterdam.

A final implication for policymakers is that handles can be provided when it comes to mandatory participation policy. It is concluded that leaving this process undefined will not lead to participation processes as desired. It will most likely result in traditional approaches unsatisfying wishes from communities, leaving potential unturned and again resulting in resistance. This research has provided a toolkit towards supporting the design of engagement in such a manner that is can be apply to various cases. Of course, outcomes will differ every time. Fortunately, this is in line with the need for tailor-made approaches to each local heat transition.

Implications for local initiatives

The first major implication for local initiatives, when relating to the case study utilized, is that traditional participation methods are unequipped to satisfy the needs of those sought to engage. Furthermore, it results in inefficiencies that end up costing said initiatives more resources than necessary. Even before engaging, an entity should make sure that they are on the same page, conveying one shared vision. Then, the approach to participation should start of at its bare bones, as presented in chapter 6. Mitigating technocratic pitfall, not wanting them to become dominant in the process. This can be supported by the design of an artefact, as this research has done through an infographic. Although the main thought behind the artefact can be recycled, the utilization of the IAD framework has brought forth the key parts which should be included. Thus, a local entity will require the capabilities to go through a similar process, supported by the IAD framework or tools alike, to find the most relevant factors for their community to display. As initiatives will not always poses resources required, there is a risk of producing an artefact entailing adverse effects.

Redesigning participation to be more suited for novel requirements has another major implication. Namely it being much more time and labour intensive than traditional approaches. Reviewing the advised approach for this thesis' case study, new structures to the neighbourhood transition are called for. Placing the local initiative in the centre of it all, leaving them to navigate more constructs of local publics then before. Even before frontrunners can be placed at the handles of their transition, their competence must be translated towards households for them to gain trust. This is crucial as otherwise they will face similar barriers the municipality is facing. Furthermore, the design assumes that constructs such as the soundboard are possible. In reality, this hinges on the availability of volunteers wanting to dedicate their spare time towards this process. Which will entail convincing households with lower intrinsic motivation to help. Furthermore, it should reflect the neighbourhood's demographics.

Even if the proposed design towards future participation and decision-making is not adapted, changing participation itself is time consuming. Engagement in a more open manner (as utilized in this research) is inherently more intensive than traditional approaches. Simply going door-to-door is extremely time consuming and perhaps not viable considering resources. Reaching out to the silent majority will always entail more work. The practical implications of this research will therefore always require a balance between what is desired and what is achievable given available resources.

8.1.3 Research limitations

Reservations should be placed on the weight of conclusions and further generalization across other cases. Let us first examine the foundation for this research, the IAD framework. As this tool is quite generic, its goal is to provide the researcher with a lens through which such a complex socio-technical system can be analysed. This qualitative attribute entails that various research, utilizing the same method on the same case, might very well differ significantly in outcomes. It must be made clear that the IAD framework does not pose to present ready-made solutions, it has more so supported this research in breaking down complexity and gaining tangible insights. Again, these insights are dominantly qualitative and thus hinge on the researcher's interpretation. Secondly, the value enhanced aspect to the IAD framework was supposed to deliver a more quantitative side to this research. Unfortunately, as mentioned, the utilization of the SSVS was no fit in combination with the chosen participation approach amongst households. The theory was still implemented, only now the results were dependant on the qualitative interpretation by the researcher. However, once results were compared to theory matches were found. Nevertheless, a quantitative analysis supporting these findings would have given the results more weight. Third, results have been presented on the second nest, concerning the municipality. Even though the IAD framework has been utilized to gather insights on this nest, its operationalization has been minimal in comparison to nests three and four. As the scope of this research let its focus onto households and their decision-making entities. Thus, generalized conclusion on the municipal plane are also to be taken with caution.

When regarding the analysis and results on nests three and four, critical annotations also apply. When isolating results presented on the third nest, it is of importance to note that these results are mostly based on 11 meetings or engagement forms otherwise (see annex D). These moments have all been initiated or cared for by the local initiative of frontrunners. Whilst in close contact, the researcher has remained as objective to observations and feedback as possible. On top of this, meetings have been conducted in a specific time frame. Thus, the results are based on this time frame of engagement. This does not entail that results found are invalid or only applicable for some time, it does however mean that insights found will not be able to cover the complete spectrum of engagement that has been taking place. Trends that have been identified over most interactions can and are generalized within this thesis. Serving as foundations for recommendations and conclusions. Furthermore, it does not mean that processes engaged in are counterproductive or unwanted, as the frontrunners within this nest have done an amazing job thus far. As with anything, such processes take time, trial and error. Finally, the operationalization of nest four is based around 13 interviews. Again, too little to generalize findings over an entire neighbourhood, let alone for each neighbourhood in heat transition. As with the analysis on the third nest, only those results on which clear consensus was observed can be generalized. But even then, with n=13 whilst the neighbourhood has 2390 inhabitants, these outcomes are not to be set in stone. Preferably, more interviews would have been conducted. However, time constraints and the labour-intensive nature to the approach have prevented this. In the next and final chapter these limitations will be translated into suggestions for further research. So that insights found can be further strengthened or placed into perspective.

8.2 Conclusion

This thesis set out to support decision-making processes throughout the Dutch urban heat transition. Over the last few years, calls from both academic literature and practise have emerged stating that participation throughout these processes is of utmost importance. Not only to gain acceptance for implementation plans in the making, but also to create a deeper comprehension of household's values, stances and their role within their transition. As locals have been deemed key decision-makers, once's that should be supported by policymakers. Inherently the qualities of participation should thus ensure a more optimal decision-making process towards a smooth roll-out of neighbourhood heat transitions. The problem identified however is that policymakers lack a comprehensive set of tools to engage in participation, better understand their stakeholders and thus better enable their decision-making within the local context of a neighbourhood transition. And so, the following and subsequent main research question remains:

"How can decision-making throughout urban heat transitions of Dutch neighbourhoods be guided?"

8.2.1 Supporting neighbourhoods in the Dutch urban heat transition

This thesis aimed to answer the main research question by first assessing state-of-the-art literature surrounding the concept of participation. Uncovering not only the potential benefit of the concept, but common pitfalls in traditional approaches and requirements for novel designs to engagement. Secondly, a framework was proposed to act as a toolkit towards novel practises of participation. This framework, the IAD framework, was reviewed against alternatives, enhanced through theory and uphold to prerequisites of novel participation. Third, to operationalize this framework inputs throughout four dimensions of analysis were collected. As this toolkit led to an analysis of not only national policy, municipal effectuation of policy and technology, but also to key attributes on a local collective (neighbourhood) and household level. Then, engagement through focus groups and interviews were used to complete data required. As the toolkit could be operationalized with a strong focus on participation, households and decision-making in the neighbourhood heat transition.

Participation
Traditional participation approaches are characterised through top-down informational meetings, being either open or invited of nature. In order to let engagement lead to a better understanding of the local context, and thus to better decision-making, participation processes should avoid pitfalls of traditional designs. Especially, when comparing theory to results from practise, it was found that decision-making should not be based on purely those attending traditional participation. As throughout these processes values are underrepresented. Furthermore, only those with strong opinions, through intrinsic motivation, attend such engagement. Resulting in a very influential silent majority being left out of decision-making. Which entails risks of decontextualizing the local stances leadings to decision-making based on assumptions which do not represent the values and stances of the neighbourhood. It is found critical to understand the decisions at hand, across all four nests of analysis identified. As this brings forth the vastly different expectations and stances that prevail throughout a neighbourhood. Once expectations and value-laden stances of different decision-makers have been brought to light, their contextual and direct barriers can be identified. This supports participation towards a process which allows for the silent majority to be at least considered.

From which processes can be designed to further include this silent majority, however labour intensive this might be. Finally, it can be concluded that the technocratic pitfall can be used as an indicator for traditional participation. A pitfall that was found too quickly dominate engagement, in line with theory one that should be avoided. But in contrast to theory, only after the values at the basis of these discussions have been extracted. As these do indicate the priorities of intrinsically motivated households.

Framework design

To adhere to the requirements for novel participation as identified, the IAD framework has been deployed. Not because the IAD framework pertains to offer "the" solution, but to research if this tool can uncover novel engagement designs and help steer decision-making of neighbourhood heat transitions. As the IAD framework offers a lens to dissect decision-making in complex socio-technical systems. To ensure that values aren't neglected, and that decision-making is based on more than insights from those willing to attend traditional participation, a novel nested and value laden design of the toolkit is presented. This design falls in line with the four planes of analysis identified, as can be seen in figure 24.

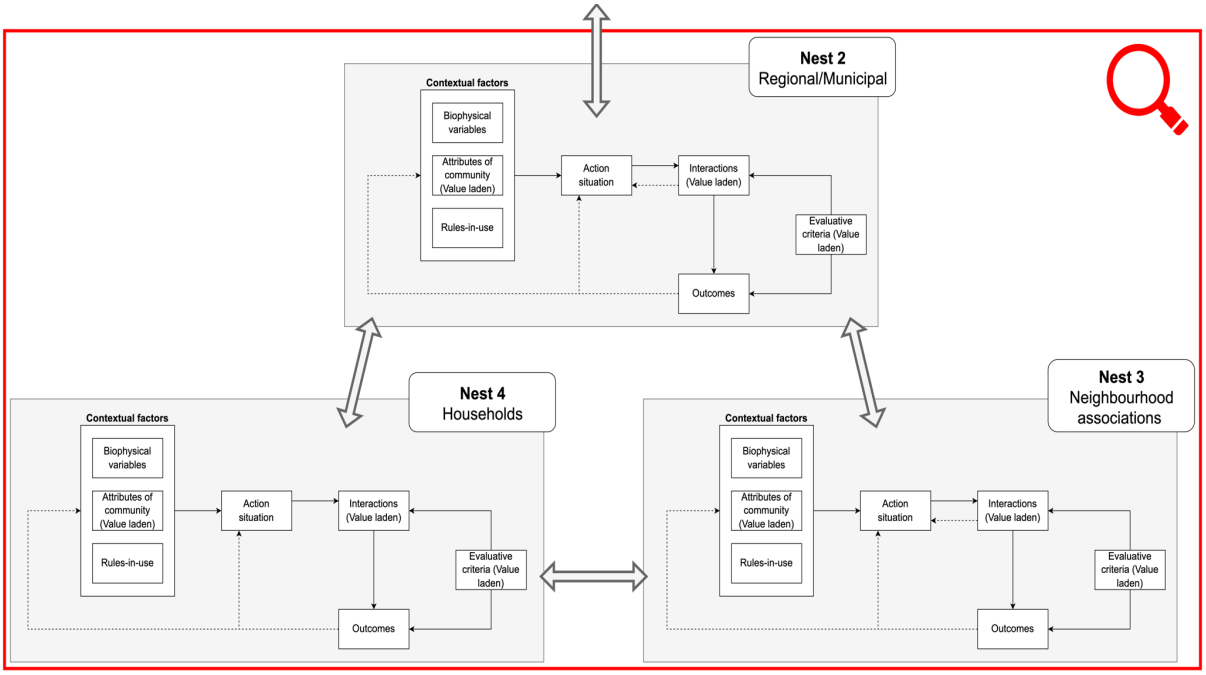

Figure 24: The design of the nested and value laden IAD framework specific to the context of this research

Tension fields arising throughout the urban heat transition

Research on input variables has brought forth important tension fields at play. The first of which is the ways in which both municipalities as households are placed within this transition. Households are acclaimed to be crucial decision-makers, indispensable to a successful transition. However, municipalities are designated orchestrators of neighbourhood transitions, gaining powerful (legal) handles in years to come. This field finds its fruition in the tension between technological alternatives. Within urban neighbourhoods, current technologies mainly offer two alternatives within the heat transition; high temperature district heating (stadswarmte) or low temperature district heating (for instance TEO). Stadswarmte presents an easier to implement solutions whilst TEO clearly enjoys more sustainable and local qualities. Furthermore, questions are be raised as to the sustainability and long-term viability of stadswarmte. This is where the inherent qualities become pillars for friction. As local initiatives

and households might prefer the more sustainable and controllable solution, municipalities seem to prefer stadswarmte. Not only through deals with made with housing corporations and utility companies, but for its ease-to-implement properties. And whilst homeowners where initially placed as foremost decision-makers, municipalities are granted legal handles to become final decision-makers for neighbourhoods. Wanting to achieve transition targets, a major roll-out of stadswarmte has become preferable since they lack resources to invest in tailor-made solutions for each neighbourhood. Leaving households feeling frustrated due to their previous placement as key decision-makers, and especially forced since it concerns their own housing. Thus, a desired image of local heat transitions is starting to clash with a very practical reality.

Local insights

Which has become clearly visible once the IAD framework was operationalized across the scoped three nests of analysis on the KNSM-eiland. As goals, criteria, values and decisions to be made misaligned over all levels of analysis. Again, the municipality favours a fast-paced roll-out of a solution that can be standardized, utilizing their close relations to housing corporations and heat companies. The local initiative however aims for a tailored sustainable alternative which embraces qualities true to their neighbourhood; TEO. As they wish to realize this transition through participation and acceptance. With their impressive technical research, they have however encountered pitfalls to the more traditional approach of their engagement. As clearly technocratic debate takes the stage during engagement. When aiming to reach the local public they are struggling to engage with, it is advised to bring participation back to its bare bones. Handles presented to do so have also been utilized for the operationalization on a household level. Through an infographic the knowledge playing field is levelled, as those without intrinsic motivation have been engaged. Leading to insights case specific as to why this observed silent majority does not currently care for their transition as much as other nests. Purely technocratic and sustainable arguments are found to be insufficient in creating urgency and thus participation. As for most this transition is not yet relevant. Only when confronted with tangible and practical problems as FGO replacement, households seem much more willing to engage. Furthermore, the omnipresent tension fields presented above have emerged in a lack of trust towards the municipality and their partners. As households fear of being the victim of top-down decision-making. Households prefer local initiatives to guide their transition, on the condition of them proving their expertise. Finally, homeowners highly value the democratic nature of decision-making through their owners' associations. Whereas tenants argue themselves to be in a more powerless position, subject to their housing corporations.

Tailored engagement design

These insights have resulted in a proposed design to future participation and decision-making across this neighbourhood. Utilizing value structures and goals deemed important per nest analysed, harmonizing former misalignment. This design, generated through the utilization of the iterated IAD framework, is thus specific to the KNSM-eiland and presented in figure 25.

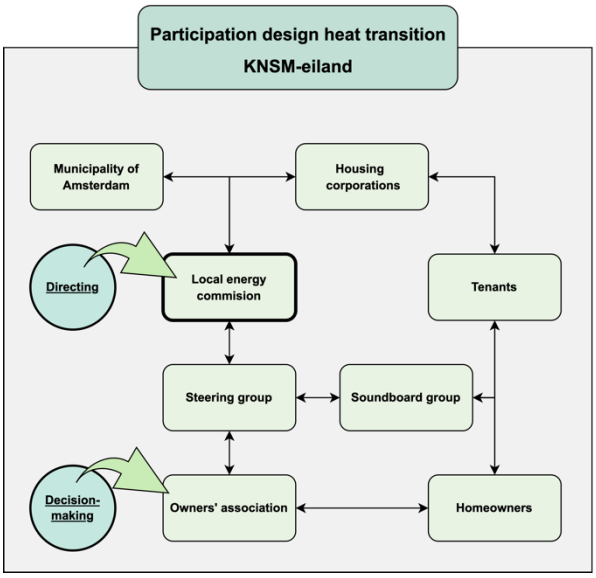

Figure 25: Recommended participation design specific to the KNSM-eiland

Central to this design is a shift in responsibilities and functions, as the local energy commission is now placed as director. Not only because stances and values of this local entity better match those of households, but also since they have already engaged in participation with their neighbourhood. Although pitfalls of traditional participation have been identified, their goals have recently shifted towards creating momentum and support, especially amongst the noted silent majority. They wish to mitigate future decontextualization based on the opinions of only those currently intrinsically motivated. Another major connotation is that this commission enjoys the most trust from the neighbourhood, as trust in the municipality is low. The design however does accounts for the needs and values of the municipality of Amsterdam. As their current lock-in does not allow for detailed and tailor-made plans, whilst they would prefer to do so. Taking a project management role allows the municipality to support their vision without having to dedicate to many resources. Furthermore, they won't be put in a position in which they might have to force decisions on households and thereby face increasing resistance.

The values of households, including the silent majority observed, can be translated and encompassed throughout this design. As the further utilization of the steering group and the addition of a soundboard group will reaffirm the importance of the local community. Allowing them to, at their pace, regain decision-making authority over their transition. As the entities steering- and soundboard group will function as middlemen for the entire neighbourhood. Constantly reflecting the current stances and needs of the KNSM-eiland. Finally, the importance of democratic decision-making has been utilized within the design. As the energy commission acts as director, the final decisions for homeowners are made within their associations' meetings.

Final conclusion

These recommendations have reaffirmed the advantage of utilizing a nested and value laden IAD framework within the context of an urban neighbourhood heat transition. The design has allowed the researcher to mitigate risks identified when other processes are deployed. As, in contrast to traditional methods, this approach has allowed for the identification of:

- Misalignment between technology, institutions and values
- Misalignment between different layers of decision-making and their inherent values
- Reoccurring pitfalls to participation and means to employ or mitigate them
- A silent majority, currently underrepresented but critical to a successful transition
- A participation and decision-making design to capitalize on inconsistencies and realign values across nest

This shows that the enhanced IAD framework can deliver upon its promises. A structured lens through which the complex and dynamic heat transition is dissected, unfolding insights that lead way towards more optimal processes. To conclude, the IAD framework, nested and value enhanced, has served this research as a toolkit to guide decision-making across a neighbourhood heat transition. The design allowed the researcher to work beyond pitfalls of traditional participation and alongside novel standards. Leading to a tailor-made approach for engagement and decision-making, uncovering tension fields and misalignment in the process. Thus, answering the main research question. This iteration of the IAD framework is a toolkit that can help guide decision-making of urban neighbourhood heat transitions in the Netherlands.

Seeing to the fact that this research has been in constant alignment with an actual neighbourhood heat transition, and that various insights gained have already been utilized in practise, a Dutch handout has been designed. The handout contains a practical summary of this thesis and its findings. In hopes that it can support those looking to utilize participation and align the process of decision-making within their heat transition. The handout is presented in Annex H of this research.

8.2.2 Recommendations for future research

The first recommendations stem from the technical analysis. As it has been brought to light that stadswarmte in its current form only has the potential to reach 2030 targets. Municipalities and heat companies alike counter this argument by stating that their HTDH networks will switch to more sustainable heat sources and lower temperatures in 2030. However, a review on the subject has imposed quite some barriers to this seemingly effortless claim. Thus, it is advised to future research the retrofitting of stadswarmte, including the consequences for households (financially for instance). Secondly, this research has observed that the neighbourhood transition might require a further focus on individual buildings. As their built qualities vary greatly over neighbourhoods. A modular low temperature heat network has been proposed as a possible solution, allowing buildings to transition when they are ready. However, research on both the technical as well as institutional aspects of such a modular network requires more focus.

Qualitative findings on behaviour and values from the analysis matched with predictions from theory. However, it is advised to further utilize the SSVS amongst a large group of neighbourhood participants. It would be interesting to research if, when utilizing the SSVS, theory still matches up to practise. Especially if values found can be linked to behaviour in ways that would relieve current participation practises of its labour intense qualities. In other words, if a survey can produce the same insights as spontaneous interviews have done in this research.

Finally, three recommendations regarding more practical implementations are presented. First, the utilization of the enhanced IAD framework on another case study relevant to the urban heat transition. In research of misalignment between nests, or planes of technology, institutions and values. If inconsistencies are reoccurring, conclusions can be extrapolated to a broader scale. Second, there lies potential for research into creating or enhancing urgency amongst households. This research has identified the replacement of FGO’s as a tangible problem leading to urgency and engagement. It is not a stretch to propose that many more phenomena can strengthen the sense of urgency amongst households facing transition. Finally, the proposed design from chapter 7 bears potential to be researched in practise. Ideally, however unlikely, future research would analyse the utilization of the novel participation design within this case. Realistically, it provides potential for its bare bones (or general principles) to be applied to similar cases within the heat transition.

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A

Toolkit competitors

As presented in chapter 1.3.1 the IAD framework is a tool that is concentrated on the physical, technical, social, and institutional context in which collective action occurs and outcomes are produced (Cole et al., 2019). This is one of the very reasons why it's application within this research is deemed of added values. However, as pointed out within that same chapter, the IAD framework has received some criticism and alternatives are available. This subchapter will therefore investigate the alternatives and argue why, for the purpose of this research, the IAD framework remains the best fit as a toolkit to support engagement.

In response to claims that the IAD framework pays too little attention towards the diversity and complexity of (natural) systems and processes Ostrom and colleagues started working on a new framework specifically created for the examination of social-ecological systems (SES) (Cole et al., 2019). Ostrom describes SES's as "complex adaptive systems where social and biophysical agents are interacting at multiple temporal and spatial scales" (Janssen & Ostrom, 2006). Most common examples of such SES's are systems in which dilemmas occur surrounding the depletion of natural resources such as forests or fresh water supplies. Whilst one might not directly relate these examples and definitions to the urban heat transition this too is a system which can be argued to be a SES. Since there are strong tension fields between social and biophysical aspects when analysing change within urban systems. This regards the depletion of natural resources, effects on (in)direct environments and social dilemmas faced by changes to be implemented. The SES framework developed by Ostrom and colleagues is presented below in figure 26.

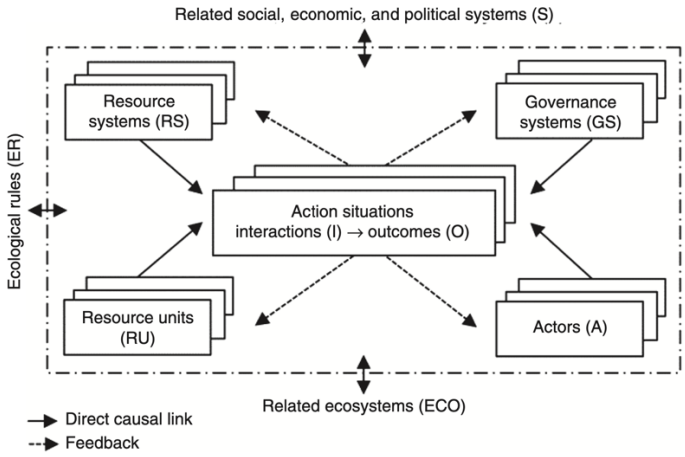


Figure 26: The SES framework (Cole et al., 2019)

As depicted in figure 26 the SES framework focusses more strongly on specific categories of attributes of SESs, this is reflected through the seven categories influencing the central action situations. Within these seven categories many second and third layer attributes have been defined. Through such detailed and structured handles within this framework a more diverse

and complex analysis should arise. Unfortunately, as presented by Cole and colleagues (2019) in their research reviews, the structure of the SES leads to a detailed yet very static analysis of action situations at hand. They found that this is often reflected by “a long list of factors that might have influenced the action situations at hand”. Such a detailed but static list of factors might highlight variables that are of importance, but it does not provide the researcher with any insights into the dynamics at hand. It does therefore not help the researcher identify and understand the complexity of the action situations. To conclude, a framework that does not, at least certainly not better than the IAD framework, provide insights into the complexity of the local context at hand is not suited for this specific research. This finding is in line with requirements found for novel participation approaches in chapter 2.

However, Cole et al. (2019) were still set on mitigating the lack of detail and complexity that analysis through the IAD framework entails. So, they set out to design a framework which contains both dynamic aspects of the IAD and the detailed focus of the SES. This resulted in the creation of the CIS framework, as generically presented in figure 27.

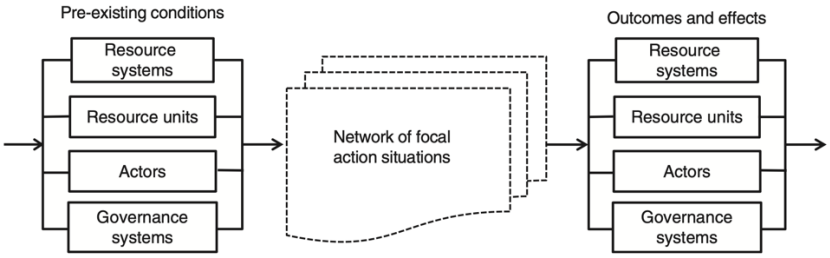


Figure 27: The CIS framework (Cole et al., 2019)

This framework firstly assumes that no action situation presents itself in isolation, nested action situations are very much connected to one and another. Furthermore, it is designed to shift the focus of the analysis on the action situations whilst still accounting for more detailed variables that lie beneath each category (such as Resource systems, units etc.). The framework thus identifies the categories relevant, including their underlying variables, which influence the action situations, which in turn influence the categories again. Hereby this framework assumes that the evaluation, which could be both feedback and feedforward, is part of the network of action situations (Cole et al., 2019). At first glance this seems to result in a toolkit which support the analysis of action situations more through a focus on predetermined variables per category. Leaving the dynamics of the system at hand, including its crucial tension field, in lesser view. Also, the role and influence of actors in their communities, and their attributes, initially seem to be represented less. Through the research on engagement, it is learned that these aspects deserve more attention within the context of the heat transition, since the focus with participation approaches should lie more on the unique local context of the system at hand.

The different analytical outcomes via the CIS, compared to the IAD, can be viewed more thoroughly through the well-known case of the Maine lobster fisheries. Both McGinnis (2010) and Cole et al. (2019) have used this case for the application of the respective frameworks. An important notation is that, compared to Ostrom, McGinnis utilizes the IAD framework enriched with a similar view on nested or coupled actions situations as Cole and colleagues. In short, when comparing both analysis of the same case, McGinnis (2010) is clearly more focused on the great variety of actor types and their attributes (individually and placed within the different communities) whilst the analysis of Cole et al. tends more towards the change in key variables

throughout the development of the Maine case. Furthermore, Cole et al. highlight patterns in interaction regarding changes in action situations whilst McGinnis dives deeper into the roles of key participants and governance structures within action situations. This can be seen as a stronger focus on the social and institutional dynamics of the system under analysis through the IAD framework. It is however important to remember that the dynamics between action situations are still very important to consider, the nested approach will thus have to be utilized.

Through this comparison the earlier notions on the preference of the IAD framework are underlined. Especially when considering the support of key requirements for novel engagement approaches as highlighted in the conclusion of chapter 2. On top of this, in both the SES and CIS frameworks the technical aspects of systems at hand seem to be extremely underrepresented when compared to analysis supported by the IAD framework. This could also explain why the IAD framework is dominant regarding its utilization in energy transition contexts, on which will be elaborated further in section 3.1.1.

B

Review of subsidies

This section will quickly review relevant subsidies available within the context of the Dutch heat transition. Subsidies are omnipresent within this transition. National and local policymakers influence which and how subsidies are designed, showcasing not only their vision but interpretation of what is crucial within this transition. For associations, companies, local initiatives and households' subsidies can make or break sustainable investments.

For homeowners, housing corporations or associations and owners' associations (VvE's) the "investment subsidy renewable energy and energy saving" or ISDE is available. This subsidy is designed to support investments in (hybrid) heat pumps, solar boilers, heat grid connections and five types of isolation measures (RVO, 2022c). The subsidy amounts can vary, however this is easily calculated through the online tool of the RVO. Exclusively for housing corporations or associations and owners' associations the "stimulation regulation natural gas-free rentals" (SAH) and "subsidy energy saving own house" (SEEH) are designed (RVO, 2021; RVO, 2022f). The SAH entails that home or building owners can apply for subsidies that cover partial expenses related to indoor building expenses and connection costs when transitioning to a heat network within five years. Per dwelling a maximum of 5000 euro's is available (RVO, 2021). The SEEH helps these same stakeholders become more sustainable by offering consultations regarding energy saving methods that can be utilized in and around the relevant housing (RVO, 2022f).

There are also project-based subsidies available. The subsidies "renewable energy transition" (HER+) and "stimulation renewable energy production and climate transition" (SDE++) are available for projects that either will reduce CO_2-emissions before 2030 (HER+) or implement emission reducing technologies through renewable energy production (SDE++) (RVO, 2022b; RVO, 2022e). Furthermore, designed specifically for the heat transition, the subsidy "risk coverage thermal heat" (RNES Aardwarmte) is available for projects investing in geothermal heat. The subsidy provides an insurance against the financial risk of failed drillings (RVO, 2022d).

For association or foundations, which could include local sustainability initiatives or cooperatives, certain other subsidies exist. The "energy investment deduction" (EIA) for example. This subsidy could allow cooperatives to deduce up to 45,5% taxes on sustainable investments (RVO, 2022a). Furthermore, the "subsidy ruling cooperative energy production" (SCE) is a subsidy available for cooperatives looking to produce renewable energy on their premises. The subsidy is constructed so that a pay-out is received per kWh of renewable electricity produced (RVO, 2022g).

Finally, the "salderingsregeling" still exists for Dutch households. This subsidy entails a recovery of VAT when private households invest in solar panels. On top of this, the government rewards households that supply renewable electricity to the grid, on average by 22,5 cents/kWh (Hier opgewekt, n.d.). Hier opgewekt also shows that for both homeowners and

VvE's the "national heatfunding" exists. This is not exactly a subsidy; however, it allows households to loan money, with the goal of investing in sustainable heat solutions, against favourable returns. For those who might find this amount of information on subsidies confusing or intimidating several online tools exist to easily scan which subsidies might be applicable for someone's personal situation, for example the tool of van Genugten (2022).

C

Socio-Demographics of the KNSM-eiland

This section will shortly present some key socio-demographics of the case study neighbourhood, the KNSM-eiland in Amsterdam. These statistics will provide the upcoming analysis with a better understanding of the local inhabitants. As “dry” numbers on age, ethnicity, income or distributions in homeowners versus tenants can help the engager form a more tailored approach upfront. Designing with respect to the fact that engagement requires different strokes for different folks. It is however key to remember that statistics alone will not present an accurate representation of the neighbourhoods, it’s customs, values and views. For this research aims to eliminate unnecessary stereotyping leading to decontextualization, not further embrace it.

The KadastraleKaart (2021) shows that the KNSM-eiland counts 2390 inhabitants, spread over 1405 households. This is further delineated through the fact that the average household consists out of 1.7 persons, which is on the lower side of the Dutch average. 52% of the KNSM-eiland consists of single person households, in 21% of household’s children are present and 27% of households does not have (live-in) children (KadastraleKaart, 2021). With a population density of 18913 people per square kilometre the KNSM-eiland is relatively highly populated (KadastraleKaart, 2021). Furthermore, the same source shows that there are little children below the age of 14 (9%), the same percentage (9%) consists out of 15- to 24-year-olds, the group of 25 to 44 year olds spans slightly more than a quarter of the inhabitants (26%), the largest age group consists out of those between the age of 45 and 64 (40%) and the final group is those above the age of 65 (19%). Figure 28 shows the migration background of those living on the KNSM-eiland, as provided by AlleCijfers (2022).

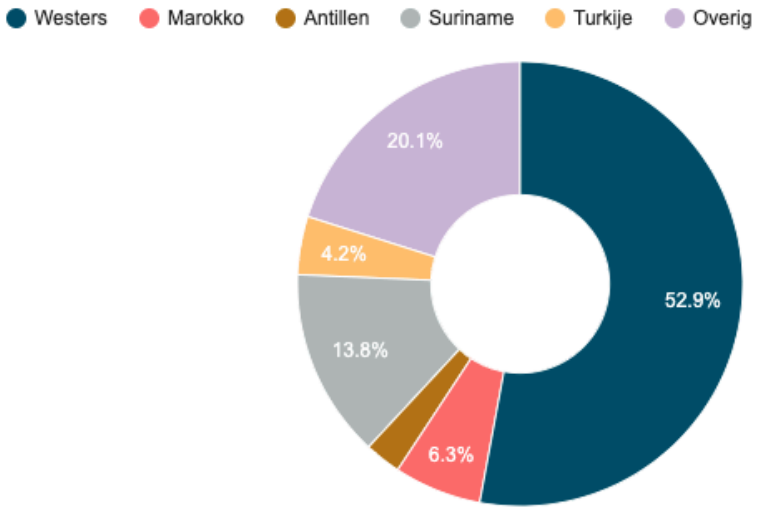


Figure 28: KNSM-eiland migration background (AlleCijfers, 2022)

AlleCijfers (2022) also shows that the average gross annual income on the KNSM-eiland is €40.500, several thousand euros above the national average. Furthermore, 62% of inhabitants between 15 and 75 years old have a high educational level, 26,8% of the inhabitants has an average level and the final 11,2% has enjoyed a relatively low educational level. Especially since youngsters have been considered in these statistics (possibly still in education) it can be concluded that a very large portion of the inhabitants have enjoyed high educations. Finally, figure 29 shows the results of the votes collected on the KNSM-eiland during the national elections of 2021. These results can be linked to certain basic values which are embodied by certain political parties, for example values towards the environment and stances regarding the energy transition. Again, this is merely for indicational purposes, no actual hard statements should be connected to these statistics. But it can be seen that a large amount of votes has been given to parties that have the environment and the transition high on their agendas.

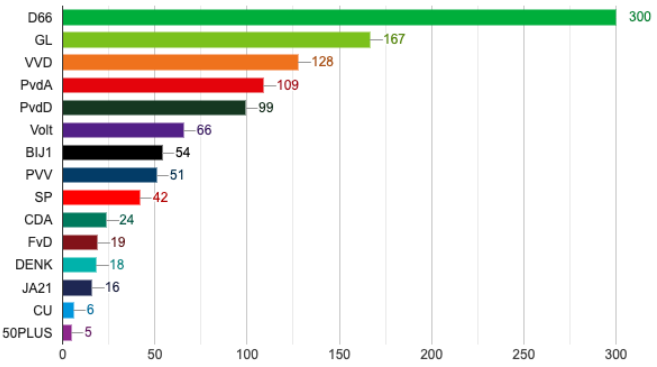


Figure 29: Distribution of local votes 2021 Dutch elections (AlleCijfers, 2022)

Now for the buildings on the KNSM-eiland, as 52% consists of rental properties and 48% is owned (KadastraleKaart, 2021). Furthermore, in 2020 the average value of houses on the KNSM-eiland was €469.000,- (AlleCijfers, 2022). Another important input is provided by Waternet (2022), as 38,4 % of dwellings on the KNSM-eiland is owned by housing corporations. Figure 30 shows which buildings are owned by which housing corporations. Finally, the KNSM-eiland is part of a larger area known as the Oostelijk Havengebied (OHG), which has its own energy commission that is currently very focused on the KNSM-eiland. This commission, based out of the neighbourhood cooperation, consists of volunteers with often (technical) relevant career back-grounds. They are researching which forms of clean energy and heat are suited for the OHG. Furthmore, they aim to give locals a voice within the course of their local heat transition. They inform, advise and support local decision-makers such as owner's associations, residents' committees and individual households. Everyone living within the OHG, that is including the KNSM-eiland, is allowed to join meetings regarding the possibilities of the neighbourhood heat transitions. The commission's main technical focus currently lies on the possibilities for TEO and other forms of DH on the KNSM-eiland.

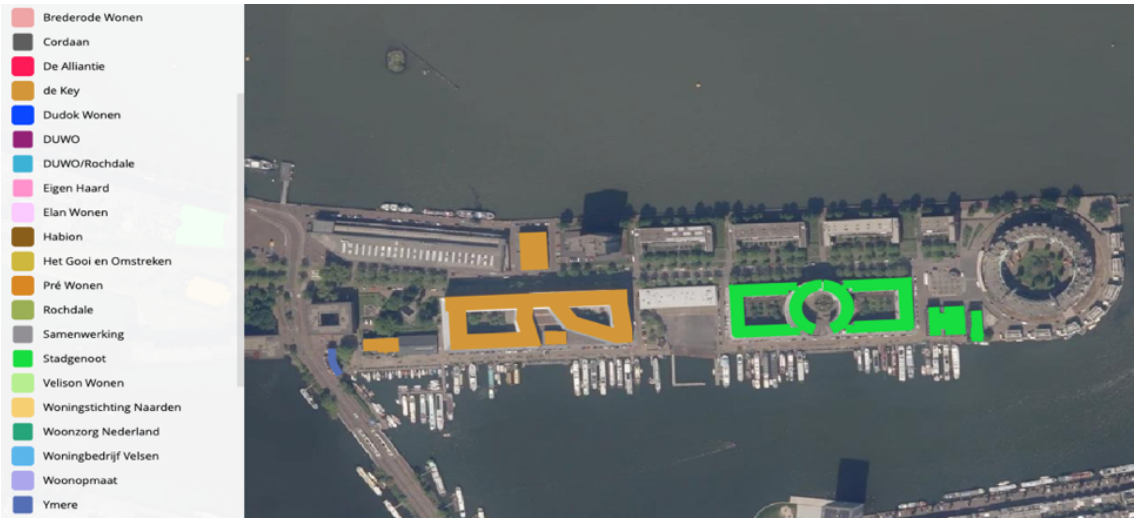


Figure 30: Housing corporation properties KNSM-eiland (Waternet, 2022)

D

Summaries of nest 3 meetings

This annex provides all summaries made after engagement throughout this nest. Engagement has mostly taken place through meetings initiated or cared for by the local energy commission. These meetings have consisted of open or invited participation where attendees were given presentations on the current state of their heat transition. Furthermore, meetings between heat companies, local initiatives and households have taken place within this nest. As have closed meetings with frontrunners from the local initiative. Finally, this annex is concluded with two pieces of relevant information in which the work of this thesis has been included.

D1. Neighbourhood association Energy Commission(online) – Resourcefully – Open presentation for interested residents KNSM-eiland - 22-11-2021

Resourcefully presentation during meeting residents KNSM-eiland

During a short presentation Resourcefully, in collaboration with Waternet, presents several scenarios through which the KNSM-eiland can become natural gas-free, certain pathways for their local neighbourhood heat transition. This is done via a holistic view of the transition on a neighbourhood level. The presentation starts of with the admittance of the fact that many other neighbourhoods nearby have already connected to the Vattenfall “stadswarmte” HTDH network. However, with t’IJ (water body) nearby, and relative high isolation levels on the KNSM-eiland Resourcefully presents pathways based on TEO. The presentation contained five different scenarios, four of which are technical variations on the aquathermal technology for heating homes. After shortly explaining the technical details of each scenario they are compared to a scenario in which natural gas remains the main heat source. The presentation is concluded with a cost-analysis (total costs of ownership) that shows all four TEO based scenarios can compete, or are even cheaper than, utilizing natural gas. Also, assumptions throughout the calculations have been presented.

Key take-aways/questions from presentation

- What are the costs per household per scenario?
- The potential governance and organization of TEO networks is crucial, who would be willing to govern such a local initiative?
- Is there enough local support? How could this be created?
- When should this transition really start, how can peak momentum be identified?
- What about the internal equipment per building for TEO systems? Is there enough space per building for gear housing?
- Since buildings differ, there is a need for an even more focussed analysis. Would this impact costs significantly?
- Could a heat corporation be formed?

Questions from neighbourhood members relating the following subjects:

- Spatial planning
- Noise pollution and vibrations due to equipment?
- Potential for cooling of TEO systems? Would this be able to replace air-conditioning?
    - It is more so the supply of cold than that it is cooling, so it cannot replace air-conditioning units
- How much equipment is needed for the neighbourhood? How many installations would have to be placed per building?
- How should we read/interpret these financial graphs and models?
- Many costs and risk related questions
- Has the TEO technology been proven? Are there Dutch testcases?
- How about the “competition”, is TEO cheaper than stadswarmte?

D2. Neighbourhood association Energy Commission (online) – Open presentation for a specific building complex KNSM-eiland - 25-11-2021

A presentation/meeting revolving the replacement of the building's flue gas outlets (FGO's)

At first the goal of the meeting is explained, as it revolves around the fact that the building's FGO's are up for replacement. If these have to be replaced the questions remains if the building then should directly disconnect from natural gas? Since replacing the FGO's is only needed if natural gas remains the main source of heating and cooking within the building. Could the replacement be stalled until an alternative heating solution is chosen? If the FGO's are replaced then all the heating systems (central heating boilers) need to be replaced too, thus this would mean investments for the coming 15 years. All important questions and notions at hand, however this meeting is not to make decisions but to inform the inhabitants of the building.

The municipality, together with an owner's association present the fact that the municipality Amsterdam aims to be natural gas free in 2040. They also present that they think a DH network is suited for this specific building. After the display of, and information on, available subsidies the municipality underlines that affordability (for everyone) is key. After this presentation a representative of Vattenfall presents the ins and outs of their HTDH network (stadswarmte). This presentation included, amongst others, what changes in the building, in the apartments and which source of the heat is utilized. Then, Resourcefully presented alternative pathways to becoming natural gas-free, via TEO. Finally, the housing corporation (owner of 55% of the association of owners) gave information on the decision-making process. As at least 70% of tenants of the corporation need to vote for certain changes. Then, decisions can be brought to the whole association of owners, including the 45% of private owners. In this arena 65% of votes are needed for decisions, the corporation thus only needs a little bit of private owners to agree with them. The corporation has taken a stance in the heat transition, as they prefer the stadswarmte solution and are in talks with Vattenfall. They argue that there, in this case, is no time to wait for alternatives such as TEO, seeing to the fact that there is a certain pressure because of the FGO's. They also claim to no raise rental prices for tenants.

Questions during this meeting are along the following lines:

- Which solutions are the cheapest?
- What are the costs for induction cooking etc.?
- Which solutions is the easiest to implement?
- Which solution has the least impact on their living environment, what nuisances can be expected during installation?
- How much time would this transition take?
- Do we lose freedom as Vattenfall would be the only heat company available? Can we switch?

Reaction to this meeting from a collective of building occupants (“action group”)

In short, a collective of inhabitants felt very pushed by the presentation regarding their heat transition. The main consensus of the message is that the group feels pressured into stadswarmte, with the replacements of FGO’s being used an excuse towards an accelerated deal with Vattenfall. They express their dissatisfaction with the state of affairs, especially since they find stadswarmte to be an inappropriate solution to living natural gas-free. They argue that this alternative is not sustainable and that proper time should be made free for the discussion of more sustainable solutions.

D3. Neighbourhood association Energy Commission (online) – Open presentation with heat company for residents KNSM-eiland - 25-11-2021

Presentation energy commission

The presentation starts off with an introduction of the energy commission itself, those involved and their expertise's. The principles of the commission revolve around the understanding that heat networks will enter everyone's lives. However, the nature of the network, the source of heat and the suitability to the neighbourhood are presented as key. With pillars such as sustainability, affordability and ownership/control. The focus here definitely lies on TEO, as water bodies are nearby, it's a renewable source of heat, it lowers dependency on other energy sources and their fluctuating prices. However, the first solution towards natural gas-free living should be saving energy, through isolation but also through lower losses in for instance heat networks. Several potential forms of organisation of TEO networks are highlighted, such as a local energy cooperation, outsourcing, private/public cooperation's or even cooperation between multiple neighbourhoods. After the more technical part to the presentation the "breed warmteoverleg" is announced. Meetings between the energy commission and all forms of associations such as owners, corporations and tenant representatives. Finally, the question is answered as to why a heat company is invited for this meeting. The commission beliefs that the heat company could potentially become a future partner, furthermore the heat company is already in talks with certain complexes on the KNSM-eiland. The heat company has also expressed their desires to decrease the future temperature of their HTDH networks to mid-temperature levels.

Presentation heat company

First questions are addressed from the previous presentation. The heat company has no current experience with cooperation's between themselves and locals. However, they are currently starting to investigate the options. Furthermore, their vision pertains that they want to listen to local needs and operate accordingly. The heat company however does see some problems with LTDH, especially the open ones in which they could possibly also supply heat. With regard to their current HTDH networks, they do not want to make any claims as to the speed of transition or the lifespan of HT heat sources. They do mention that technically it is possible to branch of a LTDH from their HTDH network. However, this is made difficult through contracting and stakeholder management. Finally, the state that they are open for more detailed talks with regard to future cooperation with local representatives.

Questions present inhabitants regarding the following topics

- What are the consequences of a LTDH network
- Why 70 degrees but not 55 degrees
- Where lies the heat loss in HTDH
- Are there hybrid solutions in terms of multiple connections from different heat companies
- What exactly is the goal of this meeting
- Why do HTDH fixed costs vary throughout Amsterdam
- Is it possible that the heat company would cooperate towards a TEO system
- HTDH systems have less of a incentive towards efficient heat use in homes
- Should the heat transition be seen separate from the energy transition
- With stadswarmte, is it possible to switch suppliers or heat companies

D4. Collective of building occupants (“action group”) – questions for owners association of complex on the KNSM-eiland – 20-02-2022

Core of the email

The group wants to make sure questions from homeowners are answered, as they feel like previous meetings did not give them the chance to ask everything they wanted. They feel that it is clear that the municipality, the corporation and heat company steer towards a fast implementation of stadswarmte within their complex. However, they feel rushed, with a lot of questions unanswered. Thus, in reflection to current courses of action they feel underrepresented. Summarized, they propose to replace the FGO’s and carefully consider which heat alternative is implemented by 2040. They advocate a more sustainable, cheaper and better solution than stadswarmte. Which should be found through independent research. This email is finished with a extensive list of questions regarding stadswarmte, FGO’s, costs and legislation.

Reaction from other inhabitants of the building

The main line of reactions is the fact that this action group has created the impression that all other building inhabitants are behind the email mentioned above. This has led to frustration and friction, as some people agree with the questions asked, they however did not give permission to ask them in their name.

Reaction from action group

Apologies are given for the fact that the email could have been interpreted as misleading (with regard to whom are questioning current courses of action). Furthermore, more argumentation against stadswarmte is provided (tv shows, podcasts and articles), which makes up for the bulk of the reaction.

D5. Neighbourhood association Energy Commission – Learning from the energy commission part 1 - 07-02-2022

Learning from monthly meeting

- First of all; there are a lot of similarities between this thesis and their struggles
- They are trying to cope with the fact that there are no legal entities for citizens/neighbourhood initiatives regarding district heating
    - That is why most are run by municipality or heat companies
- Heat companies that supply stadswarmte
    - The (informational) engagement from the heat company is mostly a charm offensive, not truly in-depth information is provided
    - Claims of very low heat losses during transport
    - The energy commission has a feeling that stadswarmte is often linked by deals between municipalities, heat companies and large housing corporations
    - During their meeting with the heat company the heat company showed sort of an ambition for lowering the district heating temperatures and using renewable sources. However, hard claims or plans were not presented
    - The researcher explained the pros of such a stadswarmte network for municipalities and housing corporations. Lying in the fact that it can be outsourced, no responsibility or risk has to be beared. Quick and dirty, easy and standardized
- The energy commission truly would prefer to use low-temperature networks with TEO, they however also see the challenges this would present
    - How to organize
    - How to give people a voice
    - How to reach people and show them the impact of technologies
    - How to regulate and operate such a system
    - Who bears responsibilities?
- They also would like to see a “taskforce” of the whole KNSM eiland for instance
    - With representatives from all VVE’s, citizens, housing corporations, municipality, energy companies and others
    - “sturingsgroepen”
        - To enhance decision making in a fair and fast manner!
- The researcher provided the attendees with a short presentation on the:
    - Technical context
    - Values and their link to behaviour
    - Institutional context

D6. Neighbourhood association Energy Commission – presentation and meeting for building representatives of the KNSM-eiland - 28-02-2022

Preface

For residents of the KNSM Island, the heat transition is already taking on more shape. Studies show that a 55-degree heat network seems feasible, but that there is still a long road to go. Do we still need to invest in flue gas ducts, central heating boilers, radiators and gas cookers? Time for a broad consultation between the VvEs, residents' committees, sustainability committees and people who are actively involved in the heat transition on the KNSM Island.

Questions from the attendees after general presentation (see 3.) of the energy commission

- A broad spectrum of technical questions, ranging from the building implementation of a low temperature TEO network, the living comfort it can provide, the difference with stadswarmte or HTDH, the need for work within homes and how to remove natural gas connections
- A broad spectrum of financial questions, ranging from more insights into the costs structures (just cheaper then stadswarmte is not enough) into the need for exact numbers. Also, what are the alternatives? What are the costs of other solutions? Questions that simply cannot be answered at this stage
- How should the organization forms for TEO be looked upon?
- How are owner's associations communicating with each other, if the approach is on a neighbourhood level. How are decision going to be made? Is everyone already being brought togheter?
- Different housing corporations on the KNSM-eiland are, according to attendees, very pushy towards stadswarmte, they feel like they do not have much of a choice themselves. What can they do?
- Questions from representatives of association boards
    - Which information should be brought to their residents?
    - Can we be provided with either
        - A technology, its costs and necessary changes in housing/building
        - Or insight into what the people actually want

Questions from the attendees after a presentation of the building research (energy labels, physical space available, current heating structures) on the KNSM-eiland

- Mostly questions regarding costs
- Physical changes needed, where do pipes go? Which appartements need rigor renovation or reconstruction?
- Is it safe? Legionella needs to be treated.
- What is the impact on the comfort of living?
- But why TEO, why not something else?

Researcher notes

- A wide variety in interests, knowledge and views on the heat transition
    - Different starting points per individual
- Questions mostly pertain to technical and financial aspects which can quickly lead to discussions which cannot be solved due to a lack in information
- Taking a step back is advised
    - Why are certain choices being made
    - Why do we need to discuss this transition now
    - Come back with more tangible research (feasibility studies that have been performed independent of any related commission)
    - Start engaging in questions that can be discussed at this moment, processes on which information is available or not required
- Ownership structures can present future bottlenecks for TEO or other LTDH networks
    - Who bears responsibility and risk?
    - Who has the qualifications?
    - Who will run operations and maintenance?
- It is very difficult to find the right process to communication with so many involved. Which information should be provided? What could better be discussed at later stages? There is a need to take this participation process to the bare bones of the matter, the essence of the transition
- Is it feasible to demarcate this transition across a complete neighbourhood? Or should it be done in smaller sections of apartment complexes or housing structures?
    - Since the priorities and qualities of each association/building vary massively
- People feel that everyone should be involved, not only representatives
    - Also include tenants
- Who is going to lead this neighbourhood transition?
    - How can commitment be realised?
    - A dedicated KNSM-eiland workgroup is required, which should pertain a good mix of the actual neighbourhood
- Associations only meet once or twice a year, with agendas already filled with activities other than the heat transition
- Conclusions: a dedicated transition group of the KNSM-eiland is to be formed (steering committee KNSM), with representatives of each association from the neighbourhood, including tenants.
- Final remark/point of learning; Everyone is an expert with an opinion, this just leads to discussions which are counter-productive since often there are no answers to the questions leading said discussion
    - However, since the end responsibility is with each homeowner the discussion is very valid!
    - How can such a discussion be avoided? By taking a step back!

D7. Neighbourhood association Energy Commission – Learning from the energy commission part 2 - 07-03-2022

Learning from monthly meeting

- Meetings with companies, experienced in LTDH systems, open to cooperation with local energy initiatives have taken place
    - A modular approach to such a transition is advised
    - Start off with only a few building complexes, then step by step expand such a network across the rest of the neighbourhood
    - This however does require some levels of commitment, as initial investment costs into the network are highest
    - Thus, a roadmap to modular development of the neighbourhood transition can be required
    - Downside, larger decision-making groups have the risk to slower progress
    - Cooperation with private firms can bright the benefit of not only experience but also outsourcing of a lot of barriers to these kinds of networks
- Reflection on meeting 6.
    - The goal was engagement with associations, which was very successful
    - Technical and financial discussions dominated the start of the meeting
    - Afterwards however the dominant ambience was very pleasant. Attendees seemed committed to further engagement
    - Agreements for a second meeting were made
    - The goal is to focus on the KNSM-eiland, as a pilot for the rest of the area
    - The “sturingsgroep KNSM” (steering committee KNSM) is to be supported by the energy commission
- Final remarks
    - Communication can become less complex and technical
    - More “back-to-basics”
    - Clarity and honesty in communication is key
    - Need for a simple communicative tool

D8. Neighbourhood association Energy Commission (online) - Open presentation for interested residents KNSM-eiland – 24 - 03 -2021

Presentation on building research

- Research that dives into the possibilities for the, amongst others, KNSM-eiland to connect to a sustainable heat network
- First insight is given into why this research is being done at this moment, why there is urgency for such research and why it is good to start of early
- Then the updated project plan is presented, which summarizes a general course of action
- From this point onwards the more technical presentation takes off
    - With an introduction into how the specific buildings have been researched, according to which criteria
    - Then an explanation on the calculations is presented
    - Concluded with the results of the research
- The research indicates that the 3 complexes studied on the KNSM-eiland are relatively well isolated and that space will become available for the placement of shared technical installations such as pumps
- However, more detailed research is required as all buildings within the neighbourhood differ significantly. Initially low-temperature networks seem possible with extra measures taken

Presentation on taking isolation and maintenance measures within a owners' association

- Four main points of attention are covered throughout this presentation
    - What are the costs
    - Which subsidies are available for such measures
    - Which financing structures or alternatives are available
    - How can decision-making, building and financing be aligned
- In order to answer these main points several indications on costs are provided
- Furthermore, examples per measure are given
- Subsidies including calculation are presented
- Loans are also discussed, including calculation examples
- A general planning structure gives handles to the integration of decision-making, financing and building
- Pointer with regard to differing voting procedures are presented in conclusion, as costs for investing in certain improvements might not always fall under maintenance. Thus, leading to different governance within associations.

Presentation on municipal approach to association related transitions

A topic which has already been discussed throughout this thesis, for reference see chapter 6.

D9. Neighbourhood association Energy Commission – presentation and meeting for building representatives of the KNSM-eiland - 30-03-2022

Preface

This meeting will be a continuation on the process started during the meeting on the 28th of February. Starting off with a short reflection on the previous meeting, a summary for those who were not able to attend then and are now. Then a presentation will be given by the researcher, presenting the preliminary design of the KNSM-eiland heat transition infographic (or artefact as referred to within this research). After which the meeting will continue discussing the potential and commitment of a KNSM steering committee.

Feedback on design of artefact (the infographic)

- More honesty/clarification in technical alternatives
    - Especially the ones that are not even mentioned
        - Like geothermal and solar thermal
- The potential of Aquathermal + the research that has already been conducted for KNSM on this technology should be more central/clear
- Aquathermal also does not have a true “freedom of choice”
    - It has however organizational freedom
    - More freedom of organization for the collective of the neighborhood
    - The individual citizens will never truly be able to chose
- Concluding; try to be more neutral regarding technical alternatives
- For the greatest part everyone was very happy with the draft of the infographic
    - It is clean
    - Simple
    - Takes you through the necessary steps, asking relevant/needed questions
    - Makes the situation less complex, no background info needed
    - It has already been used with municipal meetings for the new subsidy for the research

The declaration of intention (steering committee KNSM)

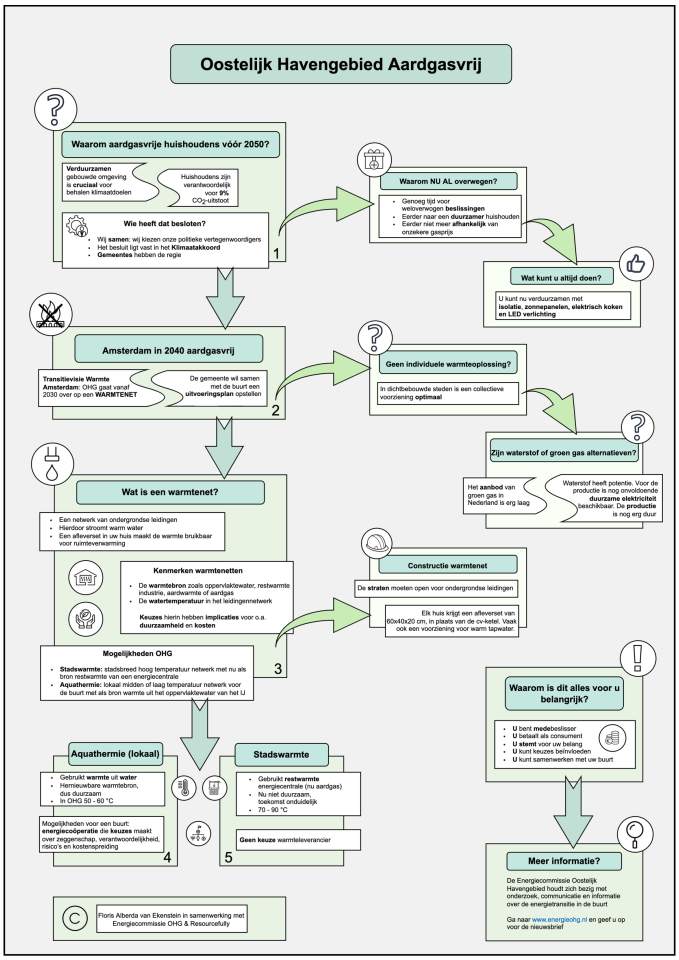
- Goal of this declaration is to create the steering committee
- This committee will have to face the following barriers
    - How to communicate in a nuanced manner
    - How to create urgency without scaring residents of
        - Climate, geo-politics, gas prices, socio-demographics
    - How should the entire community be represented through such a committee, as it consists of those who can be seen as frontrunners
    - How to create momentum
    - How to create support
    - How to engage with locals
- Final comments
    - Within such groups there are always (logically) differences in knowledge and viewpoints, so first everyone has to be on the same page in order to bring a structured and cohesive story to the residents on the island
    - Cooperation with housing corporations seems to be a hurdle
    - Independent feasibility studies are required

D10. Neighbourhood association Energy Commission – open notification to residents regarding the steerinig committee KNSM-eiland

The Broad Heat Consultation KNSM Island in February led to the KNSM Energy Steering Group, which will work on the communal approach to energy transition on the KNSM-eland. During the 2nd meeting, in March, owners and tenants discussed a joint declaration of intent. The aim is to make the island as energy neutral as possible. Promising options for a heat network are being further investigated. There will be a roadmap indicating how the steering group wants to achieve its goals and how the sustainability of this neighbourhood can be accelerated. Housing corporations are also invited to participate. More information via energie@buurtcooperatieohg.nl

D11. Neighbourhood association Energy Commission – open notification to residents regarding the infographic natural-gas free Oostelijkhavengebied (and KNSM-eiland)

Why are we striving for natural gas-free neighbourhoods? In this infographic you will find the most important questions and answers. You can also download it here.



E

Interview approach and structure

This annex firs provides the informed consent form used prior to all interviews with local households. The informed consent form has been created up to TU Delft standards in collaboration with a data steward for the TPM faculty. Furthermore, this form has been approved by the ethics commission of the faculty. Each participant was provided plenty time to read the material. Once no questions remained and participants agreed, the forms were signed twofold. As a prerequisite to use insights gained from said interviews.

E2 presents the original Short Schwartz Values Survey as created by Lindeman & Verkasalo (2005). This survey has been the basis for the Dutch translation created for the purpose of this research, as presented in E3. After participants agreed with the consent form, they were presented with the Dutch Short Schwartz Value Survey. This was done to retract quantitative data concerning household prioritized values and behaviour. As mentioned throughout the thesis unfortunately this survey was deemed too complex for participants.

E1. Informed consent form

Operationalisatie van het IAD framework voor het ondersteunen van buurten binnen de Nederlandse stedelijke energietransitie

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U wordt uitgenodigd om deel te nemen aan een onderzoek genaamd “Operationalisatie van het IAD framework voor het ondersteunen van buurten binnen de Nederlandse stedelijke energietransitie”. Dit onderzoek wordt uitgevoerd door Floris Alberda van Ekenstein, van de TU Delft en Resourcefully.

Het doel van dit onderzoek is het vergaren van inzichten in de wensen en waarden die spelen rondom beslissingen in het proces naar een aardgasvrije wijk. Hierbij wordt gekeken naar de mogelijke technische opties binnen de wettelijk en beleidsmatig gestelde kaders. Vervolgens wordt er veel aandacht besteed aan de implicaties van technisch/beleidsmatige keuzes voor buurtbewoners of andere lokale partijen. Dit onderzoek/gesprek zal ongeveer 30 minuten in beslag nemen. De data zal gebruikt worden voor de Master Thesis van Floris Alberda van Ekenstein, hetgeen gepubliceerd zal worden op ten minste het online archief van de TU Delft (TU Delft Repository). U wordt gevraagd om een korte vragenlijst te beantwoorden en vervolgens in gesprek te gaan met de onderzoeker.

Zoals bij elke (online) activiteit is het risico van een databreuk aanwezig. Wij doen ons best om uw antwoorden vertrouwelijk te houden. We minimaliseren de risico’s door zo min mogelijk persoonlijke data te verzamelen. De persoonlijke data die verzameld wordt dient alleen voor administratieve doeleinden en wordt aan het eind van het onderzoek vernietigd. Tijdens het gesprek zullen er notities worden gemaakt. Deze notities worden vertaald naar een samenvatting van het interview. Deze samenvattingen zijn volledig geanonimiseerd. Ook uw antwoorden op de korte vragenlijst zullen volledig geanonimiseerd worden. Anonieme data uit de samenvattingen en vragenlijsten zullen (online) openbaar beschikbaar zijn.

Uw deelname aan dit onderzoek is volledig vrijwillig, en u kunt zich elk moment terugtrekken zonder reden op te geven. U bent vrij om vragen niet te beantwoorden.

Mocht u (achteraf) vragen of opmerkingen hebben dan kunt u Floris Alberda van Ekenstein bereiken via F.J.P.AlberdavanEkenstein@student.tudelft.nl

Gaat u verder naar de vragenlijst dan stemt u in met het openingsstatement.

TU Delft
Delft University of Technology

Resourcefully

Gelieve de keuzevakjes van toepassing aan te kruisen	Yes	No
A: ALGEMENE OVEREENSTEMMING - ONDERZOEKSDOELSTELLINGEN, TAKEN VAN DE DEELNEMERS EN VRIJWILLIGE DEELNAME		
1. Ik heb de informatie over het onderzoek gedateerd __/__/__ gelezen en begrepen, of deze is aan mij voorgelezen. Ik heb de mogelijkheid gehad om vragen te stellen over het onderzoek en mijn vragen zijn naar tevredenheid beantwoord.	☐	☐
2. Ik doe vrijwillig mee aan dit onderzoek, en ik begrijp dat ik kan weigeren vragen te beantwoorden en mij op elk moment kan terugtrekken uit de studie, zonder een reden op te hoeven geven.	☐	☐
3. Ik begrijp dat mijn deelname aan het onderzoek de volgende punten betekent	☐	☐
• *Informatie wordt gewonnen via een korte vragenlijst en in de vorm van aantekeningen van het te voeren gesprek* • *U mag hierbij zelf de vragenlijst invullen*		
4. Ik begrijp dat de studie in juni eindigt.	☐	☐
o.v.v. eventuele vertragingen die kunnen worden opgelopen		
B: POTENTIËLE RISICO'S VAN DEELNAME (INCLUSIEF GEGEVENSBESCHERMING)		
5. Ik begrijp dat mijn deelname de volgende risico's met zich meebrengt […]. Ik begrijp dat deze risico's worden geminimaliseerd door […]	☐	☐

• *Het oplopen van het corona virus. Dit risico wordt beperkt door*
  ○ *Richtlijnen van de overheid (RIVM) worden ten alle tijden nageleefd*
  ○ *De onderzoeker zal, naar zijn beste weten, handelen om te voorkomen dat hij besmettelijk is ten tijden van de ontmoeting*
  ○ *Bij twijfel zal de onderzoeken een thuistest hebben afgenomen*
  ○ *Bij klachten zal de onderzoeker de afspraak afzeggen/verzetten en thuisblijven*
  ○ *Passende afstand wordt gehouden*
• *Een coronabesmetting kan nooit met 100% zekerheid worden voorkomen. Geen van beide partijen (onderzoeker & deelnemer) kunnen hiervoor aansprakelijk worden gehouden*
• *Als u zich op enkel moment niet veilig of fijn voelt kunt u ten alle tijden vragen om te pauzeren of stoppen*		

6. Ik begrijp dat mijn deelname betekent dat er persoonlijke identificeerbare informatie en onderzoeksdata worden verzameld, met het risico dat ik hieruit geïdentificeerd kan worden […]	☐	☐
• *Het risico dat derden uw gegevens bemachtigen en u te bereiken bent (via email) voor partijen waar u geen toestemming voor heeft gegeven* • *Het risico dat uw locatie, beperkt tot de buurt waar u in woont, bekend wordt voor derde (ongewenste) partijen* • *Het risico dat u herkend wordt aan de hand van geanonimiseerde data (antwoorden/inzichten in de vorm van een samenvatting van notities) in combinatie met een leeftijd en geslachtsindicatie*		
7. Ik begrijp dat de volgende stappen worden ondernomen om het risico van een databreuk te minimaliseren, en dat mijn identiteit op de volgende manieren wordt beschermd in het geval van een databreuk […]	☐	☐
• *D.m.v. het anonimiseren van namen (bijvoorbeeld; verhuurder 1 of huiseigenaar 1 etc.)* • *D.m.v. het weglaten van adressen (geen verdere specificatie dan het "KNSM-eiland")* • *D.m.v. het niet delen van persoonlijke identificeerbare gegevens met derden* • *D.m.v. het vernietigen van administratieve data aan het eind van het onderzoek*		

Gelieve de keuzevakjes van toepassing aan te kruisen	**Yes**	**No**
8. Ik begrijp dat de persoonlijke informatie die over mij verzameld wordt en mij kan identificeren, zoals "*Naam, leeftijd, soort beslissingsmaker"*, niet gedeeld worden buiten het studieteam.	☐	☐
9. Ik begrijp dat de persoonlijke data die over mij verzameld wordt, vernietigd wordt op […]	☐	☐
Het einde van dit onderzoek, naar verwachting in de maand juni 2022		
C: PUBLICATIE, VERSPREIDING EN TOEPASSING VAN ONDERZOEK		
10. Ik begrijp dat na het onderzoek de geanonimiseerde informatie gebruikt zal worden voor […]	☐	☐
• *Master Thesis Floris Alberda van Ekenstein* • *De bevordering van de energietransitie (Indirect verworven inzichten) door Resourcefully, de Energie Commissie OHG of andere belanghebbenden* • *Eventueel vervolgonderzoek TU Delft*		
11. Ik geef toestemming om mijn antwoorden, ideeën of andere bijdrages anoniem te quoten in resulterende producten.	☐	☐
D: OPSLAG VAN, TOEGANG TOT EN HERGEBRUIK VAN GEGEVENS (OP LANGE TERMIJN)		
12. Ik geef toestemming om de geanonimiseerde data, een samenvatting van de aantekeningen gemaakt tijdens het interview, die over mij verzameld worden publiekelijk gearchiveerd worden in 4TUResearchData opdat deze gebruikt kunnen worden voor toekomstig onderzoek onderwijs.	☐	☐
13. Ik begrijp dat de toegang tot deze repository open is voor alle geïnteresseerden.	☐	☐

Handtekeningen

Naam deelnemer	Handtekening	Datum

Indien van toepassing;

Ik, **de wettelijke vertegenwoordiger**, verklaar dat de informatie en het instemmingsformulier aan de potentiële deelnemer correct zijn voorgelezen, en dat hij/zij de kans heeft gekregen om vragen te stellen. Ik verklaar dat de potentiële deelnemer zijn/haar instemming vrijwillig heeft gegeven.

Naam wettelijke vertegenwoordiger	Handtekening	Datum

Ik, **de onderzoeker**, verklaar dat ik de informatie en het instemmingsformulier correct aan de potentiële deelnemer heb voorgelezen en, naar het beste van mijn vermogen, heb verzekerd dat de deelnemer begrijpt waar hij/zij vrijwillig mee instemt.

Naam onderzoeker	Handtekening	Datum

Contactgegevens van de onderzoeker voor verdere informatie:

Floris Alberda van Ekenstein

+31 6 21495514

F.J.P.AlberdavanEkenstein@student.tudelft.nl

E2. The Short Schwartz’s Value Survey

Information:

This short value scale is a shortened version of Schwartz’s Value Survey (SVS), which includes 57 value items that represent ten motivationally distinct values. The Short Schwartz's Value Survey gives insight in the ten broad values, not in the 57 specific values .

Reference: Lindeman, M. & Verkasalo, M. (2005). Measuring values with the Short Schwartz's Value Survey. Journal of Personality Assessment, 85(2),170-178.

Instructions:

Please, rate the importance of the following values as a life-guiding principle for you. Use the 8-point scale in which 0 indicates that the value is opposed to your principles, 1 indicates that the values is not important for you, 4 indicates that the values is important, and 8 indicates that the value is of supreme importance for you.

The scale:

	Opposed to my principles	Not important			Important			Of supreme importance	
1. POWER (social power, authority, wealth)	0	1	2	3	4	5	6	7	8
2. ACHIEVEMENT (success, capability, ambition, influence on people and events)	0	1	2	3	4	5	6	7	8
3. HEDONISM (gratification of desires, enjoyment in life, self-indulgence)	0	1	2	3	4	5	6	7	8
4. STIMULATION (daring, a varied and challenging life, an exciting life)	0	1	2	3	4	5	6	7	8
5. SELF-DIRECTION (creativity, freedom, curiosity, independence, choosing one's own goals)	0	1	2	3	4	5	6	7	8

6. UNIVERSALISM (broad-mindedness, beauty of nature and arts, social justice, a world at peace, equality, wisdom, unity with nature, environmental protection)	0	1	2	3	4	5	6	7	8
7. BENEVOLENCE (helpfulness, honesty, forgiveness, loyalty, responsibility)	0	1	2	3	4	5	6	7	8
8. TRADITION (respect for tradition, humbleness, accepting one's portion in life, devotion, modesty)	0	1	2	3	4	5	6	7	8
9. CONFORMITY (obedience, honoring parents and elders, self-discipline, politeness)	0	1	2	3	4	5	6	7	8
10. SECURITY (national security, family security, social order, cleanliness, reciprocation of favors)	0	1	2	3	4	5	6	7	8

Short Schwartz’s Value Survey in Dutch (SSVS-D)

Floris Alberda van Ekenstein

Document version: April 2022

Adapted from:

Lindeman, M. & Verkasalo, M. (2005). Measuring values with the Short Schwartz's Value Survey. Journal of Personality Assessment, 85(2),170-178

Boer, D. (2014). SSVS-G. Short Schwartz’s Value Survey - German. In C. Kemper, M. Zenger, & E. Brähler (Eds.). Psychologische und sozialwissenschaftliche Kurzskalen (pp. 299-302). Berlin: Medizinisch-Wissenschaftliche Verlagsgesellschaft.

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Goglin, C. (2021). *Emotions and Values in Equity Crowdfunding Investment Choices 2: Modeling and Empirical Study*. John Wiley & Sons.

Demi, S., Colomo-Palacios, R., Johansen, S. H., & Sánchez-Gordón, M. (2020, June). Mapping human values and scrum roles: a study on students' preferences. In *Proceedings of the IEEE/ACM 42nd International Conference on Software Engineering Workshops* (pp. 570-576).

Adaptation reported in:

Alberda van Ekenstein, F.J.P. (2022). Local values towards a local heat transition: *Guiding neighbourhood participation in the Dutch urban heat transition through the IAD framework.* Masters Thesis Complex Systems Engineering and Management. Faculty of Technology and Policy Management. Delft University of Technology.

Instructies:

Vraag uzelf alstublieft af: “Welke waarden zijn voor mij belangrijk als leidende beginselen in mijn leven, en welke waarden zijn niet of minder van belang voor mij”. Onderstaand vindt u een lijst met tien waarden. Deze waarden zijn wereldwijd als belangrijk voor mensen bestempeld. Achter elk van de tien waarden vindt u bijbehorende indicators ter verduidelijking.

U wordt gevraagd om te beoordelen hoe belangrijk elk van de 10 waarden zijn als levens leidende principes voor u. U kunt scores van -1 t/m 8 toekennen, probeer hierbij elke score maar één keer te gebruiken. Hoe hoger de score die u toekent des te belangrijker deze waarde in uw leven is. De onderstaande beoordelingsschaal dient ter ondersteuning:

-1	=	In strijd met mijn principes
0	=	Dit principe is helemaal niet belangrijk voor mij
4	=	Een belangrijk principe voor mij
7	=	Een zeer belangrijk leidend principe voor mij
8	=	Van het grootste belang als leidraad in mijn leven

Tips:

- Bekijk eerst rustig alle tien de waarden
- Ken hierna de score van 8 toe aan de waarde die voor u van het allergrootste belang is
- Ken hierna de score van -1 toe aan de waarde die het meest tegen uw principes ingaat
- Beoordeel nu de waarden met de overgebleven acht scores (0 t/m 7)
- Gebruik alleen hele getallen

Lijst met waarden:

Waarde	***Beoordeling*** -1 t/m 8
Macht: *Sociale macht, autoriteit en rijkdom*	
Prestatie: *Succes, bekwaamheid, ambitie, invloed op mensen en gebeurtenissen*	
Hedonisme: *Bevrediging van verlangens, plezier in het leven en zelfverwennerij*	
Prikkels: *lef hebben, een gevarieerd en uitdagend leven leiden en een opwindend leven leiden*	
Zelfsturing: *Creativiteit, vrijheid, nieuwsgierigheid, onafhankelijkheid en je eigen doelen kiezen*	
Universalisme: *Ruimdenkendheid, schoonheid van natuur en kunst, sociale rechtvaardigheid, een wereld in vrede, gelijkheid, wijsheid, eenheid met de natuur en milieubescherming*	
Welwillendheid: *Behulpzaamheid, eerlijkheid, vergevingsgezindheid, loyaliteit en verantwoordelijkheid*	
Traditie: *Respect voor traditie, nederigheid, aanvaarden van je deel in het leven, toewijding en bescheidenheid*	
Conformiteit: *Gehoorzaamheid, eren van ouders en ouderen, zelfdiscipline en beleefdheid*	
Veiligheid: *Nationale veiligheid, familie veiligheid, sociale orde, netheid, wederkerigheid van gunsten*	

F

Interview summaries

This annex contains summaries of all 13 interviews conducted. As mentioned in annex E, before participation households had to sign the informed consent form. Thus, all interviews presented are backed by said form. These 13 summaries contain a reflection of the core insights per interview, as interviews could range anywhere from 20 to 90 minutes. Participants were engaged without prior contact. This approach was designed to gain insights of those normally not attending meetings throughout nest three. That is what sets the analysis, and these summaries, apart. As nest four insights have been mostly based on spontaneous conversations in people's homes or gardens. Each summary provides only the personal information required for the purpose of this interview. As engagement has taken place with six homeowners and seven tenants of the KNSM-eiland. The summaries are ordered in chronological order.

F1. Resident 1 – KNSM-eiland - 11-04-2022

Background

This resident is male, senior and has been living within the neighbourhood for well over 12 years. He owns a house together with his wife within a complex in which decision-making is accomplished via a owners' association. The resident mentions that he is not very invested nor interested in the energy/heat transition. He does however has heard about stadswarmte or HTDH that could be potentially utilized within his neighbourhood. His main comment on this development is that it polarizes people, technical or in-depth knowledge is not something he pertains.

Main take-aways from the interview

- Does not have knowledge on plans of municipality regarding the heat transition
- He knows of the general neighbourhood commission, not specifically of the energy commission nor has he visited their information gathering
- He does attend half yearly owners' association meetings, this is however with a healthy reluctance
    - In general, these meetings are too bureaucratic, to many opinions (mainly from those who are trying to accomplish something or those opposing) which lead to too many unstructured discussions
- Knows that individual homeowners within the complex are not working on individual solutions towards the heat transition
    - And especially recognizes the potential of collective solutions, mainly regarding logistics, organization and finances
- Regard the heat transition; lies his trust within local parties that have proven expertise, technically educated people
    - These are the people that have the knowledge to make the right decisions for us all
    - Has a worse sentiment when bringing up the municipality and their role within the heat transition, mainly due to unrelated policy
- Does not have the intrinsic motivation to fully commit time and effort towards this transition, however this homeowner does find it interesting thus is willing to "stay up to date"
- When presented with the infographic, created through this research, reactions were very positive. A simple, quick and short way to come to core information regarding their transition, very insightful through the basics
- However, the main tendency is that this resident feels "too old" to be very engaged in this transition. Furthermore, it feels like it is not urgent at this moment, the matter stands "too far from his bed". The transition lies too far in the future to be actively engaged in it

F2. Resident 2 – KNSM-eiland - 11-04-2022

Background

This resident is female, senior and has been living within the neighbourhood for well over 12 years. She owns a house together with her man within a complex in which decision-making is accomplished via a owners' association. The resident mentions that she is not invested nor interested in the energy/heat transition at all. "This is something that should be left to the professionals"

Main take-aways from the interview

- Overall agrees with her husband, resident 1
- However, there are some key differences noted below in comparison to interview 1
    - Actually, she has no interest in the transition
    - Association meetings are not something that is frequented by this resident
        - Too much of a hassle, too much complaining and discussions
    - This whole transition should be left with those that have the relevant knowledge
        - Whether this is the municipality or local initiatives, it does not matter
    - Since, end the end, decisions are made for her housing she
        - Would engage when concrete decisions are to be made
        - Not through intrinsic motivation
    - Overall, it is just too much bureaucracy
    - "I'm too old to invest time into developing knowledge that could be useful"
    - "Let the young and smart of our society come up with fitting solutions, this is not something I should be a part of"
    - Thus, not negative towards the transition however just not interested or invested

F3. Resident 3 – KNSM-eiland - 11-04-2022

Background

This resident is female, senior and has been living within the neighbourhood for a very long time (around 15 years). She partially owns a house (the inside surface) within a complex, the rest of her house (the outside surface, hallways etc.) are owned by a housing corporation. Thus, this resident is partly homeowners partly tenant. Decision-making is accomplished via a mixed owners' association, in which the housing corporation covers a large share of the total association (around 57%). However, before the corporation can take decisions to the owners' association 70% of tenants have to agree with said decision. The resident mentions that she has no knowledge but is very interested in the heat transition, in part due to suspicion towards the housing corporation.

Main take-aways from the interview

- First the insights with regard to the housing corporation are presented
    - The group of "owner/renters", to which this resident belongs, are not included in the owners' association. This is since the majority of their property is still owned by the corporation
    - It is also stated that this group is poorly communicated with
    - The resident has too little trust in the housing corporation to lean towards a HTDH stadswarmte solution
    - Not only due to a lack of communication, but trust has also been broken since several matters have "gone behind their backs", such as financial inquiries
    - Also, since 70% of tenants (and owner/tenants) have to agree with corporation decisions regarding the transition, but on this topic information is also lacking. The housing corporation does not seem actively involved with their tenants whilst they still require 70% of votes to connect the complex to stadswarmte
    - This resident finds that there is little social support or interest from most tenants regarding the transition. Most would find anything acceptable as long as costs do not rise significantly
- Even though the resident does not poses knowledge regarding the heat transition, she remains very interested
    - "We have to leave natural gas behind at some point in time, so why not do it now. If we have to start off by paying a little extra that is fine"
    - However, it has to be done in a sustainable manner, sustainability is very important
    - The replacement of the FGO's within the complex has pushed the transition to stadswarmte very quickly, whilst tangible information on the solution remains to be received. Which again adds to distrust. Since she has read concerns but does not know the ins and outs of biomass and natural gas based residual heat
    - Once trying to dive deeper into the heat transition a lot of information, at time contradictory, is presented. So much so that she finds herself lost in the complexity of it all. Is aquathermal too innovative? To unproven? Is stadswarmte that bad for the environment? What are the costs? Why are we not supporting innovations instead of lining the pockets of large monopolists?
- The resident is extremely happy with the work of the local energy commission
    - This commission has earned a lot of trust from her, as they tend to local concerns and interests. It is truly by and for the neighbourhood. Also due to the fact that this commission can communicate with the municipality and perhaps steer their plans. As no meaningful connection between the municipality and

the neighbourhood has led to little trust nor faith. She attends many meetings, however the highly technical nature can be daunting

- She finds trust the most crucial aspect to the heat transition, or perhaps distrust is more impactful on current and future processes
- Once presented with the flowchart she found it extremely convenient, compact and clear. Especially for the more senior inhabitants of the KNSM-eiland this could be of great additional value
    - As she sees most as layman, which could benefit with such core information
    - Also, since the current overflow of information can be confusing
    - It remains of great importance that information is brought objectively, since it is hard to figure out whom or what to believe
- It is clear that a lot of value is put towards engagement and trust, how should this be achieved according to this resident?
    - Open and honest conversations
    - Engagement (not invited perse)
    - Initiative from those creating policy or plans
    - Engagement through understanding
    - Equal chances for every type of question, whether they are “simple” or not
    - Information should be provided from a central, neutral entity

F4. Resident 4 – KNSM-eiland - 14-04-2022

Background

This resident is female, adult and has been living with her partner within the neighbourhood for a very long time (18 years). She is a tenant within a small housing complex, owned by a housing corporation. Thus, decision-making is accomplished via 70% of tenant's agreement. With an academic (technical) background she finds aquathermal concepts for heating to be very interesting. However, at this stage there is little motivation/interests to attend meetings regarding sustainability or the local heat transition.

Main take-aways from the interview

- Has mainly negative experiences with the housing corporation regarding transitions towards sustainability
    - Trying to switch to electric cooking took their household over 2 years to get done. As the corporation had to provide new electricity groups which proved to be difficult since communication was very poor and still is not fully completed
- As of now, interested in sustainability and innovations as she has tried to get solar on the premises. However, actively engaging within the heat transition is not something that is within her current interests
- This resident acknowledges the pros of switching to stadswarmte or HTDH. However, she wants to be completely independent of natural gas. Furthermore, biomass is not a source of heat in which this tenant has faith. At first aquathermal was new to her, but the concept of this innovation sounded very interesting and promising. She did state not to have much knowledge regarding the in-depth technical and managerial sides to the heat transition. This does not matter that she is not interested and that she would like to voice her opinion at some point
- This tenant also finds trust to be a major part of any transition
    - Trust is complex and can be a barrier
    - Social acceptance is key
    - Nobody wants imposed decisions from higher up (national or municipal decision-making) when it hits this close to home
- Very happy with local initiatives, such as the energy commission, however it does present a conundrum
    - Are local initiatives capable enough? Is there enough knowledge and professionalism?
    - Are they eventually pressing their own agenda?
    - Could end up resulting in more delays and confusion then when one central entity would make decisions for entire cities or neighbourhoods
    - The resident prefers true professionals
    - However, the advantages of such local initiatives are very clear
- Overall, this transition is found to be
    - Extremely complex, so many stakeholders that are all entitled to their own opinion
    - How should the collective operate and make decisions?
    - Urgency nor momentum is truly present at this point in time
- Finally, the flowchart was found to be insightful. It could however do with less information (this interviewee was presented with a working version or draft 4, the final version indeed has less information)

F5. Resident 5 – KNSM-eiland - 14-04-2022

Background

This resident is female, senior and has been living within the neighbourhood for over 7 years. She owns a house within a complex. Thus, this resident is homeowner, decision-making is accomplished via their owners' association. The resident mentions that she has knowledge and is very interested in the heat transition, in part due to owning a house within a larger complex. So that communal decision-making will have to take place as solutions for future heating are bound to be collective.

Main take-aways from the interview

- Within her complex a lot of residents are interested in the heat transition, which has made this interviewee interested too. Furthermore, it has provided her with a lot of information and other opinions
- Both aquathermal and stadswarmte are known
    - A concern here is that other solutions are being excluded. "There is still the potential of hydrogen and others right? We cannot be sure how the technology is going to develop in the coming years"
- The main question here is when it is going to be relevant for this resident
    - When is this transition of importance to me?
    - Am I going to be able to enjoy it? Is it useful for me?
    - Am I going to have to invest? Do I want that?
    - When is it truly urgent? Is it my place to do something in this transition?
- Intrinsically positive regarding the transition, sustainability is of great importance
- But when is the time to decide?
    - The urgency towards decision-making at this point is non-existent
    - Through those invested within their building the resident remains up to date, not through constant attendance of meetings
    - Deciding now is made impossible by the shroud of uncertainty covering every aspect of this transition
- If decisions are to be made on a neighbourhood level
    - Then it is better to do so locally, by and for the neighbourhood
    - Municipalities are too busy to extract local values and needs
    - The more local, the more engagement with actual locals
        - Resulting in more social acceptance and smarter decision-making
        - It might be slower but thought to be better
    - Top-down decision making by government and municipality will not work
        - Will find more resistance
        - Will result in more delays
- Age plays a significant role within this transition as stated by the participant
- All those involved heavily within this transition are currently not delivery any signs of urgency, whilst this should be done. Currently, decisions regarding potential private money households have to invest are not hold since there is no tangible need yet to decide or invest
- Problems or risks always seem to dominate conversation
- "When the time to actually decide arrives I will start actively engaging, however that time is not now"
- Current information flows from commissions and sorts is fine, it lacks detail but that is to be expected
- When presented with the flowchart the initial reaction was positive, "it looks great"

F6. Resident 6 – KNSM-eiland - 02-05-2022

Background

This resident is male, senior and has been living within the neighbourhood for around 30 years, one of the first residence of his building. He is a tenant within a small housing complex, owned by a housing corporation. Thus, decision-making is accomplished via 70% of tenant's agreement. The resident mentions that he has no knowledge nor a lot of interest in the heat transition, which could be due to the fact that he has not gained a lot of information. It is certainly due to the fact that corporations will have to initiate such transitions, as tenants do not feel very powerful.

Main take-aways from the interview

- The conversation started off with a statement regarding a lack in knowledge, merely being brought up to speed with the transition through a folder send by the corporation. This folder contained some information on stadswarmte, and that it will become sustainable in the future (no in-depth info)
- In essence, this tenant has no problem with a monopolist providing heat to his building. Although it is acknowledged that more parties will lead to more market workings. This again could also lead to "trouble"
- It is his belief that the more important matters within this country are designed by larger corporations, as they are most influential on governmental policy. This is not steered by locals. Through this rational he lacks confidence in local parties for the design of their heat transition. With most of his concerns lying in the fact that locals are no professionals, since such a complex process requires expert knowledge. Furthermore, locals have too many opinions, will the correct decision be made in the end?
- That is why he will only give his opinion once a "informed" decision can be made, once all facts are determined by professionals. Facts such as
    - Costs
    - Technical viability and reliability
    - Housing corporation stance on the matter
    - Organization
    - Future proof? Durable?
    - Sustainability
- At this point his house has a high yield central heating system, so personally there is no need to rush
- Also, there is a belief that the whole transition would be better off by laying the focus on the newly built environment, not on older housing. For now, solar panels would be the easiest implementation for older buildings
- Due to the need for more information to form an opinion, the transition also has no urgency for this tenant. Furthermore, the housing corporation will likely determine their course of action regarding this transition
- Finally, again regarding the lacking momentum and urgency, the question remains when one should really start to engage? When is it truly of importance? "This will not happen between now and at least ten years"
- "When all the technical, institutional, and financial research has been done, then I would like to receive a complete information package. Since from this point on one can truly form an opinion and make decisions"
- According to the tenant all of the tenants feel like this, more so they feel that the corporation will decide in the end.
- The only form of urgency that currently exists is that off "take easy gains by focussing on the newly built environment, not here"

F7. Resident 7 – KNSM-eiland - 02-05-2022

Background

This resident is male, senior and has been living within the neighbourhood for over 20 years. He rents a house together with his wife, within a relatively small complex. Thus, this resident is tenant (within social housing), decision-making is accomplished via the housing corporation. The resident mentions that he has knowledge and is very interested in and enthusiastic over the heat transition, in part due to a background in social work. Especially with a focus on creating a healthy world in which everyone wants to live and receives equal treatment (based on earlier Dutch communist views).

Main take-aways from the interview

- First of all, this gentleman attaches great value to the way through which people interact with each other
    - Would love to see more social cohesion within the neighbourhood
    - Especially between tenants (social) and private homeowners
- According to him the tendency of tenants is that they would like do more regarding sustainable living and heating, since this would also save them money
- “This is not a discussion relevant for future generations, for my children, but also one that hits close to home. It is also of important in this very moment, for me and my wife”
    - Finds that there is a lot of urgency to transition the current heat supply
    - One of the most complex challenges in our country now
- Has a strong feeling that private homeowners are reluctant to invest, amongst them there is little to no social acceptance to transition now
- Tenants find themselves in a though spot, as they cannot truly influence the course of their transition
    - Housing corporations are very influential
    - There main motive is and will always be making money
        - And their operate through their deals with municipalities and large energy/heat companies
    - Thus, little trust can be placed in housing corporations
        - He has not received information, there has been no meeting for tenants
    - Furthermore, the gentleman has very little faith in the municipality
        - Does not want to be steered towards local monopolies
        - Finds that municipalities are only truly influenced by larger parties
        - Finds that municipalities do not have what it takes to make long-term decisions (also due to their nature/organisation)
- Would prefer the KNSM-eiland to be frontrunner in this transition through an innovative and sustainable low temperature heating network, as he finds this neighbourhood to be the ideal testing ground
    - However, this local transition is not to be led by neighbourhood commissions and associations. These entities are in place to ensure social welfare within the neighbourhood, not to engage in such complex matters
- The only way a local energy initiative is feasible is when the whole neighbourhood unites and makes their wishes heard with the municipality. This could be achieved through pressure via local news or television. Unfortunately, the municipality now only focusses on the large deals that have been made (referencing to stadswarmte exploitation). He finds that the local focus of this transition is lost through such deals

F8. Resident 8 – KNSM-eiland - 05-05-2022

Background

This resident is female, adult and has been living within the neighbourhood for a long time. She rents a house within a large complex. Thus, this resident is tenant, decision-making is first accomplished via 70% of tenant's agreement. Then issues or initiatives are decided upon within the mixed owners' association. The resident mentions that she has little (technical) knowledge nor is very up to date regarding developments within the heat transition. She however has voted for a complex connection to the stadswarmte network (HTDH).

Main take-aways from the interview

- Had just received a new kitchen and is already cooking electric, so switching to stadswarmte did not seem like such a hassle. Once she received the letter, to show preference for either stadswarmte or not, from her housing corporation she thus voted for the solution. She did mention that this was received on a short notice, without extremely extensive information. Furthermore, due to this short notice, she doubted whether the 70% would actually be met. This does not really matter according to her
- Urgency for them occurred through the need to replace the FGO's within the complex. This was motivational since they would otherwise be stuck with new FGO's (and thus natural gas) for at least 12 more years. Furthermore, the geo-political situations and gas prices have played a role towards the momentum/urgency
- Madame thinks that this transition should have just been decided through a simple and clear policy (top-down)
    - It was not the right move to "let everyone have a say"
    - This takes too long and makes it too complex
    - It should have been a short, clear and quick decision
- Thus, when stadswarmte was presented as an option
    - A lot of tenants seem to find this an ok solution, since they were confronted with a choice in an instant
    - As they do not want to pay for gas for twelve more years
    - This was also the only alternative presented by the housing corporation
    - And since the housing corporation presents this as the one and only option it feels fine
        - Better than when the municipality would now force a solution
    - The choice to vote for stadswarmte was purely practical, "don't be too difficult"
    - The choice was not to further use natural gas, thus a switch to stadswarmte
- So, even though madame has no technical/institutional knowledge, the choice was guided through
    - Urgency/confrontation, values brought up by war, finances, health risks through FGO's and sustainability. This could be seen as a "natural urgency" which presented itself, basically independent from most information regarding the transition. A choice had to be made, simple as that.
- Had hear of aquathermal through the energy commission, however this sounded like something which would take a lot of time to develop and implement. Furthermore, it sounded like it could be more expensive than stadswarmte
- Finally, the monopolistic positions created through stadswarmte did receive critique
    - No free choice, nor the option to compare, in heat provider is a definite con
    - However, cost indications seemed fine
    - Did find that the connection between housing corporation and municipality is very tight, but since the corporation presented the final decision it felt more trustworthy

F9. Resident 9 – KNSM-eiland - 05-05-2022

Background

This resident is male, adult and has been living within the neighbourhood for some years (2/3). He owns a house within a large complex. Thus, this resident is homeowner, decision-making is accomplished via their owners' association. The resident mentions that he has some knowledge but is not very interested nor up to speed regarding the local heat transition. Most importantly this gentleman is extremely pragmatic.

Main take-aways from the interview

- The homeowner finds that the local heat transition is not a "topic" in his environment right now
    - There is no urgency, not in conversation nor in meetings with the owners' association
- The most important aspect is that homeowners are going to have to pay for this transition at some point
    - Thus, what is this transition going to cost us per household?
    - Around 80% of his motivation for certain decision-making is based on finances
    - Besides this, the main point of importance is that households are enabled to make a clear and informed consideration of all alternatives
- When considering HTDH versus LTDH (aquathermal)
    - "It's all fun and games but.."
    - What are the costs?
    - How does it impact quality of living?
    - What is the reliability? What is the quality of the system?
    - Do we remain independent?
- Autonomy is very important to this homeowner
    - Does not want the municipality to make a decision which impacts him this directly, prefers bottom-up decision-making
    - Thus, at some point in time, will be involved with the local heat transition, willing to (in the future) pay more to remain independent
    - But again, mainly a person of numbers. First reliable and clear information needs to be presented before informed discussions can start
- There is no rush, the fact that natural gas will eventually be disconnected is a given. However, this will take at least 10 to 15 years
    - Making older housing natural gas-free is a slow and complex process, unlike the newly built environment
    - Thus it makes more sense to shift focus towards these types of buildings
- If at some point in the future the information required is gathered, then local decision-making will take over and he will be engaged in the process. This will remain a challenge as owners' associations are very slow decision-making areas. However, again the lack of urgency is emphasized. There is no rush, this transition needs more time to develop. The technical alternatives can still further innovate and develop, perhaps leading to lower costs or more feasible businesses case

F10. Resident 10 – KNSM-eiland - 05-05-2022

Background

This resident is female, senior and has been living within the neighbourhood since 1995. She owns a house within a large complex. Thus, this resident is homeowner, decision-making is accomplished via their owners' association. The resident mentions that she has some knowledge but is mainly interested in the local heat transition through intrinsic motivation. Wanting to create a better world for current and future generations. Pertains a great sense of fairness and equality.

Main take-aways from the interview

- The FGO's within the complex have been replaced 1,5 years ago. Furthermore, within her household induction cooking is already the standard and the main central heating system has been upgraded
- Is up to date regarding the work of the energy commission and the discussion surrounding a natural gas-free KNSM-eiland.
    - She expects the owners' association to make the first steps towards the transition within their complex
    - The solution presented should thus be a collective one, as she would like to see heat pumps or DH systems. This transition, within the urban context, should not be tried to be achieved via individual solutions
    - However, within the building (and thus the association) the transition is not urgent or actual at all. Mainly since central heating installations are up to par and that the FGO's have been recently replaced. Since homeowners will have to finance their own transition there is little urgency to start now, as previous investments result in a period of at least 10/15 years before systems are up for replacement again
- There is however a strong feeling of urgency when conversing with this homeowner
    - Whatever little changes she can make herself she will
        - Lowering the temperature of her central heating and putting on warmer clothes, so simple but yet such a revelation
    - Urgency stems from
        - Current situation in the world
        - Natural gas extraction from Groningen
        - Gas prices
        - Sustainability and renewability
        - Fairness, division of goods and resources, worldwide
    - "We need to leave natural gas behind as soon as possible, tomorrow is essentially too late"
        - If needed utilize second best options such as stadswarmte
        - And keep innovating and developing
        - Rather see progress than never ending discussions
- Information supply is key for awareness
    - For this homeowner it has lowered many a barrier
    - Mainly through friends actively engaging in sustainable measures and initiatives
- A final comment is that, eventually, it is of great importance that decision-making regarding local transitions happens in a democratic manner. Thus, within her urban context, the owners' association should have the final say. Not the municipality for instance

F11. Resident 11 – KNSM-eiland - 05-05-2022

Background

This resident is female, adult and has been living within the neighbourhood for at least 6 years. She rents a house within a smaller complex. Thus, this resident is tenant, decision-making is accomplished via 70% of tenant's agreement. Often initiated by the housing corporation owning the complex. The resident mentions that she has little (technical) knowledge nor is very up to date regarding developments within the heat transition. The main consensus of the conversation is that decisions do often lie with the housing corporation, thus as tenant there is not much influence to exercise.

Main take-aways from the interview

- Via the housing corporation this tenant had managed to switch induction cooking
    - The corporation ensured proper connections; the tenant invested in the hardware
    - Also, a fairly high return central heating system is installed within the household
- Main consensus is that, since this participant is a tenant with a housing corporation, she cannot be very involved in their local heat transition. As decision-making does not truly lie with tenants but mainly with the corporation
    - However, if something is to be decided the following is of importance
        - Costs
        - What is truly sustainable
        - Dependency on foreign gas supplies
    - And urgency is not really here right now
        - "only if actual decisions are to be made, then true urgency presents itself"
        - As a tenant there is automatically less urgency
        - It stands "too far from my bed", in other words this transition is not really hitting close to home at the moment
        - The current geo-political situation does add something to the awareness, as do the current gas prices
    - The transition does not "live" within the complex as a topic of conversation or discussion
        - "We as tenants aren't going to decide anyway"
        - No real choice equals no real interest
        - And since the housing corporation is not engaged with the topic, urgency is not forced
    - At some point, when neighbourhood level decisions are to be made, it would be fine if this is done either locally or on a municipal plane
        - "No problem if an alternative is selected for us"

F12. Resident 12 – KNSM-eiland - 09-05-202

Background

This resident is female, (younger) adult and has been living within the neighbourhood for 3 years now. She owns a house within a large complex, together with her partner. Thus, this resident is homeowner, decision-making is accomplished via their mixed owners' association, in which a housing corporation has a significant share. The resident mentions that she has little knowledge and is not that interested in the local heat transition. A realistic view on the transition however is of great importance for her, everyone should be able to comfortably afford the transition. Finally, a long-term and future proof approach to the transition should be taken, not being led by policy varying from year to year.

Main take-aways from the interview

- As mentioned, this homeowner has little knowledge of the heat transition, however a rather strong opinion is formed throughout engagement
    - "Plans and policy are all fun and games, they can sound great but they should mainly be tailored to the average Dutch household. As currently policy measures are simply too expensive for households to implement"
    - Of course, this transition is of great importance, however it is still too early to negotiate serious measures or plans
        - Clearly not being a fan of the push towards stadswarmte that is unfolding itself within her complex
- This homeowner is considerate and mindful
    - As questions are being posed upon the sustainability of current alternatives
    - Perhaps new technology in 3/5 years will grant us with alternatives that are way more sustainable and future proof
    - As it is important for measures taken now to be up to par in future situations
    - She does not want a change in policy, plans or technology every 5 to 10 years
        - This is not sustainable!
    - The social aspect to this transition is also very important and underexposed at this moment
        - Is every able to afford current plans set out?
    - Thus, first it is important that long term research is done
        - This should be done through local energy initiatives
        - Not by municipality nor national government, as she has little faith in these entities. They have proven themselves to be incapable of long-term decision-making far too often
        - Local expertise's should be utilized, led by younger generations with relevant knowledge and know-how
            - Not only technical but also social
- The current geo-political situation, including rising gas prices, have added some urgency to the discussion. However, this is not merely enough to actively stimulate engagement
    - It mostly leads to people being more aware of their energy usage, lowering temperatures in housing and sorts. It does not lead to an urgent need to transition current heating systems. The urgency for the heat transition will only come once a complete package of information can be provided. Since homeowners do not want to rush decisions based on too little information

F13. Resident 13 – KNSM-eiland - 09-05-2022

Background

This resident is female, senior and has been living within the neighbourhood for around 30 years. She rents a house within a large complex. Thus, this resident is tenant, decision-making is first accomplished via 70% of tenant's agreement. Then issues or initiatives are decided upon within the mixed owners' association. The resident mentions that she has is up to date regarding developments within the heat transition. She finds sustainability key and would like to live in an extremely sustainable (newly built) housing environment.

Main take-aways from the interview

- As mentioned, sustainability is very important to this tenant, when the opportunity presents itself to live in an innovative and extremely sustainable environment, she would gladly take this chance. However, currently she still rents an apartment within a large housing complex, owner by private parties and the housing corporations from which she rents
- Due to the ongoing debate on the replacement of the FGO's within their complex she has voted for the corporation's initiative to switch to stadswarmte
    - Even though she is actually against stadswarmte in it's current form (as HTDH system), since she protests the current heating sources of either biomass or natural gas (these are not sustainable)
    - However, a choice had to be made and this was the only option in her eyes that at least makes her heating a bit more sustainable
        - Furthermore, the housing corporation told her that there are plans to eventually make stadswarmte more sustainable, apparently through hydrogen
        - Since this is the only alternative that is ready to deploy, and due to the promise of increased sustainability in the future, this tenant agreed to stadswarmte
- If there had been no urgency through the need to replace the FGO's, then she would have preferred a local energy initiative in the form of a LTDH network
    - As she had heard about the potential of aquathermal and the work of the local energy commission
- However, an understanding for the practical choice of the housing corporation, and by extension that of the municipality, was presented
    - As she understands the complexity of decision-making in such contexts
    - This is almost impossible to undergo if everyone gets to have their say
    - Furthermore, the stakes/interests of tenants are admittedly different than those of homeowners
- A major downside to stadswarmte, beside lesser sustainable potential, is the fact that one is assigned to a local monopolist. This takes away the options to choose for the most sustainable heat supplier
- Finally, urgency and understanding could have been enhanced if the housing corporations would have started the conversation of this transition with its tenants, instead of with the heat company

F14. Residents declining interviews – KNSM-eiland - 2022

Main reasons for declining an interview

- “I have no knowledge on the subject”
- “I’m not interested in the subject”
- “This transition is still such a long way off”
- “I know nothing about the transition”
- “I can’t say anything useful on the subject”
- “This is something I don’t have to engage in at this point”
- “This transition does not worry me now, maybe in ten years”

Explanation and reaction

Many comments, especially those regarding a certain knowledge barrier, were tactfully countered by the researcher. Focussing on not overstepping on anyone’s free time or feelings towards the subject. However, even after explaining that knowledge (or even interest) on the subject is not required most still declined for this exact reason. Which could potentially show that people are afraid to engage in conversation on the topic due to their lack of knowledge. Ofcourse, many other factors come into play when asking people to sacrifice free time for an interview. Thus, this statement is to be taken lightly.

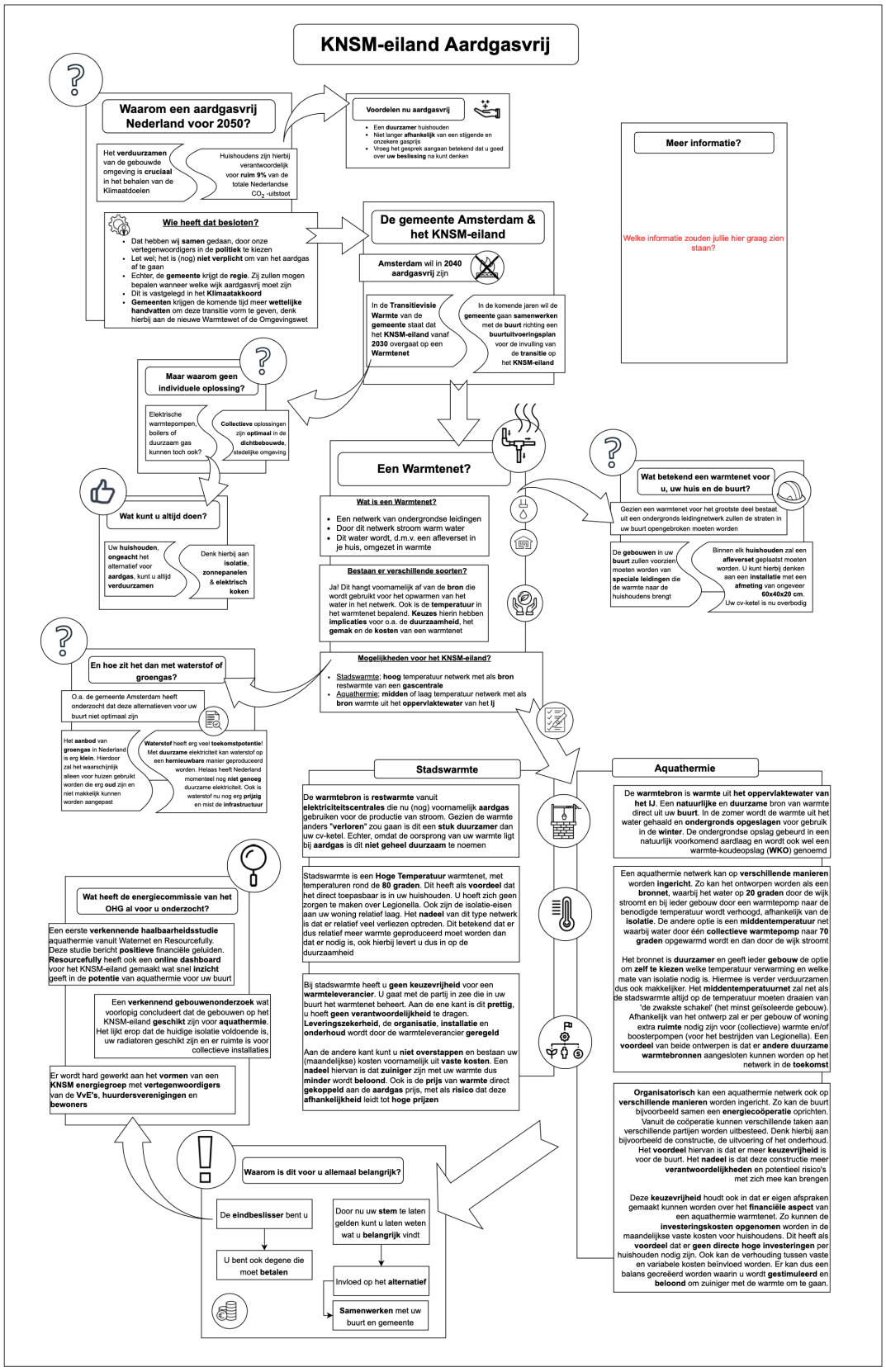
G

Designs of artefacts

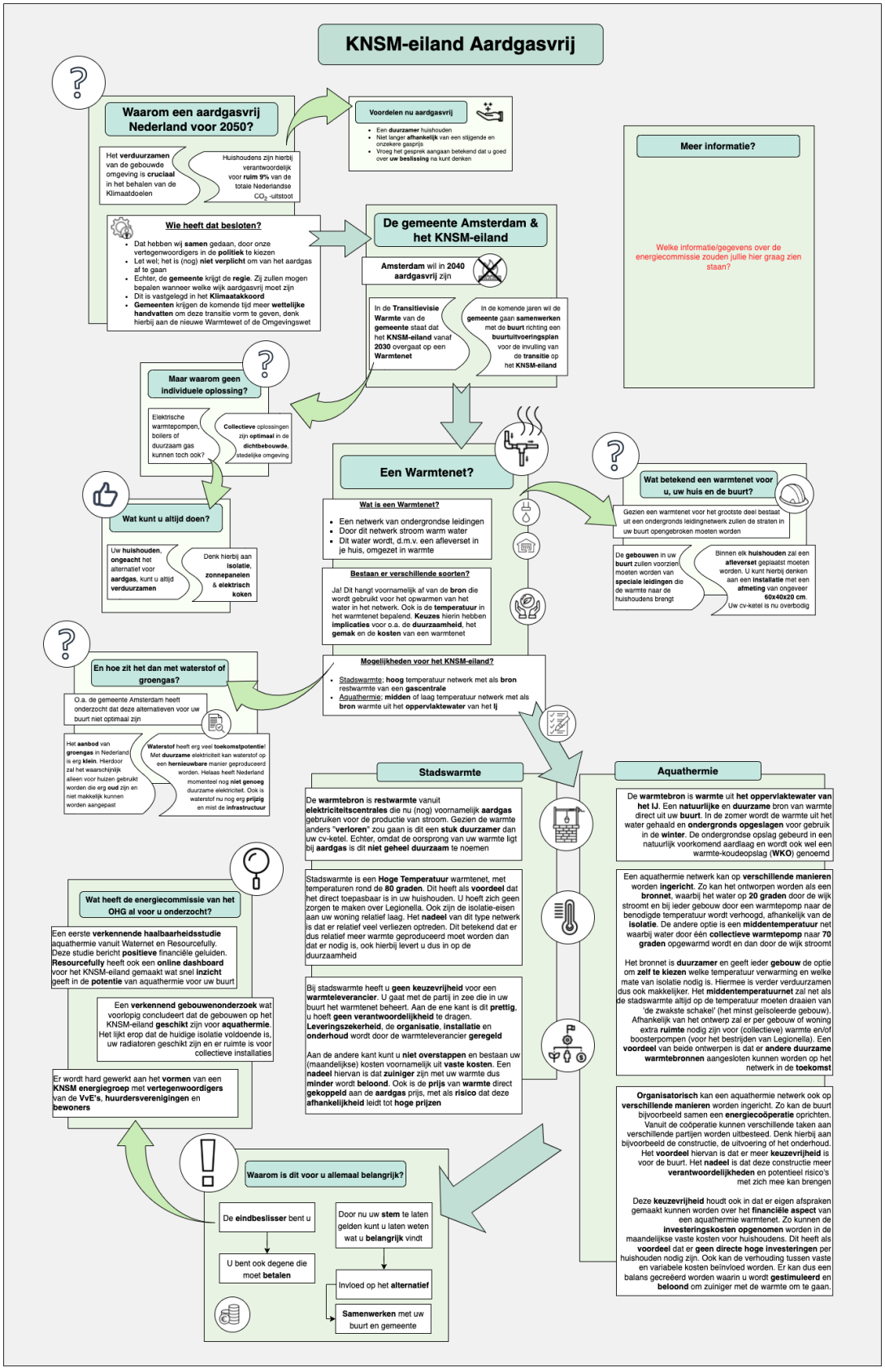
This annex contains the chronological evolution of the artefact design utilized throughout this thesis. Not all iterations have been included, only those portraying significant changes are presented. This iterative process has taken place in collaboration with the local energy commission. In specific, the design finds its roots through analysis and insights of prior participation with households. From this point, the first design was brought to live after a meeting with the frontrunners of this local entity. Once approved, the iterative process towards the final version has been conducted in collaboration with the publication and relations team of the local initiative. Mostly working with a former career expert. Although it must be mentioned that this team has kept a supporting role, providing valuable feedback but not influencing key design decisions. As it remains a product of this research.

This infographic has proven to be of high value, as it has helped engagement throughout nests three and four. Furthermore, it has been implemented in the real time heat transition of the KNSM-eiland (and used for surrounding neighbourhoods). As it is available on multiple websites, printed in the local newspaper, utilized for informational flyers and included in a subsidy application. Further feedback on the infographic can be found throughout summaries presented in annex D and F.

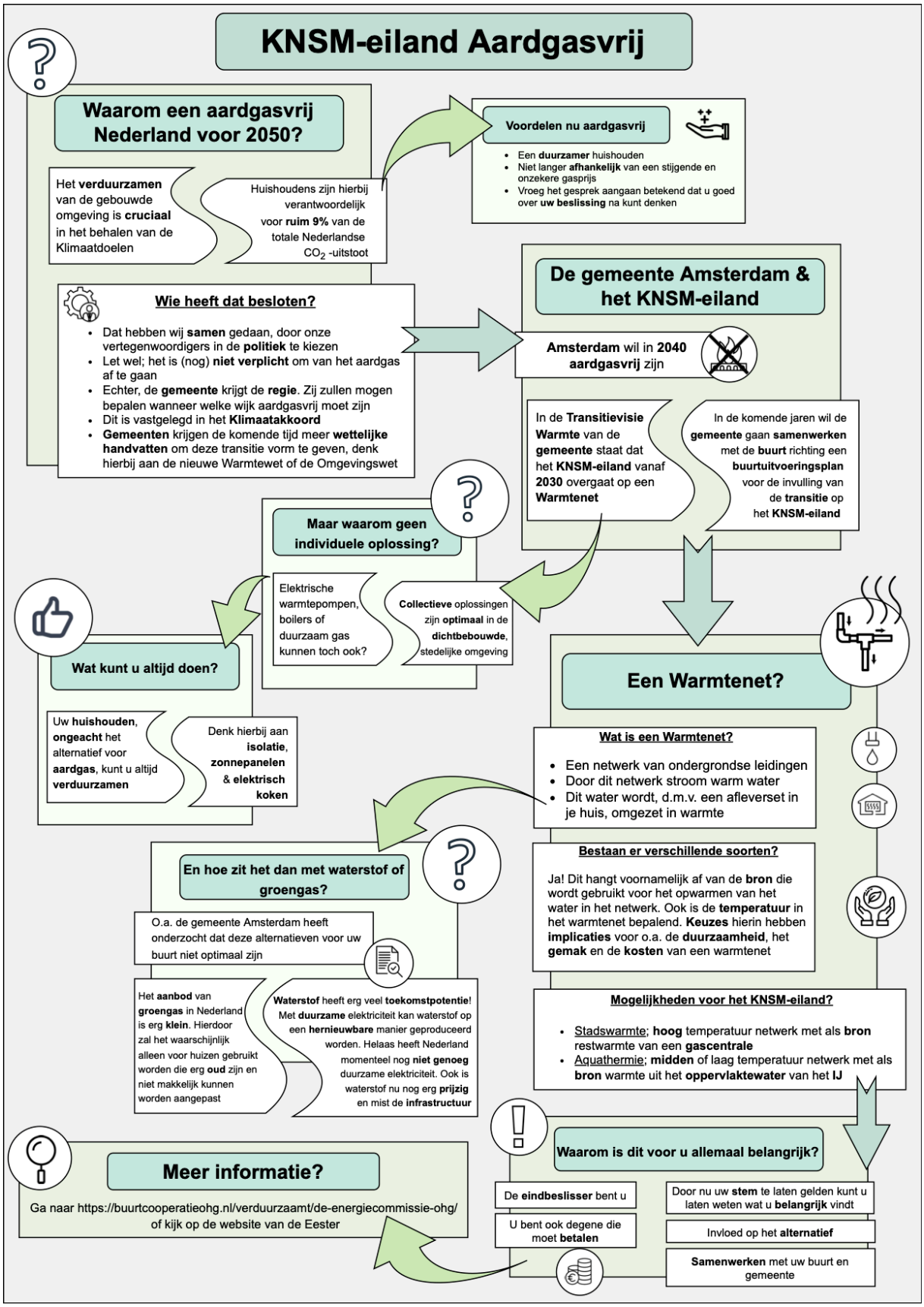
G1. First infographic draft



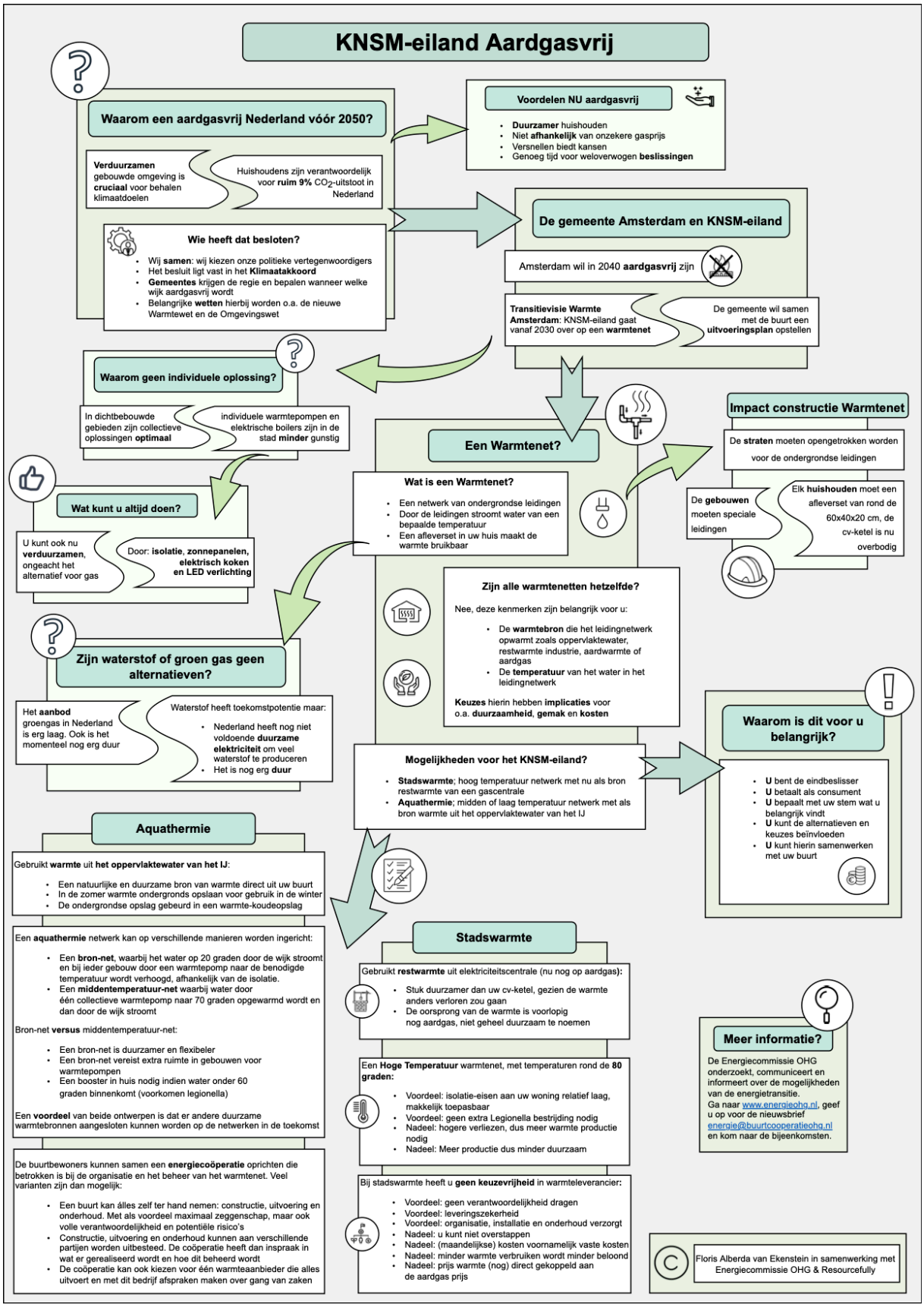
G2. Second infographic draft



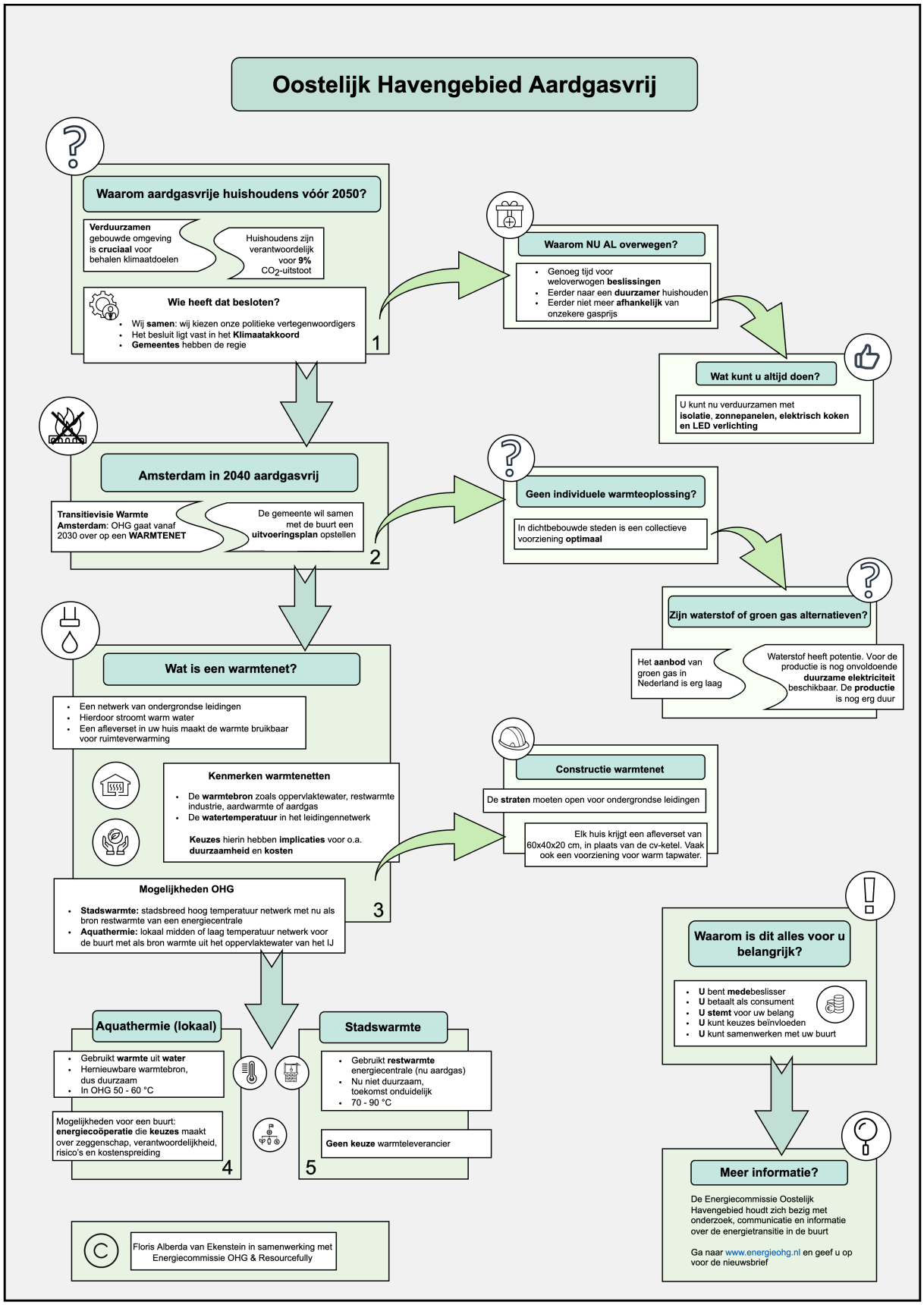
G3. Third infographic draft



G4. Fourth infographic draft



G5. Final communication infographic natural gas-free neighbourhoods



H

Dutch research handout to support practise

This annex contains a Dutch summary of this thesis, in the form of a folder or handout. This artefact has been designed in such a manner that it is easy to read, in line with key findings for practise and relevant for those aiming to utilize this research's design for their heat transition. As such a product is called for from practise.

Folder besluitvorming en participatie

De stedelijke warmtetransitie op buurtniveau - KNSM-eiland Amsterdam

Over deze folder

De informatie in deze folder is gebaseerd op de afstudeerscriptie van Floris Alberda van Ekenstein. De scriptie is ingediend voor het behalen van de master "Complex Systems Engineering and Management" aan de TU Delft. Het doel van deze folder is om een gecondenseerd en praktisch inzicht te bieden in het onderzoek naar besluitvorming op buurtniveau binnen de Nederlandse stedelijke warmtetransitie. Centraal in dit onderzoek staat het gebruik van een op maat gemaakt framework. Dit framework biedt de gebruiker een lens om complexe processen gestructureerd te analyseren. De toepassing hiervan leidt tot een proces waarin participatie en waarden het middelpunt bekleden. Binnen dit onderzoek is het kader toegepast op de warmtetransitie van het KNSM-eiland in Amsterdam. Voor meer tekst en uitleg wordt u aangemoedigd het volledige onderzoek te raadplegen.

Aanleiding onderzoek

- **Noodzakelijk** om CO_2-uitstoot van de gebouwde omgeving te verminderen
- **Gemeenten** moeten, samen met huiseigenaren, uitvoeringsplannen opstellen
  - Concrete ontwerpen voor de warmtetransitie op buurtniveau
  - Steun en acceptatie door samenwerking, niet door besluiten opleggen
- **Participatie** is cruciaal gezien huiseigenaren verantwoordelijk zijn voor investeringen
- Het geconstateerde **probleem** is dat beleidsmakers niet beschikken over het gereedschap om participatie in te richten
  - Waarmee buurten en hun huishoudens beter begrepen kunnen worden
  - Waarmee besluitvorming binnen de lokale context beter ondersteund kan worden

Doel onderzoek

Het ontwerpen van een kader waarmee besluitvorming op buurtniveau binnen de Nederlandse stedelijke warmtetransitie kan worden ondersteund

Maar wat is participatie?

"Een proces waarbij het publiek wordt betrokken bij het nemen van beslissingen "

Waarom?

- Richting een aanpak op maat
- Contextuele inzichten voor betere besluitvorming

Maar ook omdat

- Je mening geven een democratisch recht is
- De maatschappelijke acceptatie te vergroten

Wat gaat er nog momenteel nog veel fout?

Valkuilen traditionele participatie

- **Lokale publieken** en hun **waarden** worden vaak vergeten
- De standpunten van bewoners worden **verondersteld** en **gestereotypeerd**
- Dit leidt tot decontextualisering
- Een **niet-representatieve** weergave van de lokale context heeft tot gevolg dat de stille meerderheid buiten beschouwing wordt gelaten
- **Ethische** connotaties gaan vaak verloren
- **Sociale conflicten** worden vermeden i.p.v. behandeld

Hoe kan dit beter?

Vereisten moderne participatie

- **Vermijd** "technocratische en populistische" valkuilen
- **Erken** en **betrek** een verscheidenheid aan belanghebbenden, inclusief standpunten en waarden
- **Gebruik** lokale verwachtingen als **uitgangspunt** voor participatie
- **Focus** op contextuele, directe en tastbare barrières
- **Verzorg** grondig inzicht in de te nemen **beslissingen**
- **Omarm** sociale conflicten

Van theorie naar kader

Gereedschapskist besluitvorming via participatie

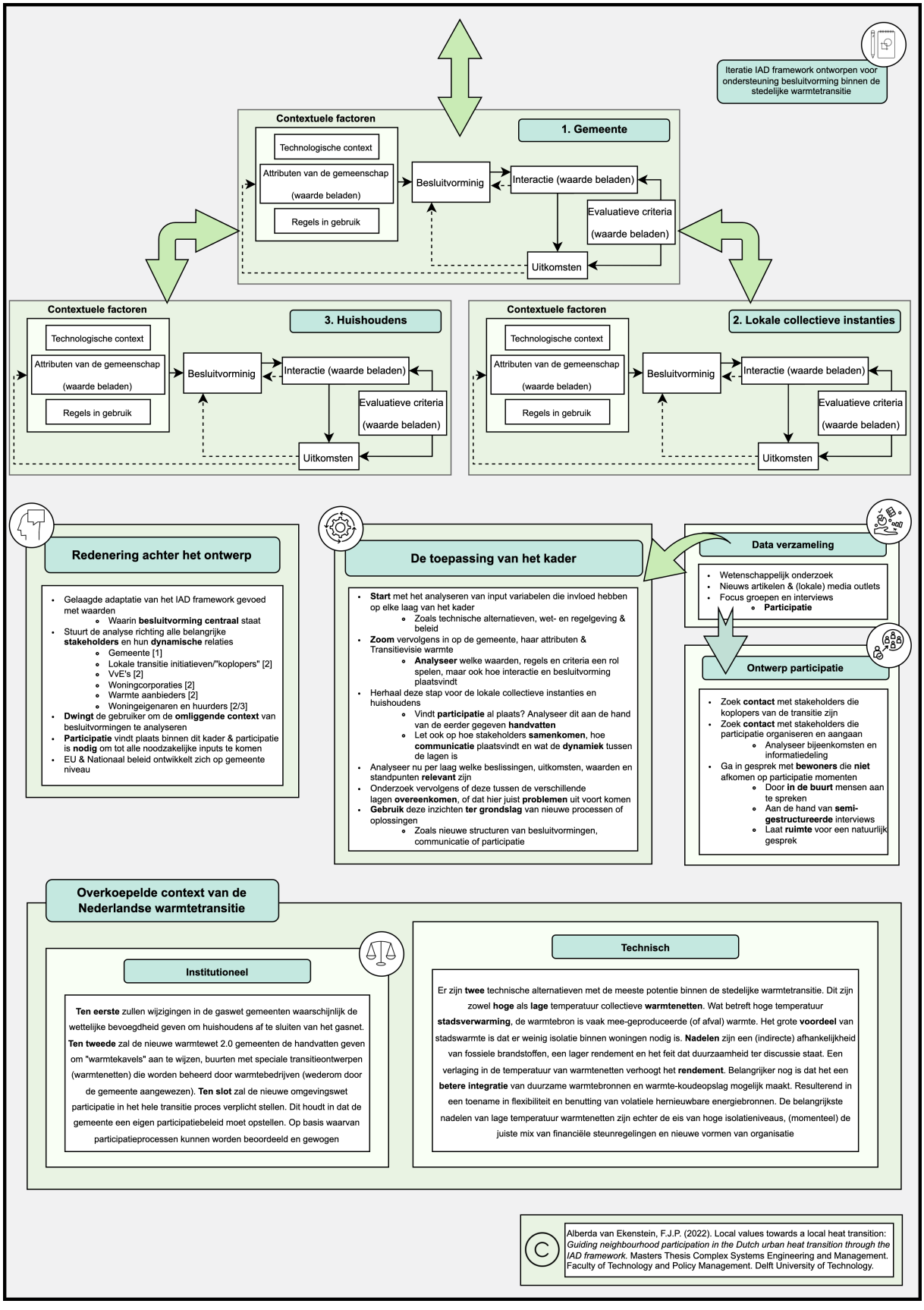
- Iteratie op het **IAD framework** van Nobelprijs winnares E. Ostrom
  - Kader voor Institutionele Analyse en Ontwikkeling
- Een kader dat complexe en dynamische processen **ontleedt** in cruciale en beheersbare onderdelen
  - Waarin besluitvorming centraal staat
- Het is **geen** stuk gereedschap wat een oplossing zal dragen
- Dit kader biedt de gebruiker een **lens** om complexe processen gestructureerd te analyseren
  - Om tot **nieuwe inzichten** te komen die kunnen dienen als de basis voor **oplossingen**

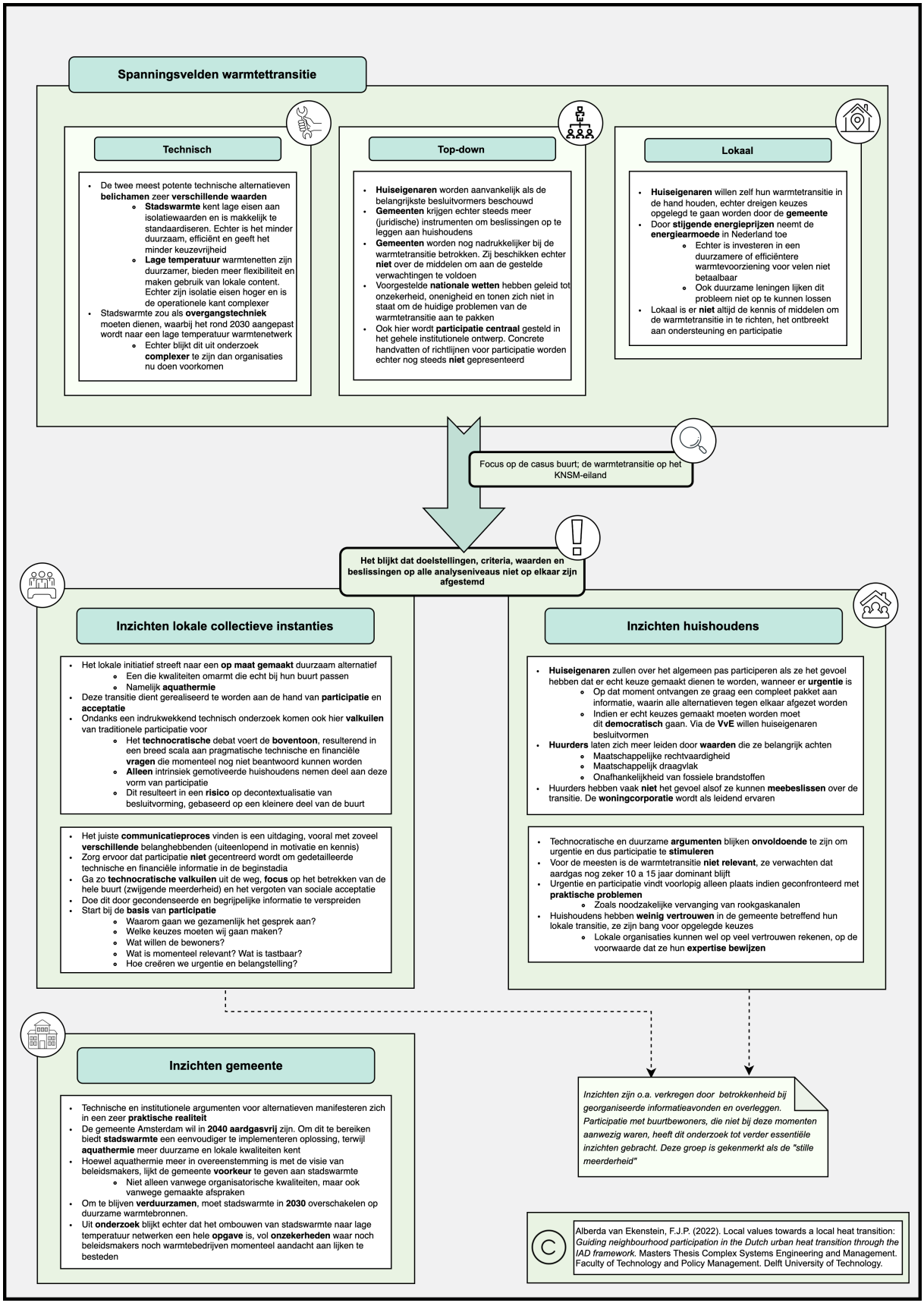
***Technocratische** valkuilen hebben betrekking op het uitsluiten van standpunten en gevoelens van lokale gemeenschappen door louter wetenschappelijke of technologische argumenten te gebruiken*

***Populistische** valkuilen hebben betrekking op het verwaarlozen van de complexiteit van waarden, technologieën en belangen die in het geding zijn binnen de warmtetransitie*

Belang van waarden voor een gelaagde analyse

- Waarden **sturen** menselijk gedrag
- **Socio-technische** systemen, zoals de warmtevoorziening van een wijk, **vertegenwoordigen** publieke en sociale waarden
  - **Veranderingen** in deze systemen dienen vertaald te worden naar veranderingen in waarden
  - In een **warmtetransitie** dienen waarden dus in acht genomen te worden
- Een beter begrip van waarden kan **barrières** blootleggen
- Een beter begrip van waarden kan **besluitvorming** verbeteren


Iteratie IAD framework ontworpen voor ondersteuning besluitvorming binnen de stedelijke warmtetransitie
Contextuele factoren
Technologische context
Attributen van de gemeenschap (waarde beladen)
Regels in gebruik
1. Gemeente
Besluitvorminig
Interactie (waarde beladen)
Evaluatieve criteria (waarde beladen)
Uitkomsten
3. Huishoudens
2. Lokale collectieve instanties
Redenering achter het ontwerp
Gelaagde adaptatie van het IAD framework gevoed met waarden
Waarin besluitvorming centraal staat
Stuurt de analyse richting alle belangrijke stakeholders en hun dynamische relaties
Gemeente [1]
Lokale transitie initiatieven/"koplopers" [2]
VvE's [2]
Woningcorporaties [2]
Warmte aanbieders [2]
Woningeigenaren en huurders [2/3]
Dwingt de gebruiker om de omliggende context van besluitvormingen te analyseren
Participatie vindt plaats binnen dit kader & participatie is nodig om tot alle noodzakelijke inputs te komen
EU & Nationaal beleid ontwikkelt zich op gemeente niveau
De toepassing van het kader
Start met het analyseren van input variabelen die invloed hebben op elke laag van het kader
Zoals technische alternatieven, wet- en regelgeving & beleid
Zoom vervolgens in op de gemeente, haar attributen & Transitievisie warmte
Analyseer welke waarden, regels en criteria een rol spelen, maar ook hoe interactie en besluitvorming plaatsvindt
Herhaal deze stap voor de lokale collectieve instanties en huishoudens
Vindt participatie al plaats? Analyseer dit aan de hand van de eerder gegeven handvatten
Let ook op hoe stakeholders samenkomen, hoe communicatie plaatsvindt en wat de dynamiek tussen de lagen is
Analyseer nu per laag welke beslissingen, uitkomsten, waarden en standpunten relevant zijn
Onderzoek vervolgens of deze tussen de verschillende lagen overeenkomen, of dat hier juist problemen uit voort komen
Gebruik deze inzichten ter grondslag van nieuwe processen of oplossingen
Zoals nieuwe structuren van besluitvormingen, communicatie of participatie
Data verzameling
Wetenschappelijk onderzoek
Nieuws artikelen & (lokale) media outlets
Focus groepen en interviews
Participatie
Ontwerp participatie
Zoek contact met stakeholders die koplopers van de transitie zijn
Zoek contact met stakeholders die participatie organiseren en aangaan
Analyseer bijeenkomsten en informatiedeling
Ga in gesprek met bewoners die niet afkomen op participatie momenten
Door in de buurt mensen aan te spreken
Aan de hand van semi-gestructureerde interviews
Laat ruimte voor een natuurlijk gesprek
Overkoepelde context van de Nederlandse warmtetransitie
Institutioneel
Ten eerste zullen wijzigingen in de gaswet gemeenten waarschijnlijk de wettelijke bevoegdheid geven om huishoudens af te sluiten van het gasnet. Ten tweede zal de nieuwe warmtewet 2.0 gemeenten de handvatten geven om "warmtekavels" aan te wijzen, buurten met speciale transitieontwerpen (warmtenetten) die worden beheerd door warmtebedrijven (wederom door de gemeente aangewezen). Ten slot zal de nieuwe omgevingswet participatie in het hele transitie proces verplicht stellen. Dit houdt in dat de gemeente een eigen participatiebeleid moet opstellen. Op basis waarvan participatieprocessen kunnen worden beoordeeld en gewogen
Technisch
Er zijn twee technische alternatieven met de meeste potentie binnen de stedelijke warmtetransitie. Dit zijn zowel hoge als lage temperatuur collectieve warmtenetten. Wat betreft hoge temperatuur stadsverwarming, de warmtebron is vaak mee-geproduceerde (of afval) warmte. Het grote voordeel van stadswarmte is dat er weinig isolatie binnen woningen nodig is. Nadelen zijn een (indirecte) afhankelijkheid van fossiele brandstoffen, een lager rendement en het feit dat duurzaamheid ter discussie staat. Een verlaging in de temperatuur van warmtenetten verhoogt het rendement. Belangrijker nog is dat het een betere integratie van duurzame warmtebronnen en warmte-koudeopslag mogelijk maakt. Resulterend in een toename in flexibiliteit en benutting van volatiele hernieuwbare energiebronnen. De belangrijkste nadelen van lage temperatuur warmtenetten zijn echter de eis van hoge isolatieniveaus, (momenteel) de juiste mix van financiële steunregelingen en nieuwe vormen van organisatie
Alberda van Ekenstein, F.J.P. (2022). Local values towards a local heat transition: Guiding neighbourhood participation in the Dutch urban heat transition through the IAD framework. Masters Thesis Complex Systems Engineering and Management. Faculty of Technology and Policy Management. Delft University of Technology.


Spanningsvelden warmtettransitie
Technisch
De twee meest potente technische alternatieven belichamen zeer verschillende waarden
Stadswarmte kent lage eisen aan isolatiewaarden en is makkelijk te standaardiseren. Echter is het minder duurzaam, efficiënt en geeft het minder keuzevrijheid
Lage temperatuur warmtenetten zijn duurzamer, bieden meer flexibiliteit en maken gebruik van lokale content. Echter zijn isolatie eisen hoger en is de operationele kant complexer
Stadswarmte zou als overgangstechniek moeten dienen, waarbij het rond 2030 aangepast wordt naar een lage temperatuur warmtenetwerk
Echter blijkt dit uit onderzoek complexer te zijn dan organisaties nu doen voorkomen
Top-down
Huiseigenaren worden aanvankelijk als de belangrijkste besluitvormers beschouwd
Gemeenten krijgen echter steeds meer (juridische) instrumenten om beslissingen op te leggen aan huishoudens
Gemeenten worden nog nadrukkelijker bij de warmtetransitie betrokken. Zij beschikken echter niet over de middelen om aan de gestelde verwachtingen te voldoen
Voorgestelde nationale wetten hebben geleid tot onzekerheid, onenigheid en tonen zich niet in staat om de huidige problemen van de warmtetransitie aan te pakken
Ook hier wordt participatie centraal gesteld in het gehele institutionele ontwerp. Concrete handvatten of richtlijnen voor participatie worden echter nog steeds niet gepresenteerd
Lokaal
Huiseigenaren willen zelf hun warmtetransitie in de hand houden, echter dreigen keuzes opgelegd te gaan worden door de gemeente
Door stijgende energieprijzen neemt de energiearmoede in Nederland toe
Echter is investeren in een duurzamere of efficiëntere warmtevoorziening voor velen niet betaalbaar
Ook duurzame leningen lijken dit probleem niet op te kunnen lossen
Lokaal is er niet altijd de kennis of middelen om de warmtetransitie in te richten, het ontbreekt aan ondersteuning en participatie
Focus op de casus buurt; de warmtetransitie op het KNSM-eiland
Het blijkt dat doelstellingen, criteria, waarden en beslissingen op alle analyseniveaus niet op elkaar zijn afgestemd
Inzichten lokale collectieve instanties
Het lokale initiatief streeft naar een op maat gemaakt duurzaam alternatief
Een die kwaliteiten omarmt die echt bij hun buurt passen
Namelijk aquathermie
Deze transitie dient gerealiseerd te worden aan de hand van participatie en acceptatie
Ondanks een indrukwekkend technisch onderzoek komen ook hier valkuilen van traditionele participatie voor
Het technocratische debat voert de boventoon, resulterend in een breed scala aan pragmatische technische en financiële vragen die momenteel nog niet beantwoord kunnen worden
Alleen intrinsiek gemotiveerde huishoudens nemen deel aan deze vorm van participatie
Dit resulteert in een risico op decontextualisatie van besluitvorming, gebaseerd op een kleinere deel van de buurt
Het juiste communicatieproces vinden is een uitdaging, vooral met zoveel verschillende belanghebbenden (uiteenlopend in motivatie en kennis)
Zorg ervoor dat participatie niet gecentreerd wordt om gedetailleerde technische en financiële informatie in de beginstadia
Ga zo technocratische valkuilen uit de weg, focus op het betrekken van de hele buurt (zwijgende meerderheid) en het vergoten van sociale acceptatie
Doe dit door gecondenseerde en begrijpelijke informatie te verspreiden
Start bij de basis van participatie
Waarom gaan we gezamenlijk het gesprek aan?
Welke keuzes moeten wij gaan maken?
Wat willen de bewoners?
Wat is momenteel relevant? Wat is tastbaar?
Hoe creëren we urgentie en belangstelling?
Inzichten huishoudens
Huiseigenaren zullen over het algemeen pas participeren als ze het gevoel hebben dat er echt keuze gemaakt dienen te worden, wanneer er urgentie is
Op dat moment ontvangen ze graag een compleet pakket aan informatie, waarin alle alternatieven tegen elkaar afgezet worden
Indien er echt keuzes gemaakt moeten worden moet dit democratisch gaan. Via de VvE willen huiseigenaren besluitvormen
Huurders laten zich meer leiden door waarden die ze belangrijk achten
Maatschappelijke rechtvaardigheid
Maatschappelijk draagvlak
Onafhankelijkheid van fossiele brandstoffen
Huurders hebben vaak niet het gevoel alsof ze kunnen meebeslissen over de transitie. De woningcorporatie wordt als leidend ervaren
Technocratische en duurzame argumenten blijken onvoldoende te zijn om urgentie en dus participatie te stimuleren
Voor de meesten is de warmtetransitie niet relevant, ze verwachten dat aardgas nog zeker 10 a 15 jaar dominant blijft
Urgentie en participatie vindt voorlopig alleen plaats indien geconfronteerd met praktische problemen
Zoals noodzakelijke vervanging van rookgaskanalen
Huishoudens hebben weinig vertrouwen in de gemeente betreffend hun lokale transitie, ze zijn bang voor opgelegde keuzes
Lokale organisaties kunnen wel op veel vertrouwen rekenen, op de voorwaarde dat ze hun expertise bewijzen
Inzichten gemeente
Technische en institutionele argumenten voor alternatieven manifesteren zich in een zeer praktische realiteit
De gemeente Amsterdam wil in 2040 aardgasvrij zijn. Om dit te bereiken biedt stadswarmte een eenvoudiger te implementeren oplossing, terwijl aquathermie meer duurzame en lokale kwaliteiten kent
Hoewel aquathermie meer in overeenstemming is met de visie van beleidsmakers, lijkt de gemeente voorkeur te geven aan stadswarmte
Niet alleen vanwege organisatorische kwaliteiten, maar ook vanwege gemaakte afspraken
Om te blijven verduurzamen, moet stadswarmte in 2030 overschakelen op duurzame warmtebronnen.
Uit onderzoek blijkt echter dat het ombouwen van stadswarmte naar lage temperatuur netwerken een hele opgave is, vol onzekerheden waar noch beleidsmakers noch warmtebedrijven momenteel aandacht aan lijken te besteden
Inzichten zijn o.a. verkregen door betrokkenheid bij georganiseerde informatieavonden en overleggen. Participatie met buurtbewoners, die niet bij deze momenten aanwezig waren, heeft dit onderzoek tot verder essentiële inzichten gebracht. Deze groep is gekenmerkt als de "stille meerderheid"
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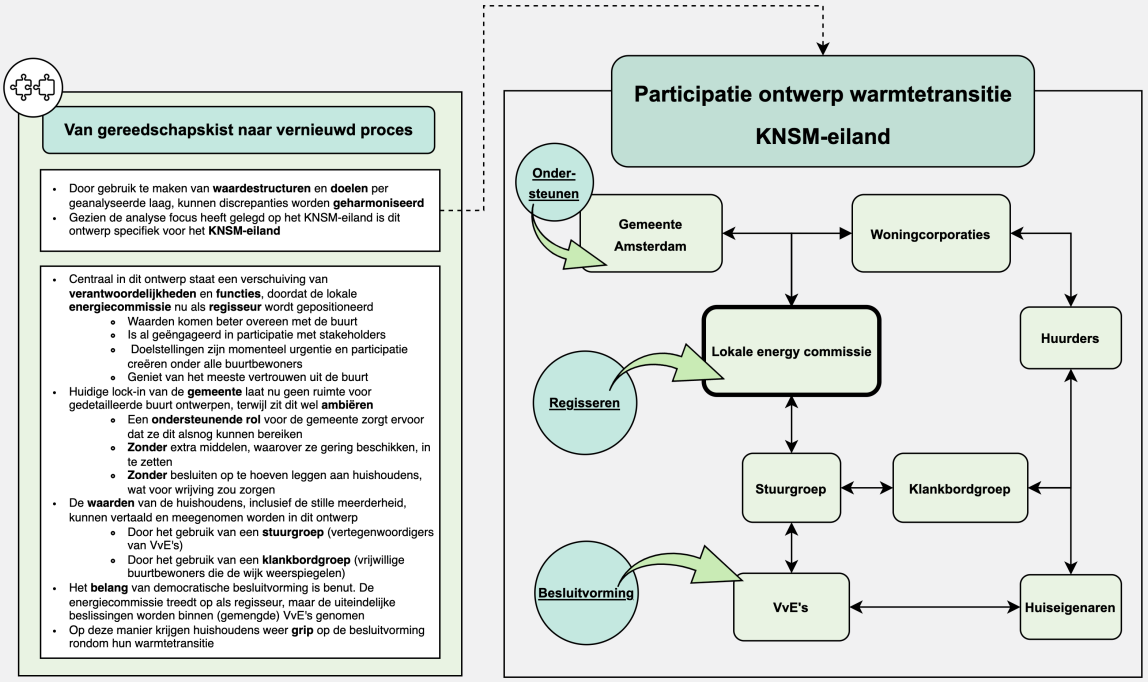
Van gereedschapskist naar vernieuwd proces

- Door gebruik te maken van **waardestructuren** en **doelen** per geanalyseerde laag, kunnen discrepanties worden **geharmoniseerd**
- Gezien de analyse focus heeft gelegd op het KNSM-eiland is dit ontwerp specifiek voor het **KNSM-eiland**

- Centraal in dit ontwerp staat een verschuiving van **verantwoordelijkheden** en **functies**, doordat de lokale **energiecommissie** nu als **regisseur** wordt gepositioneerd
  - Waarden komen beter overeen met de buurt
  - Is al geëngageerd in participatie met stakeholders
  - Doelstellingen zijn momenteel urgentie en participatie creëren onder alle buurtbewoners
  - Geniet van het meeste vertrouwen uit de buurt
- Huidige lock-in van de **gemeente** laat nu geen ruimte voor gedetailleerde buurt ontwerpen, terwijl zit dit wel **ambiëren**
  - Een **ondersteunende rol** voor de gemeente zorgt ervoor dat ze dit alsnog kunnen bereiken
  - **Zonder** extra middelen, waarover ze gering beschikken, in te zetten
  - **Zonder** besluiten op te hoeven leggen aan huishoudens, wat voor wrijving zou zorgen
- De **waarden** van de huishoudens, inclusief de stille meerderheid, kunnen vertaald en meegenomen worden in dit ontwerp
  - Door het gebruik van een **stuurgroep** (vertegenwoordigers van VvE's)
  - Door het gebruik van een **klankbordgroep** (vrijwillige buurtbewoners die de wijk weerspiegelen)
- Het **belang** van democratische besluitvorming is benut. De energiecommissie treedt op als regisseur, maar de uiteindelijke beslissingen worden binnen (gemengde) VvE's genomen
- Op deze manier krijgen huishoudens weer **grip** op de besluitvorming rondom hun warmtetransitie



Conclusies

Discussie

- Zowel het ontworpen framework als de aanbevelingen (participatie en besluitvormingsstructuur) zijn gedetailleerd op de warmtetransitie van het **KNSM-eiland**
  - Exacte **vertaling** van alle inzichten naar andere buurten is daarom **afgeraden**
  - Gebruik het proces als **raamwerk**
- Het framework verondersteld **geen** problemen te verhelpen of oplossingen aan te dragen
  - Het biedt **alleen** een gestructureerde blik op besluitvorming
- Analyses voortschrijdend uit het framework blijven **afhankelijk** van het gebruik door de onderzoeker
- Inzichten verkregen uit betrokkenheid en participatie hebben plaatsgevonden in een **gelimiteerd tijdsbestek**
- De interactie die heeft plaatsgevonden dekt een **fractie** van de gehele **buurt**
  - Alleen inzichten waarover sterke consensus bestaat zijn daarom gepresenteerd
  - Echter dienen inzichten **met zorg** gegeneraliseerd te worden

Gebruik kader

- Het ontwerp heeft de onderzoeker **in staat gesteld** de risico's te beperken die bij het gebruik van andere processen worden vastgesteld. In tegenstelling tot traditionele methoden, heeft deze aanpak het mogelijk gemaakt om de volgende zaken te **identificeren**:
  - **Verwrongen** afstemmingen tussen technologie, instituties en waarden
  - **Verwrongen** afstemmingen tussen lagen van besluitvorming en hun inherente waarden
  - Terugkerende **valkuilen** van participatie en middelen om deze te matigen
  - Een **stille meerderheid**, ondervertegenwoordigd maar cruciaal voor besluitvorming
  - Een participatie- en besluitvormings**ontwerp** om in te spelen op inconsistenties en om waarden te harmoniseren
- **Het kader biedt** een gestructureerde lens waardoor de complexe en dynamische warmtetransitie kan worden ontleed
  - Inzichten ontvouwen zich die leiden naar optimalere processen
- Een **gereedschapskist** om besluitvorming te begeleiden bij de warmtetransitie op buurtniveau

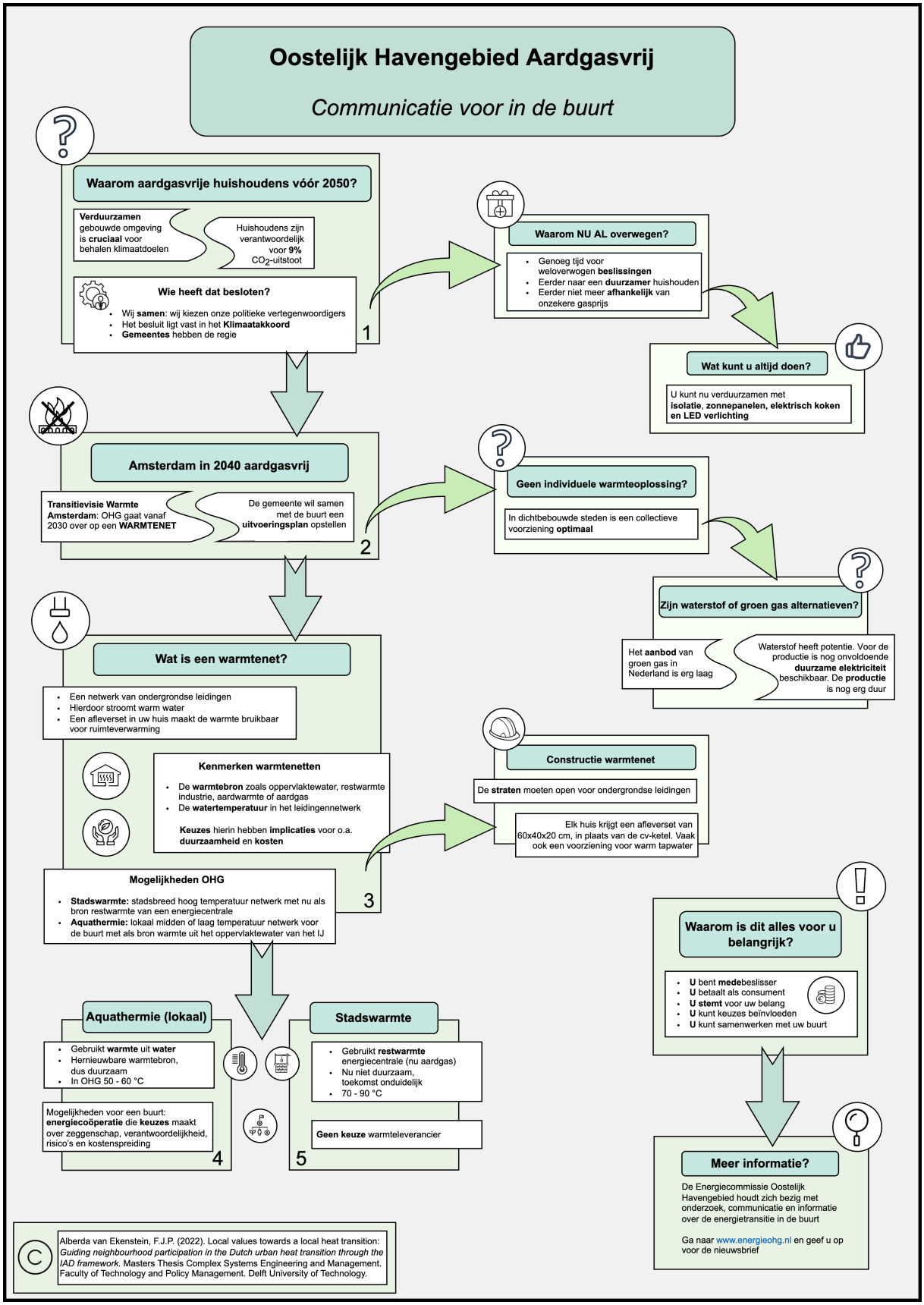
Implicaties

- De **gemeente** kan er baat bij hebben om een meer **begeleidende** en **ondersteunende** rol op zich te nemen
- Dit zou betekenen dat de gemeente initiatieven het **vertrouwen** en de **steun** moeten geven die nodig is om hun transitie te realiseren
- Aan de strategie kleven **risico's**, omdat er sprake is van een **herverdeling** van grote verantwoordelijkheden
- Gemeenten zullen nog steeds de gestelde **doelen** willen **bereiken**, terwijl die doelen alleen gehaald kunnen worden als lokale partijen hun transitie op een **acceptabele** en **tijdige** manier realiseren

- Voor lokale initiatieven zijn de traditionele participatiemethoden **niet toegerust** om te voorzien in de **behoeften** van degenen die men wil betrekken
- Het **herontwerpen** van participatie resulteert in een proces dat veel **tijd-** en **arbeidsintensiever** is dan de traditionele benaderingen
  - Het leidt ook tot **meer** verantwoordelijkheid
- De praktische implicaties van dit onderzoek zullen daarom altijd een **evenwicht** vergen tussen wat gewenst is en wat haalbaar is

- **Handvatten** voor **participatie** kunnen wel degelijk gegeven worden

*Het feit dat de warmtetransitie (nog) **niet relevant** voelt voor velen betekend uiteraard **niet** dat dit ook daadwerkelijk zo is. Het **creëren** van **urgentie** en het aangaan van **participatie** is momenteel van groots **belang**. Niet alleen om in te spelen op huidige geo-politieke kwesties, het duurzaamheidsdebat en energiearmoede, maar om **huishoudens** voor te bereiden op wat moet gaan komen. Besluiten zullen uiteindelijk gemaakt worden. Door nu aan dit proces deel te nemen blijft de oorsprong van het besluit **in eigen hand**. Mocht er te laat **geëngageerd** worden, dan zullen keuzes van **bovenaf** bepaald moeten worden.*


Oostelijk Havengebied Aardgasvrij
Communicatie voor in de buurt
Waarom aardgasvrije huishoudens vóór 2050?
Verduurzamen gebouwde omgeving is cruciaal voor behalen klimaatdoelen
Huishoudens zijn verantwoordelijk voor 9% CO_2-uitstoot
Wie heeft dat besloten?
Wij samen: wij kiezen onze politieke vertegenwoordigers
Het besluit ligt vast in het Klimaatakkoord
Gemeentes hebben de regie
1
Waarom NU AL overwegen?
Genoeg tijd voor weloverwogen beslissingen
Eerder naar een duurzamer huishouden
Eerder niet meer afhankelijk van onzekere gasprijs
Wat kunt u altijd doen?
U kunt nu verduurzamen met isolatie, zonnepanelen, elektrisch koken en LED verlichting
Amsterdam in 2040 aardgasvrij
Transitievisie Warmte Amsterdam: OHG gaat vanaf 2030 over op een WARMTENET
De gemeente wil samen met de buurt een uitvoeringsplan opstellen
2
Geen individuele warmteoplossing?
In dichtbebouwde steden is een collectieve voorziening optimaal
Zijn waterstof of groen gas alternatieven?
Het aanbod van groen gas in Nederland is erg laag
Waterstof heeft potentie. Voor de productie is nog onvoldoende duurzame elektriciteit beschikbaar. De productie is nog erg duur
Wat is een warmtenet?
Een netwerk van ondergrondse leidingen
Hierdoor stroomt warm water
Een afleverset in uw huis maakt de warmte bruikbaar voor ruimteverwarming
Kenmerken warmtenetten
De warmtebron zoals oppervlaktewater, restwarmte industrie, aardwarmte of aardgas
De watertemperatuur in het leidingennetwerk
Keuzes hierin hebben implicaties voor o.a. duurzaamheid en kosten
Mogelijkheden OHG
Stadswarmte: stadsbreed hoog temperatuur netwerk met nu als bron restwarmte van een energiecentrale
Aquathermie: lokaal midden of laag temperatuur netwerk voor de buurt met als bron warmte uit het oppervlaktewater van het IJ
3
Constructie warmtenet
De straten moeten open voor ondergrondse leidingen
Elk huis krijgt een afleverset van 60x40x20 cm, in plaats van de cv-ketel. Vaak ook een voorziening voor warm tapwater
Waarom is dit alles voor u belangrijk?
U bent medebeslisser
U betaalt als consument
U stemt voor uw belang
U kunt keuzes beïnvloeden
U kunt samenwerken met uw buurt
Aquathermie (lokaal)
Gebruikt warmte uit water
Hernieuwbare warmtebron, dus duurzaam
In OHG 50 - 60 °C
Mogelijkheden voor een buurt: energiecoöperatie die keuzes maakt over zeggenschap, verantwoordelijkheid, risico's en kostenspreiding
4
Stadswarmte
Gebruikt restwarmte energiecentrale (nu aardgas)
Nu niet duurzaam, toekomst onduidelijk
70 - 90 °C
Geen keuze warmteleverancier
5
Meer informatie?
De Energiecommissie Oostelijk Havengebied houdt zich bezig met onderzoek, communicatie en informatie over de energietransitie in de buurt
Ga naar www.energieohg.nl en geef u op voor de nieuwsbrief
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