Gasless Groningen
The role of Groningen homeowners

Master thesis Serena Loos

Colophon

Preface

Dear reader,

This is my thesis written for the master Environmental and Infrastructure planning, which is the final piece of the master and represents the last chapter of the adventure called studying. The subject of this thesis is the role of homeowners in the energy transition. More specifically, Groningen homeowners and their acceptance of the measure to terminate natural gas consumption. Since my study, I have always been intrigued by climate change and everything that has anything to do with this. In my bachelor's thesis I focussed on climate adaptation, therefore in my master's thesis I really wanted to focus on mitigation and the energy transition. Through my years of study I developed an interest for the role of citizens. Participation, acceptability.. What do people actually think of regulations by the government? Do they understand the urgency? And most important, how can we convince and involve all people in together creating a more environmental friendly world? These are questions I hope I can keep focussing on in my future career.

I could not have written this thesis without the help of several people, therefore I would at first like to thank my supervisor Ferry van Kann, who helped me finding a right direction of my research, offered useful literature and was always prepared to help out. His feedback inspired me when I was insecure or stuck, and he gave useful suggestions on how to improve my research. Furthermore I would like to thank everyone that in any way made this research possible, especially by filling in the survey or urging others to fill it in.

Special thanks go out to my children, who are my true motivation to get my master's degree, to provide them with a better future and to show them that you can reach whatever you want, as long as you really want it.

Last but definitely not least, I would like to thank my husband, who in 2013 stood completely behind my decision to start studying again, even though this would have large effects on our lives. He never doubted that decision, and never doubted my capability for even a second. He always managed to encourage me when motivation was low or stress was high. Especially during the writing of this thesis his support really helped me through the last mile.

I wish you joy in reading this thesis, as I had joy in writing it.

Kind regards,

Serena Loos

Abstract

The goal of the Dutch government is to reduce carbon dioxide emissions to almost zero by 2050. Therefore all households in the Netherlands need to quit consuming natural gas. Another reason for terminating the consumption of natural gas is that the extraction of natural gas in Groningen has to end, as it causes earthquakes. Therefore, and because Groningen already aims to eliminate carbon dioxide emissions already by 2035, Groningen was the perfect case for this research.

This research is an exploratory case study into the public acceptability and pro-environmental energy behaviour of Groningen homeowners, and more specifically, the effect of contextual factors. Are they willing and able to quit consuming natural gas? How can the municipality increase public acceptability and instigate pro-environmental behaviour of homeowners in order to successfully get the present owner-occupied housing stock in Groningen off natural gas before 2035?

A literature review, survey and policy document analysis have been performed to collect data to answer this question. The fact that Groningen faces earthquake problems does not affect the acceptability or energy behaviour of Groningen homeowners. Seeing other people collecting renewable energy does affect energy behaviour, and a lack of sufficient resources or information causes homeowners to less likely to show pro-environmental behaviour.

Just half of Groningen homeowners think the measure to terminate natural gas consumption is acceptable, and most people are not planning to get off gas themselves already in the near future. As 2035 is already in 16 years, something has to happen to move these homeowners.

Key words: Public Acceptability, Environmental Behaviour, Energy Behaviour, Environmental psychology, Energy Transition, Sustainable Housing, Gasless Housing, Homeowners

List of Abbreviations

ETP	Energietransitieplan (Energy Transition Plan)
GFT	Goal Framing Theory
NAM	Norm Activation Model
NIMBY	Not in my backyard
TPB	Theory of Planned Behaviour
VBN	Value Belief Norm (theory)

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1. Introduction

1.1 The Dutch Energy Transition – The end of Groningen natural gas

The Dutch government needs all households in the Netherlands to quit consuming natural gas by 2050. This is a huge task, which concurs the desired energy transition in the Netherlands. The goal of the Dutch government is to reduce carbon dioxide emissions to almost zero by 2050 (Rijksoverheid, 2018). The termination of natural gas consumption by households will have to contribute to reaching this goal.

The concept 'energy transition' refers to a fundamental change in our energy system, a "*nonlinear shift from one dynamic equilibrium to another*" (Loorbach et al., 2017, p. 600), and is discussed in chapter two of this thesis. An energy transition is desired in the light of climate change. Climate change expresses itself in global warming, caused by greenhouse gas emissions through using fossil fuels like oil, gas or coal (Boden et al., 2012). The most well-known and worried effect of global warming is sea level rising, which threatens countries that are situated on or below sea level. Besides, in the Netherlands climate change causes more hot days, more extreme showers and drought (KNMI, 2014), which all can underlie social and economic problems. In 2015 the Netherlands agreed on the Paris Agreement which has as main goal to keep the global temperature rise below 2 degrees Celsius and to pursue efforts to restrict the increase even further to 1,5 degrees Celsius (UNFCC, 2019). The PBL calculated the effects of the Climate Agreement that was designed in the Netherlands, and concluded that the aimed reduction in greenhouse gas emissions (with a main focus on carbon dioxide) will probably not be achieved due to several uncertainties, among which the behavioural reactions of citizens and companies (PBL, 2019). Therefore the Dutch government has to make more moves and try to deal with uncertainties.

Besides the (inter)national commitment to reduce greenhouse emissions, ceasing Groningen gas extraction is also desired in the light of the earthquakes caused by gas extraction in Groningen. The earthquakes have been going on for years, causing economic damage and problems for the welfare of people living in the area. Besides the physical damage to their houses, these people experience the feeling of living in insecurity and they also face more health issues than people outside of the area (RUG, 2016). Because of these problems, the Dutch government decided in March 2018 that the exploitation of the Groningen gas field will be ended as soon as possible, but at the latest in 2030, to guarantee the safety of the area (Rijksoverheid, 2019).

There are a lot of questions surrounding the termination of Groningen gas exploitation. It is questioned whether the Netherlands should better not quit consuming natural gas at all, but instead of extracting it in Groningen, import it to meet the demand. However, there are some obstacles in doing this. At first, importing gas will not contribute positively to the 2050 goal of (almost) no carbon dioxide emissions in the Netherlands (Rijksoverheid, 2018). Also, the imported gas is of another quality than the gas used in Dutch households, making it necessary to convert it (NAM, 2019). Furthermore, importing gas is costly and creates dependency on other countries, in which especially for Russia the desirability is questioned (Cukier & van der Walle, 2018). Concluding, the Netherlands should keep looking for other ways to replace the consumption of natural gas and instigate the Dutch energy transition. Several options are contemporarily being discussed and researched at different levels to replace the natural gas consumption of households, which each have their advantages and drawbacks that will not be discussed in detail in this introduction. An increase in the use of biogas is a possibility, also the opportunities that (green) hydrogen might offer are being explored.

The termination of (natural) gas consumption in Dutch households is of course just one step in the Dutch energy transition. However, energy use in households is a serious contributor to the emission of greenhouse gases (van der Werff & Steg, 2014). The impact of this termination for households will thus be essential in the energy transition (RvO, 2018). However, houses without

a gas connection will need a lot more electricity for cooking and heating in order to replace the use of gas. To intercept this increasing demand, it is necessary to look for preferably renewable energy solutions, in order to keep up with the goals of an carbon dioxide emission free Netherlands in 2050. Examples are the use of residual heat networks, geothermic heat, heat pumps and solar water heaters.

1.2 Owner-occupied houses

Through laws and regulations the government can influence the construction of new houses to be built without a gas connection. Similarly, housing associations can also be pushed to refurbish the (social) rent housing stock, to cut them off natural gas. However, in 2018 over 4,3 million houses in the Netherlands are owner-occupied, which is over 56% of the total housing stock (CBS, 2019). Despite the ambitions of the Dutch government regarding carbon emissions, the private housing stock seem to be disregarded. For these houses, the responsibility for replacing the use of gas with sustainable solutions lays at the homeowners. To refurbish their house to a sustainable residence that will not make use of gas, homeowners need to make interventions and investments that are sizable (RvO, 2018). These investments will increase proportionally with the age of the building, as effective sustainable heating in a house for example relies on the quality of its insulation (Milieucentraal, 2019). Older houses often are not insulated properly. Furthermore, in older houses it is often hard and expensive to make adjustments in the energy system. Are home-owners not only willing, but also able to make such investments in their homes and do they know what their options are? There is a lack of insight in their acceptability and ability. Short-term and unsustainable decisions and solutions lurk.

An example of an unsustainable but cheaper solution, is to only replace the central heating boiler with an electrical central heating boiler, without paying attention for demand limitation and insulation. Decisions like these are undesirable, as they will lead to a huge increase in energy consumption. This will in turn also cause an increase in carbon dioxide emissions, as long as Dutch energy is not completely renewable (RvO, 2018). Furthermore, decisions like these will not only lead to higher costs for these households, they will most likely also face future problems related to draught and damp. Proper insulation and ventilation is necessary in order to be able to heat a house without gas. Problems like this will not only negatively affect the comfort of living, but can also cause health issues. For these reasons, the Dutch government must prevent unsustainable decision making at all costs.

There is little research on the implementation of sustainable energy solutions for the existing private housing stock, meaning there is a knowledge gap on how to efficiently involve home owners in the energy transition. The importance of public acceptability in changing to a more sustainable energy system is often discussed and emphasized (Schuitema & Jakobsson Bergstad, 2013; Steg et al., 2015; Perlaviciute et al., 2018; Rijnsoever et al., 2015). However, as Steg et al. (2015, p.8) point out: "*it is important to understand which factors influence public acceptability of energy policies and energy system changes*". Furthermore, Steg et al (2015) emphasize the importance of understanding to what extent and under which circumstances households are willing to accept and adopt several renewable energy sources. Shutting down the gas consumption for households demands conscious environmental behaviour of the individuals, in order to make sure that they will replace the use of natural gas with the best sustainable option and to avoid an (extreme) increase in their electricity usage or uncomfortable living situations (RvO, 2018). Perlaviciute et al. (2018) argue that public acceptability should be incorporated into the planning process from the start, as it is at the heart of changing the energy system. Therefore, there should already be paid more attention for the acceptability of homeowners.

Unfortunately, there are still many people that question the consequences of climate change and how to deal with these, the role and responsibility of human, or even the fact that the climate is changing at all. This can be seen in (responses to) media, but also in political discussions and

election programs and results. Especially on the internet, but also in public, the 'left vs right' discussion contemporarily runs freely amongst anyone who likes to join. Even though this can be seen as a problem "an sich", this will not be covered in this thesis. This is because this research focuses on a small part within the energy transition, being the role of homeowners in the wish of the government to halt natural gas consumption for households.

1.3 Research question

As more than half of the contemporary existing housing stock is owner-occupied, it is clear that homeowners have a big role in the energy transition in the Netherlands (CBS, 2019). This makes it crucial to understand what determines their acceptability of the measure to stop natural gas consumption, and what drives them to make sustainable decisions. Environmental behaviour can be explained by several models which are discussed in chapter two. All these models to some degree agree that pro-environmental behaviour is activated through normative considerations. It is therefore important to strengthen normative goals so that the so-called 'normative goal-frame' will become focal (Steg et al., 2014). Question is then, which factors trigger normative considerations. Besides the values that underly normative considerations, researchers seem to agree that contextual factors play a key role (Steg & Vlek, 2009; Steg et al, 2014; Ertz et al., 2016). However, which contextual factors precisely affect normative goals remains the question. According to Steg & Vlek (2009) there is a knowledge gap in the effects of contextual factors on environmental behaviour, they state that "*The effects of contextual factors on environmental behaviour need to be examined in more detail, as well as how these factors affect various environmental behaviours vis-à-vis motivational factors.* " (p. 315). Ertz et al. (2016) questions which contextual factors determine what type of goal-frame most strongly affects behaviour. Steg et al. (2015) argue that it is important to study which situational cues activate the normative goal frame and under which circumstances it will be activated.

By researching the motives of current homeowners, this study can provide insight on acceptability and intended environmental behaviour of homeowners in shifting to a sustainable housing stock. It can be possible to predict how they will conceive and to which extent they intent to act sustainably to the (future) measure to end natural gas consumption in households. When this information can be achieved it can function as a basis for building an approach on how to get private houses off gas. Which can be useful to increase acceptability and foster pro-environmental behaviour. This can in turn contribute to the goal of the Netherlands being carbon dioxide emission free by 2050.

Groningen is even more ambitious than the national government, as it aims for a carbon dioxide emissions free city by already 2035 (Gemeente Groningen, 2018). Besides, this area is facing diverse problems due to natural gas extraction which can be an extra incentive to quit consuming natural gas. These points make Groningen a relevant case for this research. The expected results of the study can be valuable for Groningen and other cities in the Netherlands that face the challenge of involving owner-occupied houses in the energy transition. This research can help finding a solution for this challenge. By giving insight in the public acceptability behind sustainable decisions of homeowners when having to quit consuming gas, this research can contribute to the theoretical debate of environmental psychology. Also, this research is relevant for planning, as public acceptability and homeowners are both very important in the achievement of the energy transition in the Netherlands.

The aim of this study is to provide approaches that can increase acceptability and foster sustainable decision making of homeowners when disconnecting the present owner-occupied housing stock of natural gas efficiently. Therefore, the next research question will be answered in this thesis:

What are efficient approaches for the municipality of Groningen to increase public acceptability and instigate pro-environmental behaviour of homeowners in order to successfully get the present owner-occupied housing stock in Groningen off natural gas before 2035?

Six secondary research questions have been formulated to help answering the main research question:

1. How does public acceptability work and why is it important?
2. What is the public acceptability of the measure to terminate natural gas consumption in Groningen?
3. Which factors determine this public acceptability and is there a relation to contextual factors?
4. How pro-environmental is the current energy behaviour of Groningen homeowners?
5. Which contextual factors affect the motivations of homeowners in Groningen to show pro-environmental energy behaviour?
6. What are the possibilities to adjust contextual factors?

1.4 Thesis outline

This introduction discussed the problem and motives for this research. Also the main research question and the supporting sub questions have been explained. In chapter 2 the existing theories and important concepts on this subject are explained in a literature review. Chapter 2.2 discusses Environmental behaviour, followed by public acceptability in chapter 2.3. Subsequently, sustainable housing and transition theory have been discussed in chapter 2.4. These theories have been shaped together in a conceptual model to guide the research, which can be found in chapter 2.5. Chapter 3 explains the methodology in this research. It shows which data collection methods have been used, how and why. Chapter 4 tells more about the specific case Groningen and is a presentation of the data that has been collected. Subsequently, in chapter 5 this data is analysed and the answers to the research questions are discussed. In chapter 6 the research and the outcomes will be critically reflected.

2. Theoretical Framework

2.1. Introduction

This chapter explains different concepts that are relevant in this thesis. It will start with environmental behaviour, followed by public acceptability, and finally sustainable housing and transitions theory will be discussed. The last subchapter will show how these concepts will come together in a conceptual model.

2.2 Environmental behaviour

2.2.1 Introduction

Environmental behaviour is one of the main concepts in this research. Therefore it is desirable to elaborate on its meaning, how it can be explained and how it can be influenced. Steg et al. (2013, p. 359) define environmental behaviour as follows: *"Any behaviour that has an impact on the environment, good or bad".* Another definition of environmental behaviour, by Stern (2000, p. 408) is: *"...the extent to which it changes the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself".* Research shows that the quality of the environment strongly depends on the behaviour patterns of human (Steg & Vlek, 2009; Stern, 2000).

Behaviour that "*harms the environment as little as possible, or even benefits the environment*" is called pro-environmental behaviour (Steg & Vlek 2009, p. 309). In the most positive scenario the desired pro-environmental behaviour of individuals in Groningen is: the acceptation of natural gas termination for households and the adoption of the most sustainable option to replace the

natural gas consumption. Therefore, the form of pro-environmental behaviour that is meant in this thesis can also be called "pro-environmental energy behaviour".

There are various factors affecting pro-environmental behaviour, motivational and non-motivational. In order to predict and/or explain environmental behaviour by motivational factors, several models and theories have been developed. In research to underlying motivational factors of behaviour are three general theoretical perspectives: weighing costs and benefits, moral and normative concerns, and the role of affect (Steg & Vlek, 2009). The most important theories within these lines will be elaborated in the following subchapters. Besides, the non-motivational factors will be touched upon.

2.2.2 Costs-benefit considerations: Theory of Planned Behaviour

Various studies to explain environmental behaviour focus on the assumption that people make reasoned choices and weigh costs against benefits. One of them is the *Theory of Planned Behaviour* (TPB) by Icek Ajzen (1985), which focuses on the role of individual costs and benefits (Steg & Nordlund, 2013). The TPB has been proven to be successful in explaining environmental behaviour in situations characterised by strong constraints on behaviour or high behavioural costs (Steg & Vlek, 2009).

In the TPB, it is assumed that individuals make reasoned choices and that their behaviour is the result from the intention to perform (Steg & Nordlund, 2013). This individuals intention is a central factor in the TPB, as the stronger the intention is to conduct a particular behaviour, the more effort will be done and the more likely the behaviour will be performed (Ajzen, 1991). Of course, non-motivational factors as availability of resources and requisite opportunities are also required for the performance of behaviour (Ajzen, 2011). When these factors are sufficient, intention will lead to action (Ajzen, 2011). The intention depends on several factors: the attitude towards the behaviour, subjective norms related to the behaviour and the perceived behaviour control (Ajzen, 1991). In figure 1 the TPB is displayed schematically.
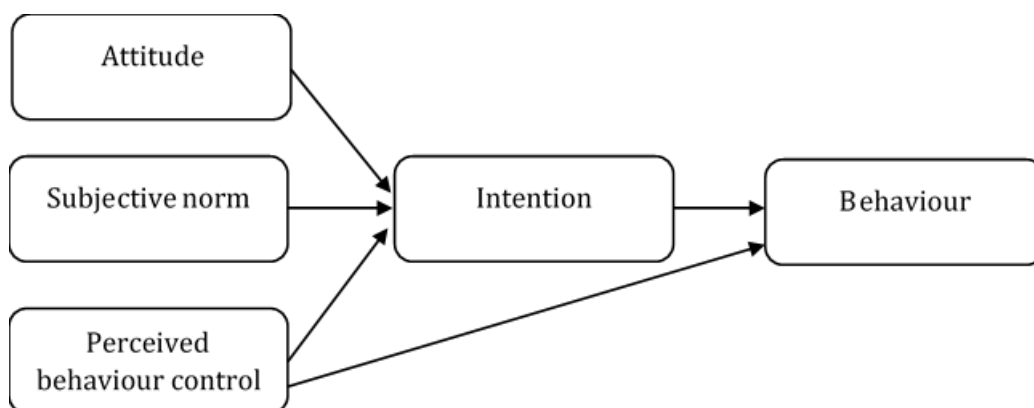
Figure 1. The Theory of Planned Behaviour, adapted from Ajzen (1991).

Attitudes are based on beliefs about the costs and benefits of behaviour and the extent to which these are important for the individual (Steg & Norland, 2013). In this way, attitudes reflect whether particular behaviour is overall evaluated positively or negatively, weighing benefits and costs.

Subjective norms are about the believed approval or disapproval of particular behaviour by other people that are important to the individual. They are weighted by the extent to which an individual wishes to comply with (beliefs about) the expectation of relevant reference groups (Steg & Nordlund, 2013).

Perceived behavioural control is an individual's perception of the possibility to perform particular behaviour (Ajzen, 1991). This depends on beliefs about the presence of facilitating – or hindering – factors that are relevant to the behaviour (Steg & Nordlund, 2013). Besides the influence on behaviour via intention, perceived behavioural control can also influence behaviour directly (Steg & Nordlund, 2013).

In the TPB it is assumed that all other motivational factors, such as values and general beliefs, are somehow interwoven in these three factors and thus influence behaviour indirectly (Steg & Nordlund, 2013). However, research has shown that in environmental cases personal norms influence behaviour as such, that they should be seen as an individual factor (Steg & Nordlund, 2013). Also, normative considerations play an important role in predicting energy savings (van der Werff & Steg, 2014). It can therefore be argued that pro-environmental (energy) behaviour is more than balancing between costs and benefits.

2.2.3 Moral and normative considerations: Norm Activation Model & Value Belief Norm Theory

Another line of research focuses on moral and normative concerns to investigate pro-environmental behaviour. In this line, values, environmental concern and personal and social norms are subject. The Norm Activation Model and the Value Belief Norm Theory are important models in literature, and are discussed in this subchapter.

Van der Werff & Steg (2014) state that the ***Norm Activation Model*** (NAM) is one of the most influential models explaining how and which factors influence environmental behaviour. The model is especially successful in explaining low-cost environmental behaviour (Steg et al., 2005). It was primary developed to explain altruistic behaviour, but has been applied in the environmental context often (Steg et al., 2005). The NAM assumes that morality plays a key role in pro-environmental behaviour, because pro-environmental behaviour most of the times involves higher individual effort and costs and thus will only be performed if one feels it is the right thing to do (Steg & Nordlund, 2013). Through normative considerations individuals prioritise collective interests above their own interests, because they experience a strong personal norm (van der Werff & Steg, 2014). In the NAM personal norms are therefore a key factor, which are activated by four situational key variables (Steg & Nordlund, 2013):
- *Problem awareness*: the level of awareness of (negative) consequences of behaviour that is not pro-environmental;
- *Ascription of responsibility*: the feeling of responsibility for the negative consequences of behaviour that is not pro-environmental;
- *Outcome efficacy*: the identification of actions that will reduce environmental problems;
- *Self-efficacy (or ability)*: the recognition of one's own ability to provide relief to environmental threats (Steg & Nordlund, 2013).

In most research however, there has not been made use of all four key variables. Often, self-efficacy is excluded, and a choice is made between either ascription of responsibility of outcome efficacy (Steg & Nordlund, 2013). A general explanation of the NAM is that behaviour occurs in response to personal norms that are activated when individuals are aware of consequences, and when they think they can adverse these (Steg et al., 2005). The relationship between the variables is causal, as people should be aware of the environmental problems, before they consider themselves responsible and feel able to effectively help to reduce these problems (Steg & de Groot, 2010; van der Werff & Steg, 2014).

A disadvantage of the NAM is that it lacks explanatory power in behavioural settings that are characterized by strong constraints on behaviour (Steg et al., 2005).

The ***Value Belief Norm*** (VBN) theory is an extension of the NAM by Stern (2000), which links value theory, New Environmental Paradigm (NEP), and NAM. As the NAM, the VBN theory also

assumes that (pro-)environmental behaviour is a result from personal norms and thus morality (Steg et al., 2005). In the VBN theory the personal norms are activated by a causal chain of beliefs depending on values (Steg et al., 2005). In figure 2 the variables in this chain are represented schematically. Each of these variables is related to the next variable, but can also be directly related to variables further down the chain (Steg & Nordlund, 2013). They will be elaborated hereafter.
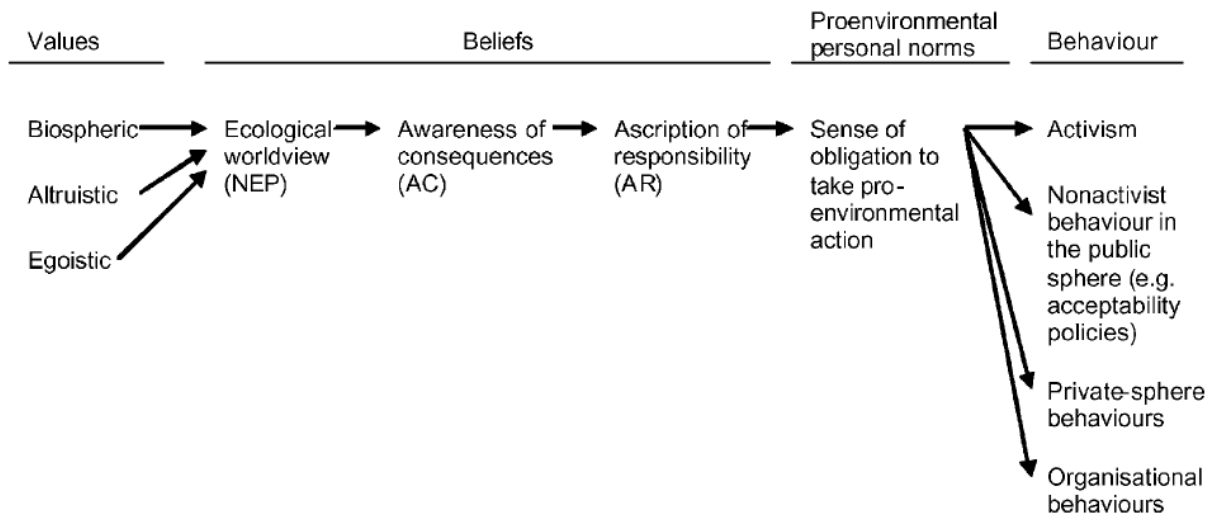
Figure 2 Schematic representation of the VBN theory (Steg et al., 2005)

Values can be defined as: "*desirable trans-situational goals that vary in importance and serve as guiding principles in the life of a person or other social entities*" (Schwartz, 1992, in De Groot & Thøgersen, 2013 p. 142). They are often formed early in life, tied to an individual's identity and culturally constructed, and therefore very hard to change (Schwartz, 2006). Values include beliefs about (un)desirability of particular end-states, are abstract constructs and they aid as guiding principles in evaluating and for behaviours (De Groot & Thøgersen, 2013). Also, they vary in importance (De Groot & Thøgersen, 2013). In literature, three types of values are in particular relevant in understanding environmental behaviour: Egoistic, altruistic and biospheric values (Stern, 2000; Steg et al., 2005; De Groot & Thøgersen, 2013). In an egoistic value orientation, people try to maximize their individual outcomes, the altruistic value orientation reflects concern for the welfare of other human beings, and the biospheric value orientation reflects concern with the biosphere and other species (Steg et al., 2005). These three value orientations are the basis for VBN theory, as they influence the beliefs of an individual. Research shows that especially biospheric values are an important factor in pro-environmental behaviour and suggests that biospheric values can activate personal norms directly (Steg et al., 2005).

Beliefs are *"thoughts about general classes of objects within a given domain"* (Steg et al., 2013). The VBN theory distinguishes awareness of consequences (when things the individual values are threatened by environmental conditions) and ascription of responsibility (the belief that the individual can act to reduce this threat), which are dependent on the ecological worldview (Steg et al., 2005). Altruistic and biospheric values are positively related to ecological worldviews, and egoistic values are related negatively (Steg & Nordlund, 2013).

The Value Belief Norm theory appeared to be successful in explaining energy use and other low-cost pro-environmental behaviour (Abrahamse & Steg, 2011; Steg & Vlek, 2009). However, as the Norm Activation Model, it has far less explanatory power in situations characterised by strong constraints on behaviour or high behavioural costs (Steg & Vlek, 2009).

2.2.4 Symbolic and affective considerations

Besides cost- and benefit considerations and moral and normative considerations, a third line of research focusses on symbolic and affective considerations. Derived from the theory of the meaning of material possessions by Dittmar (1992), there are three types of motives that may underlie (pro-environmental) behaviour: instrumental, affective and symbolic motives (Gatersleben & Steg, 2013). These motives are often related and mainly used to study motives for the purchase and use of instrumental goods. The instrumental function relates to e.g. costs or size, the symbolic function relates to e.g. self-identity or status, and affect to e.g. fun, how someone feels (Gatersleben & Steg, 2013). Affective motives however, are also being studied as a motivator for pro-environmental behaviour (Gatersleben & Steg, 2013).

Even though research on affect in the environmental context is mainly focussed on car use (Steg & Vlek, 2009), symbolic motives and affect can also be relevant in explaining pro-environmental behaviour in this thesis. This because people can feel good about themselves when they act pro-environmentally. It is desired that people invest in e.g. an heat pump and/or solar panels, to replace gas consumption and intercept or even prevent an increase in their electricity use. Noppers et al. (2014) argue that the adoption of sustainable innovations (like renewable energy production, smart energy systems etc.) depends not only on the instrumental attributes of the innovation as is often thought, but also on their positive environmental and symbolic attributes. Especially positive evaluations of the symbolic attributes of a sustainable innovation seem important in encouraging the adoption (Noppers et al., 2016). This suggests people can perceive status by adopting sustainable innovations, making the symbolic motives also relevant for this thesis.

2.2.5 Goal Framing Theory

Subchapters 2.1.2, 2.1.3 and 2.1.4 have shown that research suggests that environmental behaviour results from cost-benefit considerations, as well as normative considerations, but also from symbolic and affective motives. *Goal Framing Theory* acknowledges that behaviour is a result of multiple motivations, and therefore has integrated concepts and variables of other theories (Steg & Vlek, 2009). 'Goals' are mental representations of desired future states, and 'overarching goals' will guide large sets of sub goals when they are activated (Lindenberg, 2013). Goal framing theory states that there are three general goals that 'frame' the way individuals process information and act upon it, namely hedonic goals, gain goals, and normative goals (Steg & Nordlund, 2013):
- *Hedonic goals*: to improve or maintain the way the individual feels right now (Lindenberg, 2013)
- *Gain goals*: to improve or maintain the individual's resources (Lindenberg, 2013)
- *Normative goals:* to act appropriately, conform social rules and norms (Lindenberg, 2013)

The active, focal goal is called the goal-frame and influences the processing of information and behaviour most, while the other goals increase or decrease its strength (Lindenberg, 2013). Motivations are thus seldom homogeneous. Hedonic goals are strongest because of their nature, while normative goals need external support to become the goal-frame (Steg & Nordlund, 2013). Activation of a goal frame can be caused by a signal inside or outside of the individual (e.g. hunger or the behaviour of others), but all three goals matter all the time (Lindenberg, 2013). Their relative strength and the extent to which they influence behaviour depends on environmental cues (Lindenberg, 2013). The environment of an individual is thus extremely important for their behaviour. The most important environmental cues that can (in)directly increase and decrease the strength of the overarching goals are: "*the presence or absence of people in the environment; cues about norm conformity of other people; objects that are strongly associated with a particular overarching goal …; cues indicating gain opportunities; and visceral cues*" (Lindenberg 2013, p. 122).

Goal Framing Theory is strongly coinciding with the three lines in research on motivational factors in environmental behaviour. Theories on cost benefit analyses focuses on *gain goal-frames*, theories and research on values, norms and environmental concerns focuses on *normative goal-frames*, and theories and research on affect focus on *hedonic goal-frames* (Steg & Vlek, 2009). All three lines of research come together in this one theory. As all lines of research are important in understanding pro-environmental behaviour, this thesis focuses on Goal Framing Theory.

The normative goal is highly important for pro-environmental behaviour, but as said, it needs more external support to be the goal-frame than – and can be weakened by – the other overarching goals (Lindenberg, 2013). When the normative goal is strong, people will have respect for norms and act accordingly. When it is weak, respect is missing and the norm will only be followed if it will fulfil a stronger goal (Lindenberg, 2013). Unfortunately, environmental cues will most of the time weaken normative goals, as there are generally more cues that strengthen gain goals or hedonic goals (Lindenberg, 2013).

2.2.6 Contextual factors
Obviously, pro-environmental behaviour does not solely depend on motivational or intra-personal factors (Steg & Vlek, 2009). In this sub chapter contextual factors and habitual behaviour are elaborated as influencers on behaviour.

Contextual factors
Contextual factors can be spatial and infrastructural, cultural and economic factors, but also institutional arrangements, and access to services, technology, products, and information (Steg et al., 2018). Also the availability of products and their characteristics are contextual factors (Steg & Vlek, 2009). Contextual factors can facilitate or constrain behaviour and influence individual motivations (Steg & Vlek, 2009). In fact, they can even make some pro-environmental behaviours simply impossible (Steg et al., 2015). For example, an individual's engagement in pro-environmental behaviour can be strongly affected by the quality of public transport, the market supply of goods, or pricing regimes (Steg & Vlek, 2009).

Contextual factors operate in several ways:
- they can directly affect behaviour;
- they can moderate the relationship between motivational factors and the behaviour;
- their relation to behaviour can be mediated by motivational factors;
- they can determine which goal-frame most strongly affects behaviour (Steg & Vek, 2009).

As explained, the normative goal is highly important for pro-environmental behaviour, thus it is desired that this goal frame is focal in facing the measure to quit natural gas consumption for households. Contextual factors are much alike the situational cues that have been discussed in subchapter 2.1.6. Contextual factors or situational cues can give environmental cues that activate the goal frame. For example, when someone is in an environment where there are signs that others do not care about norms (garbage, graffiti, etc.) these signs work as cues that weaken the normative goal (Lindenberg, 2013). The other way around, it can also be argued that cues in the environment that show others dó care about norms can strengthen the normative goal, for example the (visual) presence of solar panels in the neighbourhood. According to Steg et al. (2015) contextual factors like subsidy schemes can facilitate pro-environmental energy behaviour, as they can make investments in e.g. solar panels more affordable and thus influence the motivational factors of individuals.

Obviously, time and money are important contextual factors. Research shows that people that have more time and money perceive pro-environmental behaviour as more important and less costly (Ertz et al., 2016). It can therefore be assumed that the availability of appropriate options to replace natural gas consumption and the costs that come with this, also strongly affect the

engagement in pro-environmental behaviour of people in the light of natural gas termination. When there are no suitable options or there is not enough information on the options, or the price is too high, this can be a constraint. Furthermore, the fact that the province of Groningen faces the consequences of earthquakes due to natural gas extraction, can either be a constraint or facilitate the inhabitants in pro-environmental behaviour. They can be glad the gas extraction will stop and choose to be frontrunners in adopting sustainable innovations. On the other side, the termination can also cause anger leading to less sustainable replacements of the natural gas or even that they will not accept the policy.

Even though contextual factors define the cost and benefits of e.g. energy behaviour, and thereby influence the motivational factors of an individual (Steg et al, 2015), they are not included in the theories that are discussed in the previous subchapters. Only few researchers have really measured the impact of contextual factors on pro-environmental behaviour, meaning there is still a knowledge gap (Steg & Vlek, 2009). It is therefore important to study under which circumstances the normative goal frame is focal and which situational cues activate it (Steg et al., 2015).

As discussed in this subchapter, literature distinguishes many possible contextual factors. The five which are most common and relevant in the frame of this thesis have been selected:
- Economic factors
- Earthquake problems, a specific factor in Groningen
- Cues of the presence of pro-environmental energy behaviour in the neighbourhood
- Access to information
- Access to services e.g. an "ontzorgpakket"
Other case specific contextual factors that could be relevant are the neighbourhood someone lives in or the construction date of their house.

Habitual behaviour
Not all decisions made by individuals are rational, even though this is implied by most theories on environmental psychology, as discussed in the previous chapters. In fact, most behaviour is habitual, the individual will automatically repeat behaviour he or she has shown before (Klöckner & Verplanken, 2013). The four key features of habitual behaviour – frequency, stability, success and automaticity – can be explained as follows: *"Every time a behavioural pattern is successfully performed in stable situational circumstances – which means the intended goals are reached and the behaviour leads to the intended outcomes – the likelihood increases that the behaviour is automatically repeated the next time the situation is encountered again"* (Klöckner & Verplanken 2013, p. 198).

Habits are important predictors of environmental behaviour like energy use, but also considered as barriers for pro-environmental behaviour (Klöckner & Verplanken, 2013). Traditional intervention types will most likely fail for habitual behaviour (Klöckner & Verplanken, 2013). Generally, habits are only reconsidered when the context changes significantly (Steg & Vlek, 2009). The measurement of habits is a challenge for research, because habits are unconscious, meaning the validity of people's self-reports is questionable (Klöckner & Verplanken, 2013).

One can argue that habitual behaviour is in its origin motivated. However, in this research it is ranked as non-motivational because the pro-environmental behaviour that is strived for in this thesis cannot be achieved by habitual behaviour, as there is no rational decision making involved anymore in habitual behaviour. As the decision to shut down natural gas consumption in households forces people to pause and think about what to do (in other words, motivate their behaviour), habits are less important in this research than in research on other environmental behaviours.

2.3 Public acceptability

2.3.1 Introduction

Acceptability is seen as component of environmental behaviour (Steg et al., 2005), which is discussed in chapter 2.2. However, as acceptability is such an important subject in this thesis, it is discussed separately.

Acceptability of environmental policies is defined by Steg et al. (2013, p. 335) as *"Either a type of non-activist behaviour in the public sphere or an attitude towards a policy measure before a policy measure is implemented".* The first approach of acceptability in this definition refers to behaviour of people that are not very active members of environmental citizenship, but do support or accept public policies. This non-activist behaviour does influence public policies and therefore can have a large effect (Stern, 2000). The second part of this definition refers to the attitude of people towards these policies, which are an important determinant of behaviour (Schuitema & Jakobsson Bergstad, 2013).

As energy policies – or positive environmental changes in the current energy systems, like renewable energy or the termination of natural gas – are in this research approached from an environmental angle, the acceptability of these policies or changes is considered likewise as in the former definition on acceptability of environmental policies.

Acceptability not only strongly influences the decision-making process around the implementation of environmental and energy policies, the implementation of such policies is in fact dependent upon acceptability (Schuitema & Jakobsson Bergstad, 2013, Bristow et al., 2010). When acceptability is low, the possibility that policies may be less effective or not even implemented at all is high (Steg et al., 2015). Thus, it is important to know what is called public acceptability, which factors determine acceptability and how acceptability can be enhanced.

2.3.2 Public acceptability

Perlaviciute et al. (2018, p.50) define public acceptability as *"a broad concept that refers to people's general evaluation of energy projects, i.e., the extent to which they favor or disfavor a particular energy project".* Public acceptability has three interdependent dimensions, based on the roles that individuals can play in the implementation of a measure or technology (Wüstenhagen et al., 2007): socio-political acceptance, community acceptance and market acceptance.

Figure 3. Triangle of public acceptance of renewable energy innovation by Wüstenhagen et al. (2007)

Figure 3 shows the three different dimensions in a triangle of acceptability of renewable energy innovation. Socio-political acceptance refers to citizens' responses to regional, national or international policy making, that will not necessarily effect their own situation (Huijts et al., 2012). Strategies in which socio-political acceptance is expressed through opinion polls, key stakeholders or political parties showing general support for a policy or technology can be used to foster community and market acceptance (Rijnsoever et al., 2015).

Market acceptance on the other hand, refers to the role of people as consumers and is mainly reflected through the adoption process of sustainable energy technologies (Rijnsoever et al., 2015). In this role people can choose whether or not to adopt and market acceptance is thus powerful (Huijts et al., 2012).

In conclusion, community acceptance is about the public response to sustainable energy technologies, innovations or policies (Huijts et al., 2012). When the adoption of such a technology affects large groups of people, community acceptance plays an important role (Rijnsoever et al., 2015). Even when socio-political or market acceptance have been secured, local stakeholders can object to projects (Rijnsoever et al., 2015). This is often referred to as the NIMBY-effect ("Not in my backyard").

Community acceptance is in literature mostly seen as a local phenomenon, as for example the placement of a windfarm will affect the local community. The termination of natural gas consumption will have different effects for several (parts of) communities. Some households can be connected to a heath-grid, others might use bio-gas or have to install a heat pump. It is imaginable that the costs and benefits of different options are various and can be perceived differently. People might feel forced, or excluded. For this reason, socio-political acceptance of this measure can be high, whereas community acceptance can be low.

2.3.3 Factors determining acceptability

What people belief the outcome of environmental policies will be, has a big role in determining the acceptability of the policy (Schuitema & Jakobsson Bergstad, 2013). Often, these outcomes have negative individual consequences, but positive collective consequences. Therefore, the acceptability of policy measures can be described as *social dilemma* (Schuitema & Jakobsson Bergstad, 2013).

In this thesis the acceptability of policy measures will be explained by the 'greed-efficiency-fairness (GEF) hypothesis' of Wilke (1991). According to the GEF hypothesis people primarily want to maximize their own outcomes in a social dilemma, but they also desire to distribute outcomes fairly and preserve collective resources (Wilke, 1991). Following this hypothesis, there are three main individual factors related to the acceptability of environmental policies: individual policy outcomes, collective policy outcomes and distribution of outcomes (Schuitema & Jakobsson Bergstad, 2013). These factors will be discussed below.

Individual policy outcomes
The believed consequences of new energy policies and changes in the energy system, affects the acceptability of the policy (Schuitema & Jakobsson Bergstad, 2013). When people expect negative consequences of policies for themselves, meaning an infringement to their freedom or too high costs for not complying with the policies, policy measures are perceived less acceptable (Schuitema & Jakobsson Bergstad, 2013). Furthermore, features of the policies determine the extent to which they infringe people's freedom. Policies can target efficiency behaviour, requiring a single action or infrequent based behaviour change, or they can target curtailment behaviour, which refers to changes in frequent user behaviours (Schuitema & Jakobsson Bergstad, 2013). Research shows that even though policies that target efficiency behaviour mostly require large investments, they are overall more acceptable than policies targeting curtailment behaviour, because they infringe people's freedom less (Poortinga et al., 2003).

Collective policy outcomes
As explained, according to the GEF hypothesis people do not only focus on their own outcomes, they also desire an efficient use of collective resources (Wilke, 1991). Thus, when people expect the implementation of policies that have negative outcomes for themselves to be effective for reducing collective problems, they are more acceptable (Schuitema & Jakobsson Bergstad, 2013). This perceived effectiveness of policies is determined by their features, e.g. the clarity of the objectives (Schuitema & Jakobsson Bergstad, 2013). Also, push measures are often more effective in changing behaviour, however the presence of pull measures seems necessary (Schuitema & Jakobsson Bergstad, 2013). Noteworthy, the perceived effectiveness of environmental policies is believed to be higher by people that are highly concerned with the environment (Schuitema & Jakobsson Bergstad, 2013).

Furthermore, environmental policies are at large more accepted when awareness and concerns about environmental problems is also high (Eriksson et al., 2006). This suggest that environmental policies are probably more acceptable in situations where environmental problems are clearly visible.

Fair distribution of outcomes
Following the GEF hypothesis, people desire to distribute outcomes fairly (Wilke, 1991). Judgements on fairness are made on expected policy outcomes and can be made on three types of comparisons:
- Intrapersonal;
- Interpersonal;
- Intergenerational (Schuitema & Jakobsson Bergstad, 2013).

Intrapersonal comparisons refer to a comparison of individual policy outcomes with previous personal outcomes, an internal reference point, or one's current situation (Schuitema & Jakobsson Bergstad, 2013). A policy can then be seen as unfair when the individual is worse off than before implementation.

Interpersonal comparisons refer to a comparison of policy outcomes for themselves, with the outcomes of other people in the population (Schuitema & Jakobsson Bergstad, 2013). If the outcome of the policy affects themselves stronger than other people, the policy may be perceived as unfair. Comparisons amongst groups also count as interpersonal. When a policy outcome affects everybody equally, it is seen as more fair then when groups of people face more negative consequences than other groups (Schuitema & Jakobsson Bergstad, 2013). This can also be specified in equity, that all people are *relatively* equally affected by policy outcomes (Schuitema & Jakobsson Bergstad, 2013). This means that policies can be seen as unfair (and thus unacceptable), when for example policy outcomes affect low-income groups stronger than high-income groups.

Intergenerational comparisons imply a comparison of current policy outcomes with outcomes for future generations and effects on the environment and nature, also called environmental justice (Schuitema & Jakobsson Bergstad, 2013). Research showed that this was the best predictor of fairness and acceptability judgements of various pricing policies, next to equality and equity (Schuitema & Jakobsson Bergstad, 2013). This suggest that environmental justice can also be an important predictor in energy policies.

Besides the evaluation of the expected policy outcomes, evaluations of the way the policy is implemented can also influence acceptability (Huijts et al., 2015). Trust and procedural fairness are therefore important factors in the implementation of a policy. Trust in actors who are responsible for the policy increases acceptance (Huijts et al., 2015). Also, fair decision-making process and procedures increases trust in the decisionmakers, and thus increases acceptability (Schuitema & Jakobsson Bergstad, 2013).

2.3.4 Enhancing acceptability

Acceptability of energy policies can be enhanced by push and pull measures (Schuitema & Jakobsson Bergstad, 2013). Pull measures aim to reward pro-environmental behaviour or to provide financial compensation for negative individual consequences, whereas push measures aim to punish environmentally harmful behaviour, to make that behaviour less attractive (Schuitema & Jakobsson Bergstad, 2013). Push measures are more accepted when they are combined with pull measures (Schuitema & Jakobsson Bergstad, 2013).

Furthermore, from a communicative planning perspective collaboration is said to positively influence acceptability. 'Inclusionary argumentation' is imperative and has the power to transform situations in the planning process, by facilitating community collaboration (Healey, 1996). Public involvement is often seen as a key factor to increase trust and procedural fairness, as long as people's views are considered seriously (Schuitema & Jakobsson Bergstad, 2013). In communicative planning practice it is essential to bring together stakeholders with different interest and try to reach consensus (Hytönen, 2016). Inclusion of stakeholders in policy making processes increases shared understanding of a problem and possible solutions, and it enhances the legitimacy of decisions (Söderholm et al., 2017). Therefore, a collaborative planning process can have surprising outputs, that would probably not be cheered upon in a top-down process, even though they can be measures that offer the most effective solution to a problem.

Concluding, it has to be kept in mind that public acceptability might rise after the policy is implemented (Schuitema & Jakobsson Bergstad, 2013). This can for example happen when trust was low on forehand, and the decisionmaker was able to fulfil its commitment after all. Also, the actual costs and benefits for the public can be much more beneficial than expected.

2.4 Transition to sustainable housing

2.4.1 Introduction

The term transition is broadly used in many scientific disciplines as well as in politics. 'The energy transition' is no longer just a scientific research project, but a goal in itself for Dutch government. By 2050 the Netherlands aims to have reduced the emission of carbon dioxide to (almost) zero (Rijksoverheid, 2018). To reach this goal, a fundamental change in our energy resources and consumption is necessary. This shift, from fossil fuels to a more sustainable system based on renewable energy, is called an energy transition. This research focuses on the role of homeowners within this transition, and more specifically their position in the decision to terminate the use of natural gas in households. Transition theory will be briefly explained in this chapter, as well as what is meant by sustainable housing in this thesis.

2.4.2 Sustainability and sustainable housing

Sustainability, in Dutch "Duurzaamheid" is in the contemporary society a real buzzword, with several meanings. Because the concept is so vague to many people, it is not used in the data collection survey to prevent confusion or even exasperation. There it will be referred to as "energy saving"

Steg et al. (2013, p.369) define sustainability as follows: *"Well-balanced human-environment relationships; an optimal balance between environmental, social and economic qualities".* Sustainability is therefore about the future of the earth, about meeting the needs of the present generation without compromising the ability of future generations to meet their needs.

In this thesis sustainable housing is defined as follows: "*Houses that are arranged to: not make use of natural gas, reduce energy consumption and provide renewable energy for own consumption where possible".* In order to get houses sustainable, adjustments and investments have to be made. Also, sustainable innovations are necessary, to come with products and services that use less

energy or produce renewable energy, like solar panels or smart energy systems. For the environmental success of sustainable innovations adoption by consumers is however critical (Noppers et al., 2014).

2.4.3 Transitions theory

Van der Brugge et al. (2005) state that a transition is a structural change in the way a societal system operates. They define a transition as "*a long-term process (25-50 years) resulting from a co-evolution of cultural, institutional, economical, ecological and technological processes and developments on various scale levels*" (Van der Brugge et al., 2005)

According to Meadowcroft (2009) "*transitions are understood as processes of structural change in major societal subsystems*" (Meadowcroft 2009, p. 324). One of these major societal subsystems in the energy transition is household energy consumption. Meadowcroft (2009) explains that transitions involve a shift in the 'rules of the game' and a movement of one dynamic equilibrium to another, and also emphasizes that is a long-term process of 25-50 years.

The definition of Loorbach et al. (2017) is likewise, although he adds that the shift from one dynamic equilibrium to the another is a nonlinear shift. Furthermore, they emphasize the term 'sustainable transition', which is increasingly being used to refer to large-scale societal changes that are thought to be necessary to solve big societal challenges, like the energy transition (Loorbach et al., 2017). They refer to sustainable transitions as *"large-scale disruptive changes in societal systems that emerge over a long period of decades"* (Loorbach et al. 2017, p.600).

According to Steg et al. (2018, p.20) *"A sustainable energy transition means substantial changes in technology and the engagement of the engineering community"* and *"...it will also mean changes in behavior and policies and, thus, will require the engagement of the social science community"*. The behaviour of individuals and households shape the acceptability and effectiveness of policies, technologies and strategies to bring about a sustainable energy transition (Steg et al., 2018).

In transition theory three concepts which emphasize transitions as a process of innovation are key: multi-stage, multi-level and transition management (Van der Brugge et al., 2005).

Multi-stage
The multi-stage concept describes a transition in four stages or phases, because it approaches transitions from the viewpoint of the speed of change (Van der Brugge et al., 2005):
- "*a pre-development phase of dynamic equilibrium where the status quo does not visibly change but changes take place under the surface;*
- *a take-off phase in which thresholds are reached and the state of the system begins to shift;*
- *an acceleration phase where visible structural changes take place rapidly through an accumulation of socio-cultural, economic, ecological and institutional changes that reinforce each other;*
- *a stabilization phase where the speed of social change decreases and a new dynamic equilibrium is reached*" (Van der Brugge et al. 2005, p.5).

Because of this speed of change, a transition can be illustrated as a S-curve, as can also be seen in figure 4.
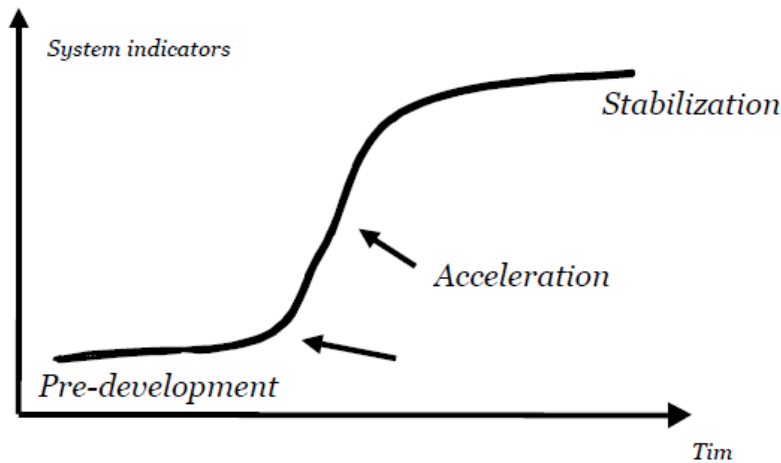
Figure 4. The Multi-Stage transition process (Van der Brugge et al., 2005)

Multi-level

The multi-level concept divides functional scale levels at which transition processes take place: the macro-level, the meso-level and the micro-level (Van der Brugge et al., 2005). At the macro-level the societal landscape is shaped by changes in the macro economy, population dynamics, politics, natural environment and worldviews (Van der Brugge et al., 2005). Trends are relatively slow, large-scale developments play an important role in the transition, but geology is mostly rigid (Van der Brugge et al., 2005). The meso-level is about the operation of the regimes , or institutions (formal as well as informal), in the social system that determine the dynamics and typically strive to maintain the status quo (Van der Brugge et al., 2005). The micro-level, or niche-level, is where individual actors, local practices and alternative technologies operate (Van der Brugge et al., 2005). Figure 5. shows the influence the macro- and micro-level have on the meso-level. Generally, the take-off phase of a transition is reached when adjustment of developments takes place at both micro- and macro-level, reinforcing each other (Van der Brugge et al., 2005).
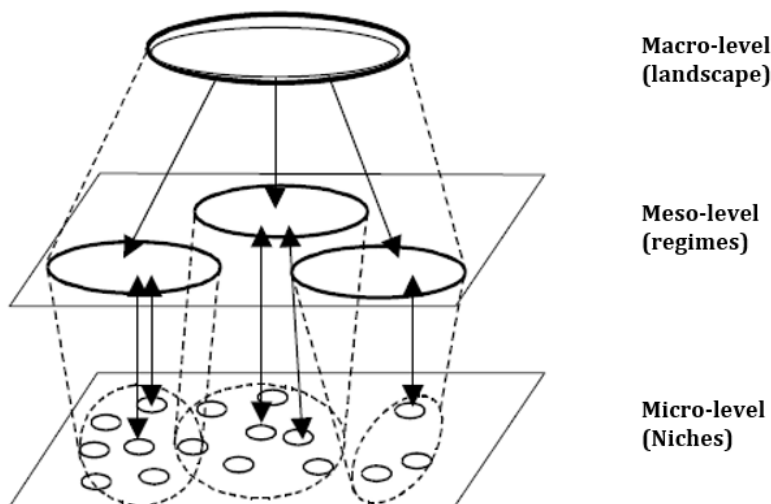
Figure 5. The Multi-Level concept (Van der Brugge et al., 2005)

Transition management

Transition management focuses on governing or steering transitions, based on the coordination of multi-actor processes at different processes and aims for long-term sustainability through joint problem perception, innovation networks and experimental playgrounds (van der Brugge et al, 2005). Because the degree of complexity of transitions is too high to manage in a traditional 'command and control' style, transition management is adaptive and anticipative (van der Brugge

et al, 2005). Figure 6 shows the Transition Management cycle, which can serve as a basis to implement transition management (Loorbach, 2010). There are four components or steps in the cycle, which do not necessarily show the order in which they should be taken, but do underpin the importance of connecting the activities (Loorbach, 2010). This management cycle shows the necessity of public acceptation, as this is an important condition for the development of coalitions and the mobilizing of actors.
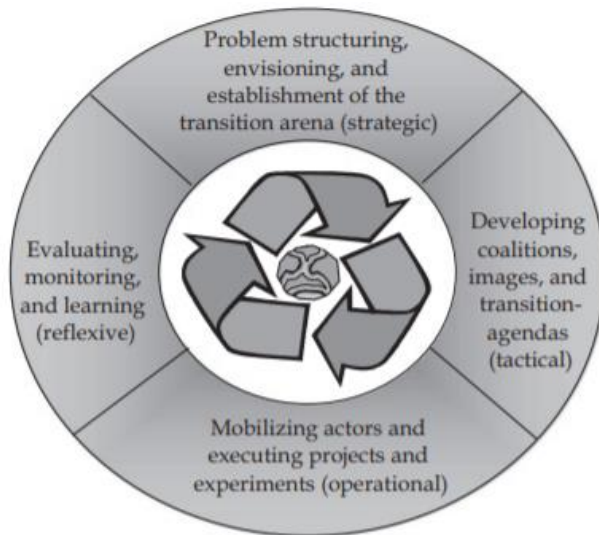
Figure 6. The Transition Management Cycle (Loorbach, 2010)

According to Loorbach (2017) the original concepts of transition theory have been extended so that more detailed understandings of the underlying patterns and mechanics could be included. This also helped to understand transitions as combined processes of building up and breaking down (Loorbach, 2017). Also, where transition research initially focused on experimentation and acceleration, nowadays the focus increasingly shifts to processes of destabilization, emergence, and institutional change (Loorbach, 2017). The transition management cycle operates on three levels – strategic, tactical and operational – which correspond with the macro-, meso- and micro-level (Van der Brugge et al., 2005). Transition management focuses on the balancing between the macro-, meso- and micro level and the reinforcing effects they have on each other.

As the transition to sustainable housing is an important step in the bigger energy transition, these theories have been taken into account. As in every transition, in the transition to sustainable housing in Groningen processes are also taking place on multi-levels, which is being discussed in chapter 4. This transition is currently at the pre-development phase: we can already see some changes on the macro and micro level, but it has not really taken off yet.

2.5 Conceptual model

The focus of this thesis is twofold. On the one hand, the acceptability of the measure to terminate natural gas in households is studied. On the other hand, environmental behaviour is discussed, as the goal is that households will not only accept the measure, but also replace the consumption of natural gas by the most sustainable solution. To show the importance of acceptability in an energy transition, transition theory has been explained. Transition theory is more an overarching theoretical framework, further research of the concept will not lead to answers to the research questions. Nevertheless, the theory is important to understand the trade-off between levels that is desired to get into take-off phase. The conceptual model in figure 7 shows the current position of the transition to sustainable housing.

As systematic research on the application of the theories to explain and predict environmental behaviour (and thus acceptability) is lacking, it is not clear yet which theory is most useful in which situation (Steg & Nordlund, 2013). Research shows that the Norm Activation Model and the Value Belief Norm theory are successful in explaining low-cost environmental behaviour and e.g. willingness to change behaviour (Steg & Vlek, 2009). However, in situations that are characterised by strong constraints on behaviour or by high behavioural costs, the Theory of Planned Behaviour has more explanatory power (Steg & Nordlund, 2013). Goal Framing Theory makes use of all three lines of research that have been discussed in this chapter. It combines theories to distinguish the three goals that influence behaviour and is therefore an integrated framework for understanding environmental behaviour (Steg & Nordlund, 2013). As the normative goal frame is important in pro-environmental behaviour, this research focusses on the normative goal frame. This chapter explained the relevance of contextual factors, and their effect on activating the normative goal frame and thus their ability to facilitate or constrain behaviour. In order to get to sustainable housing in Groningen it is therefore necessary to understand which contextual factors affect the motivations of individuals in such a way that the normative goal frame will be focal, leading to pro-environmental behaviour. The contextual factors have been displayed in the conceptual model in figure 7. These factors, through the normative goal frame, affect pro-environmental behaviour of citizen in Groningen. The following contextual factors are analysed:
- Earthquake problems, a specific factor in Groningen
- Economic factors
- Access to information
- Access to services like for example an "all-in-one package" that takes care for the complete burden
- Cues of the presence of pro-environmental energy behaviour in the neighbourhood

In order for the implementation of the policy measure to terminate natural gas consumption to be successful in first place, acceptability of this measure is crucial. Therefore it is necessary to measure acceptability in Groningen and determine which factors have the biggest effect. This chapter has explained that there are three factors determining acceptability, being:
- the expected individual policy outcomes;
- the expected collective policy outcomes;
- a fair distribution of the expected policy outcomes.
Because a fair distribution of outcomes refers to a comparison of one's own expected outcomes with a previous situation (intrapersonal), with other people's outcomes (interpersonal) or future generation's outcomes (intragenerational), it can be argued that individual policy outcomes can be covered by a fair distribution of policy outcomes. Therefore is has not been included as a separate variable. As explained in subchapter 2.3.3, public acceptability of policies is often higher in situations where awareness and concerns about environmental problems is also high. It can therefore be suggested that people that face the consequences of gas extraction in Groningen, show a more positive attitude to the measure to terminate gas consumption. This can be seen as an expected collective policy outcome. The relation between expected interpersonal outcomes of the measure and public acceptability can be interesting; do citizen in Groningen think the measure is fair, or do they believe the outcome of this measure affects themselves stronger than other people, as they were also already the ones facing the problem? The cloud in the conceptual model in figure 7 shows that the expected policy outcomes affect public acceptability. However, these expected policy outcomes can also be influenced by contextual factors, through the normative goal frame.
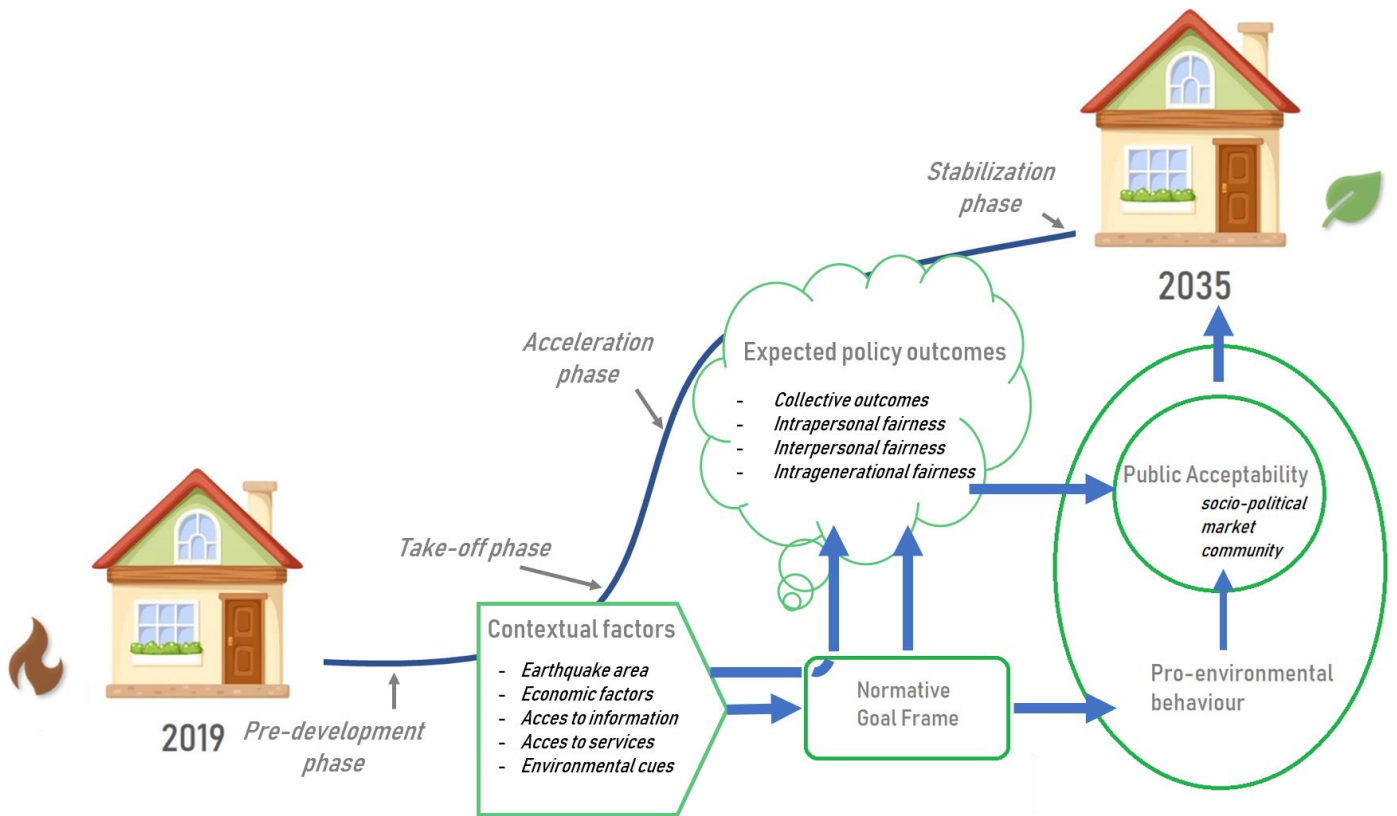
Figure 7. Conceptual model (Author, 2019)

The models shows that in the current situation, the houses still use natural gas and the transition is in pre-development stage. The arrows show an assumed relation between the concepts, substantiated by the discussed theories in this chapter. It is explained that when the normative frame is focal, acceptability of pro-environmental policies or pro-environmental behaviour is higher. Also, it can be expected that high public acceptability might lead to pro-environmental behaviour which in turn leads to sustainable housing. The contextual factors and their relation to pro-environmental behaviour are key in this research. By analysing the variables in this conceptual model it becomes clear which factors have the most effect in Groningen. When these factors are known, it can be researched what approach will fit best to influence them positively.

3. Methodology

3.1 Introduction
Chapter 2 discussed the relevant theories and concepts in this thesis. This chapter explains the research type and strategy, the data collection methods and why these methods have been selected. Also a more detailed explanation of the case selection and the way the data is analysed is included. Lastly, ethical considerations and other relevant subjects that were faced in the data collection have been touched upon.

3.2 Research type
The case study strategy will be used in this research, as the focus is on Groningen, and the context is quite specific, as Groningen faces earthquake problems, contrary to other provinces. According to Yin (2014, p. 16) a case study is "*an empirical inquiry that investigates a phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and*

context may not be clearly evident". Furthermore, the research approach of this study is premised in the quantitative tradition with acceptance of qualitative data, which is called mixed methodology (O'Leary, 2017). A combination of a qualitative and quantitative approach will allow to build a broader view by adding depth, without losing the ability to generalize (O'Leary, 2017). Also, a mixed methodology will allow for triangulation and the approaches and retrieved data can complement each other to find the answers that are being sought-after (O'Leary, 2017). To develop an suitable approach to increase public acceptability and instigate pro-environmental behaviour of homeowners, it is useful to base this not only on quantitative data, but also substantiate it with qualitative data.

3.3 Data collection methods

As explained in chapter 1 the aim of this study is to provide tools to increase acceptability and foster sustainable decision making of homeowners to disconnect the present owner-occupied housing stock of natural gas efficiently. Therefore, we need to find out what is known in general about public acceptability. In order to reach this goal there are several methods of data collection used in order to retrieve the desired data to answer the research question, being: a literature review, a document analysis and a survey. At first the literature review and document analysis was performed, as the findings would provide input for the survey. Thereafter the survey was developed and data was collected. Finally, this collected data was analysed and again connected to theory and data found in policy documents. The data collection tools will be elaborated further in the next sub-chapters.

3.3.1 Literature review

At first, a literature review has been performed, which functions as a theoretical framework for this research and delivered important input for the survey. Several books and scientific articles have been used, for a complete overview see the references. In order to work with recent data, relatively new articles have been selected, unless the studied theory concerned a foundation for others to continue their research on. To find the articles and books there has been made us of Google Scholar, SmartCat and the university library. Used search terms were amongst others "acceptability", "public acceptability", "environmental behaviour", "sustainable behaviour", "energy behaviour", "energy transition", "transition theory" and "contextual factors". Also, in Google Scholar the method to filter out only the articles that referred to an important article on e.g. environmental behaviour was applied, which sometimes led to more recent insights on the subject.

3.3.2 Survey

Surveys are suited to offer insights in opinions, behaviour and characteristics of people (Clifford et al, 2016). Therefore, to (partly) answer the sub-questions a survey is used. The primary, quantitative data collected with this survey shows the current level of acceptability and pro-environmental behaviour, and the possible effect of several contextual factors on future levels of acceptability and behaviour.

As this research focuses on the existing owner-occupied housing stock, the research population for the survey exists of all houses in the municipality of Groningen that have been built before 2000. Houses that have been built after 2000 are likely to be less hard to get off gas. Also there is a chance that newer houses are already making use of sustainable solutions like a heat pump or are even completely off gas. These houses are less relevant in this research, as the acceptability of these people probably already is high. Therefore people that own a house built after 2000 are not in the research population. Only owner-occupied houses are researched, private sector rent is left out of account. To ensure the representativeness of the sample it is important that all Groningen houses are represented, in order to be allowed to make statements about the whole population (Moore & McCabe, 2006). The reason for selecting Groningen is explained in chapter 3.4.

The survey data collection has taken place in weeks 21, 22, 23 and 24. The survey has been distributed in several ways. At first, it has been shared on social media where people of the authors' network shared the request with their own network. This way a big audience was reached. However, this method is mainly based on goodwill, also it is a random sample and therefore not representative on its own. Therefore, the author also went door-to-door in the selected neighbourhoods to ask people directly for their help. It was taken into account to visit different areas of the neighbourhood, in order to include houses that were constructed in different years and to get a diversity of people, which will give a more complete view of the neighbourhood. This way, the representativeness of the survey is strengthened. This can be classified as a stratified sample (Moore & McCabe, 2006). In order to enlarge the number of respondents these visits took place in the evening or afternoon on different days, excluding Sundays. Furthermore, respondents had the opportunity to fill in the survey directly on the tablet or on paper, also the 'drop-off and pick-up method' (Clifford et al, 2016) was offered with a paper version of the survey. When there was no-one home or the resident responded that he/she had little time, a paper invitation with the link (and QR-code) to the survey was given. The researcher gave preference to the respondents filling in the survey themselves, to prevent the possibility of influencing the respondents opinion and to secure their privacy. Also this anonymity can lead to fewer social desired answers.

The researcher planned to finish data collection in week 23, however, at that moment there were 84 respondents collected which was not sufficient. At least 100 respondents were desired to be able to apply several statistical tests, even when the data would be subdivided (for instance a selection of homeowners with an house built before a certain date). Therefore, in week 24 it was decided to apply another method to distribute the survey, as the door-to-door method had not yet delivered the intended result. Permission was asked to supermarket managers to approach grocery shoppers when leaving the supermarket. An advantage of this method is that a lot more people can be addressed, also in timeframes where it is either not appropriate to ring the door, or there are few people at home, like in the morning. It had to be kept in mind that the population of the research consists of homeowners in the municipality of Groningen, thus this was questioned before starting the survey. A disadvantage would be that people have little time (due to e.g. frozen groceries), in that case the paper invitation with link was given. Furthermore, the survey could be filled in on paper and on the tablet, to the preference of the respondent. At the end of the data collection period, 105 respondents have been gathered.

3.3.3 Document analysis

Besides the literature that has been studied to form the theoretical framework and conceptual model in chapter 2, policy documents have been analysed. Policy documents are relevant in this study because they give information on how the government or municipality is proceeding or wishing to deal with issues regarding the energy transition. It can therefore contribute to answering some of the secondary research questions. However, they can give a one-sided or too positive image and the collected data should not unquestioningly be accepted as the truth (O'Leary, 2017). Thus, it is necessary to complement this secondary data extracted from policy documents with other data, which is called triangulation. The policy documents are therefore used as a basis to examine how public acceptability works in the Netherlands and Groningen, and what the options to influence acceptability and adjust contextual factors are. Besides, the found information is combined with the survey data and literature. The examined policy documents are displayed in table 1. These documents have been gathered on the internet by searching for terms like "Groningen aardgasvrij" and "Groningen energietransitie". The documents have been scanned for information on how the termination of natural gas consumptions will be executed. When found, it was read thoroughly, in which the focus was on public acceptability and instruments.

Document title	Organisation	Publication Date
Actieplan Groningen Aardgasloos in 2035	Gemeente Groningen	18–11–2016
Stand van zaken energietransitieplannen – collegebrief	Gemeente Groningen	28–3–2018
Energierapport Transitie naar duurzaam	Ministerie van Economische Zaken	1–1–2016
Voorstel voor hoofdlijnen van het Klimaatakkoord – H5. Burgerparticipatie	Rijksoverheid	10–7–2018
Routekaart Groningen CO_2 - Neutraal 2035	Gemeente Groningen	1–8–2018
Burgers aan het woord over het klimaatakkoord	NPBO	31–8–2018

Tabel 1 Policy documents that have been analysed

The data retrieved with the document analysis contributes to answering the sub-questions below, and is complemented and enriched by scientific articles and data gathered with the survey.

1. *How does public acceptability work and why is it important?*
6. *What are the possibilities to adjust contextual factors?*

3.4 Case selection

The reasons for choosing Groningen are already touched upon in chapter 1. Groningen wishes to reach the goal of an carbon dioxide emission free city already in 2035, instead of the national deadline of 2050. This urgency makes Groningen an eligible case for this study. Furthermore, in the past years Groningen suffered from earthquakes due to gas extraction. Besides of climate change and the negative effect on the environment, this can already be a main reason for Groningen to instigate the Netherlands to quit consuming natural gas. This makes Groningen extra relevant as a case, as it is interesting to research whether facing earthquake problems really contributes to the acceptability of the local people and whether this can be used to foster sustainable decision-making. This research focuses on the in 2019 reclassified municipality of Groningen, thus including Haren and Ten Boer.

As also explained in chapter 1 this thesis focuses on the private housing stock in the municipality of Groningen. Table 2 shows that especially the neighbourhoods Meerstad, Haren, Meerdorpen, Ten Boer and Hoogkerk have a high percentage of owner occupied houses. These neighbourhoods are therefore more suited for data collection than the neighbourhoods surrounding the city centre. However, the housing stock in Meerstad is mainly build after 2000, and thus has a higher change of already being sustainable. Furthermore, the housing stock in Meerdorpen is very small. Therefore, it is chosen to focus the data collection on Hoogkerk, Haren and Ten Boer, as these neighbourhood compose the top 3 of owner occupied houses constructed before 2000. For convenience Haren Land & Haren Centrum are merged in this selection, as well as Ten Boer Oost and Ten Boer West. Respondents of other neighbourhoods were of course not excluded, as long as they are homeowner in the municipality of Groningen. It has to be kept in mind that the neighbourhood Hoogkerk has a bigger percentage of houses constructed after 2000, because of the newly built quarter that is included in this neighbourhood.

Neighbourhood	Housing stock	% owner occupied	% built before 2000
Meerstad e.o.	349	88	29
Haren Land	735	83	91
Meerdorpen	446	79	87
Ten Boer Oost	593	78	91
Ten Boer West	2459	76	83
Haren Centrum	8190	71	89
Hoogkerk e.o.	4829	66	70
Noorddijk e.o.	7386	62	91
Noordoost	7537	57	94
Helpman e.o.	9931	55	91
Zuidoost	1127	47	8
Nieuw-West	7127	41	77
Zuidwest	6066	40	81
Oud-West	7256	39	96
Oud-Zuid	10538	36	91
Noordwest	9747	23	84
Oosterparkwijk	7060	23	85
Oud-Noord	10028	19	85
Centrum	11519	17	89

Tabel 2. Key figures housing stock 2018 (CBS, 2019)

3.4 Survey data analysis

This subchapter explains the way the gathered survey data has been analysed. The survey data is mainly being used to answer the sub-questions that are discussed in this subchapter, but also contributes to answering the other sub-questions. The survey can be found in the appendices.

The survey has been developed in Google Forms, which gave the possibility for respondents to fill it in online. Also, Google Forms collects the quantitative data from all respondents in one document, which could easily be converted to SPSS, which has been used for the analysis of the data. Per research question it is explained wat has been done with the data to come to the answer.

2. *What is the public acceptability of the measure to terminate natural gas consumption in Groningen?*

To give input for the answer to this question it was added to the survey (question 4). It could be answered on a five point Likert scale (highly unacceptable – highly acceptable), giving an ordinal variable. Through descriptive statistics the answer to this question can be presented through the percentages per category. Furthermore, the ordinal variable has been converted to a binair variable, so the answer could simply be yes or no and more test could be run on it. In this case, the middle/no opinion category has been counted as no, because we focus on the "yes".

3. *Which factors determine this public acceptability and is there a relation to contextual factors?*

To answer this question there have been added five statements to the survey (question 13 till 17), that literature has shown that determine the acceptability. All of these statements have been formulated positively, meaning that all positive answers contribute to a higher public acceptability. They could be answered on a five point Likert scale: "Totally disagree – totally

agree", thus, each statement provides an ordinal variable. The Chi-Square test and logistic regression were used to analyse if there is a relation between the determing factor and the answer to survey question 4 (do you think it is acceptable). For logistic regression it was necessary to convert the ordinal variables to a binaire variable (agree/not agree). The no opinion or middle category has again been counted as not agree.

To measure whether there is a relation to contextual factors the answers to survey question 5 till 8 were analysed. They each represent one of the contextual factors that have been chosen to analyse, the answers give a binaire variable. These were analysed with the ordinal variable from question 4 by means of the Chi-Square test. Also, the converted binair variable answer to question 4 is being used to run logistic regression tests between acceptability and the individual contextual factors.

Finally, the degree of acceptability is measured as a ratio variable by giving every "agree" and "totally agree" of the five statements in survey question 13 till 17 one point, through which a maximum score of 5 is possible. A score of 5 will mean that the individual totally accepts the measure to terminate gas consumption in households. This way the one-way ANOVA test or independent samples t-test could be used to measure the mean acceptability in different groups.

4. *How pro-environmental is the current energy behaviour of Groningen homeowners?*

This question will be answered by question 9 till 12 of the survey. The questions can be answered with "yes", "no" or "maybe". Every question represent a degree of sustainable energy behaviour, which is higher with every next question. The answers can be presented separately through descriptive statistics and made visual in a graph. To be able to analyse it further the answers have been converted to a ratio variable. A yes to the first question gets one point, the second gets two, the third gets three and the last gets four. In this way, a maximum score of 10 is possible. If someone scores a 10, this means that their energy behaviour is as sustainable as possible (within the context of residential gas consumption). This has been subdivided to house age or gender with the linear regression or independent-sample T-test if this has given an interesting result.

5. *Which contextual factors affect the motivations of homeowners in Groningen to show pro-environmental energy behaviour?*

To answer this secondary research question it has been split up in two: the contextual factors that have already contributed to the motivation for pro-environmental behaviour, and contextual factors that affect future motivations. For the first part the relation between the answers of survey question 9 till 12 (on behaviour) and the answers to survey questions 5 till 8 (on current contextual factors) have been analysed. The answers to survey question 5 till 8 each represent one of the contextual factors that have been chosen to analyse. The contextual factor "access to services" has been left out, as this is not applicable yet. To analyse if there is a relation, a series of two-sample T-tests has been used. The ratio variable is the (converted) degree of sustainable energy behaviour from survey question 9 till 12, as explained at the former secondary research question. The two groups are for each contextual factor "yes" or "no". Thus, for each factor a separate T-test will be used. This is because respondents have the possibility to check more than one "contextual factor", excluding the possibility to have one independent factor with more than two groups (as respondents can be part of several groups).
The second part has been analysed with the data retrieved from survey question 18 till 24. In this question, respondents were asked for each possible contextual factor to what extent it can contribute to their behaviour. The answers give a ordinal variable. Through descriptive statistics the results are presented. Furthermore, relations have been tested between these results and current behaviour or acceptability, in order to explain the answers.

All possible relations have been tested in the ways described above, meaning there are a lot of results and tables. Since these cover more than 21 pages it is decided to not put it in the appendices, but they are of course available on request. Obviously, only the relevant results have been presented in this thesis. To present the results Excel and Word have been used, as these programs can make graphs and tables that look more attractive than the ones SPSS makes.

The variable "Zip code" has not been used in the end, as the distribution of respondents could not give a representative image per neighbourhood. It has been decides to keep focussing on the whole municipality. Furthermore, some respondents had not filled in the question on financial resources, these have been left out in calculations where this variable was taken into account.

3.5 Quality and ethics

There is always a change of under-representation of certain people due to refusing to fill in the survey or partly filling in the survey. However, the focus of this thesis was not so much on characteristics of the respondent, but mainly focussed on the contextual factors, behaviour and acceptability.

From an ethical point of view, people have not been approached before 11.00a.m. or after 9.00p.m. or around dinnertime. Furthermore, only people aged 18 years or older were asked to fill in the survey. To protect the respondent's privacy, there were no personal records asked in the survey. The ZIP code was asked without the letters, this gave the respondent anonymity and the author the possibility to analyse data on a geographical scale. In order to increase the number of respondents, they could participate in a lottery to win a €10,- gift card. If they wanted to, respondents were free to fill in their email address, which would only be used in case they were the winner of the gift card. Obviously, the researcher handled all data with care and safeguarded it with a password.

The researcher made sure she had a proper appearance, to increase trust. In order to convince as much respondents as possible to help, correct language and a smile were important.

4. Results

4.1 Introduction

The following chapter will discuss the concepts 'public acceptability' and 'pro-environmental energy behaviour' in relation to the data that has been collected. Furthermore, the link to contextual factors will be discussed. All these concepts will be discussed separately. Besides, the relation between these concepts will also be touched upon.

4.2 Public Acceptability

As explained in chapter 2, acceptability is determined by the expected individual outcomes, collective outcomes, and a fair distribution of outcomes of a policy. At first, a general question in the survey was asked to find whether people think the measure to terminate natural gas consumption for households is acceptable. The graph in figure 8 shows that more than half of Groningen homeowners think it is acceptable, a small 20% does not agree and almost 23% has no opinion or does not know yet whether they think the measure is acceptable.

To which extent do homeowners think the measure to terminate natural gas consumption in households is acceptable?
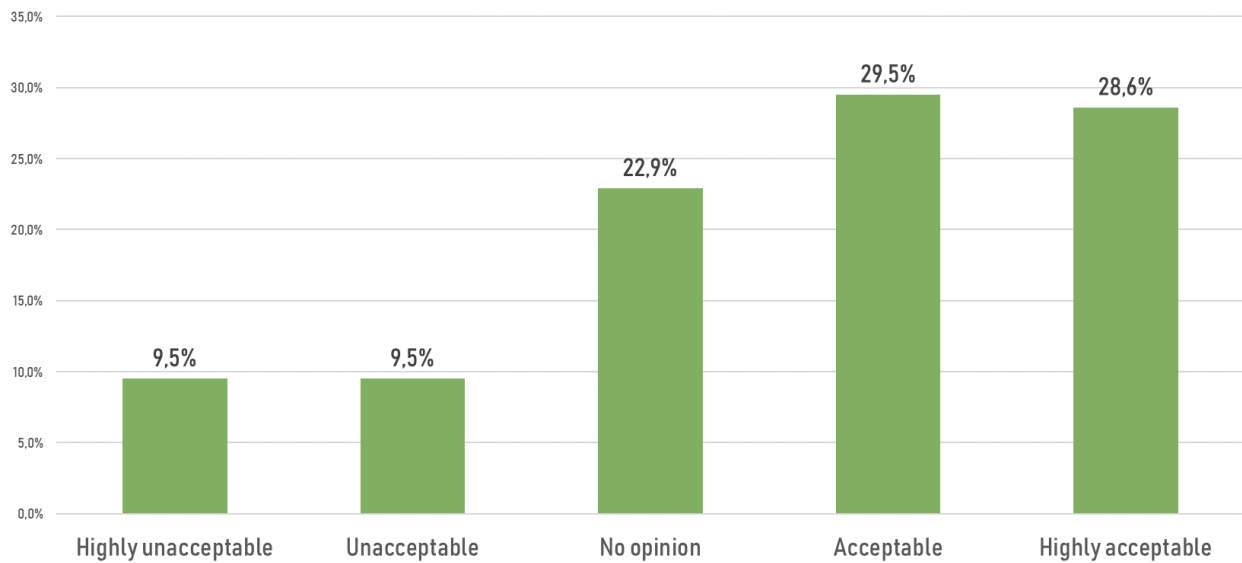
Figure 8 Current acceptability of Groningen homeowners (Author, 2019)

An returning comment that was made when people filled in the survey, which can partly explain the high share of '*no opinion'*, was:

> *"The acceptance of the measure to terminate natural gas consumption in households really depends on what the use of natural gas will be replaced with" (anonymous respondents).*

A Chi Square test analysing gender versus acceptability gives *p* = 0,017, meaning there is a significant difference between the acceptance of women and men. Table 3 shows women more often think the measure to terminate natural gas in households is acceptable than men.

Do you think the measure to terminate natural gas in households is acceptable for homeowners?

Gender	No	Yes	Total
Female	17	39	56
Male	27	22	49
Total	44	61	105

*Tabel 3 Cross tab gender * acceptability*

Following, the several components of acceptability are displayed in the graph in figure 9. This graph shows that especially two factors are highly agreed upon: The factor that is appointed as collective outcome *"I think the measure … is necessary to stop the earthquakes*", and the factor that is appointed as a fair distribution of outcomes *"I think this measure will have (very) positive effects for the environment and future generations".*

Determining factors of public acceptability

- ■ I think the measure to determinate natural gas will be detrimental for me, however, if everyone will have to quit consuming the whole Netherlands will profit
- ■ I think the measure to determinate natural gas is neccessary to stop the earthquakes
- ■ When I will have to make my house gasless, I will be better of than in my current situation
- ■ I think the measure to determinate natural gas will affect everyone equally. Groningen homeowners are not more or less affected than other people in the Netherlands
- ■ I think this measure will have (very) positive effects for the environment and future generations

Figure 9 Determining factors of public acceptability
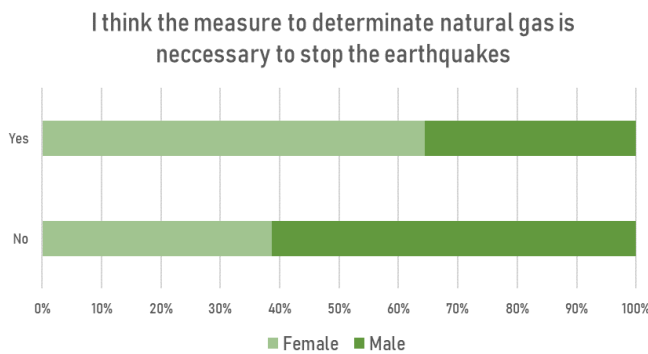
*Figure 11 Collective determining factor * gender*
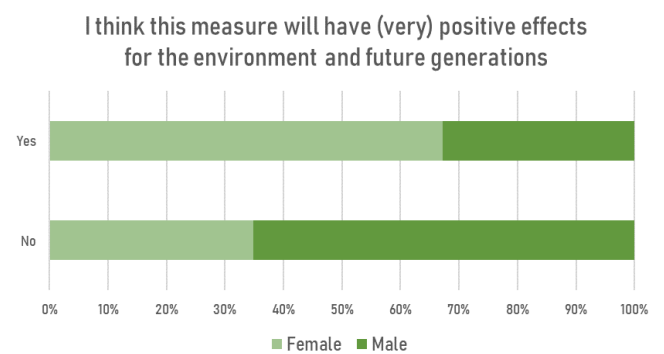
*Figure 10 Intragenerational distribution * gender*

These two factors ("..*necessary to stop earthquakes*" and "..*positive for environment..*") both have been more agreed upon by women than by men, as can be seen in figures 10 and 11. These relations are significant according to the *p*-values in table 4. A relation is significant when the value is lower than 0,05. The relation between a fair distribution of outcomes (*"I think this measure will have (very) positive effects for the environment and future generations")* and gender is moderate, whereas the other relation is weak.

Determining factors * gender		
Determining factor	*p – value*	*Phi & Cramer's V*
I think the measure to determinate natural gas is necessary to stop the earthquakes	0,016	0,238

I think this measure will have (very) positive effects for the environment and future generations	0,02	0,303

*Tabel 4 Pearson Chi Square determining factors * gender*

The relation between most of the determining factors and people's answer to acceptability is significant. The values can be read in table 5. The significant relations mean that these factors indeed influence the acceptability of homeowners. The result of a Phi & Cramer's V test reveals that especially the relation between a fair intragenerational distribution and the acceptability of the measure is strong. In fact, logistic regression indicated it is 10,5 times more likely that people who agreed that the outcome of the measure will be very positive for future generations and the environment, also think the measure is acceptable for homeowners.

Determining factors * acceptability yes/no		
Determining factor	*p – value*	*Phi & Cramer's V*
Individual vs whole Netherlands	0,142	
Necessary to stop earthquakes	0.000	0,344
Future better off than current situation	0,001	0,324
Equally affects everyone in the Netherlands	0,001	0,318
Positive effect environment & future generations	0.000	0,524

*Tabel 5 Pearson Chi Square determining factors * Acceptability*

4.3 Pro-environmental energy behaviour

The graph in figure 12 shows how pro-environmental the current energy behaviour of Groningen homeowners is. It can be seen that when effort or costs of certain behaviour increases, the percentage of homeowners that show this behaviour dramatically drops. However, there is a great deal of people considering to produce renewable energy or install a heat pump. Remarkable is that 10% of the homeowners do not show or intent to any show pro-environmental energy behaviour at all.
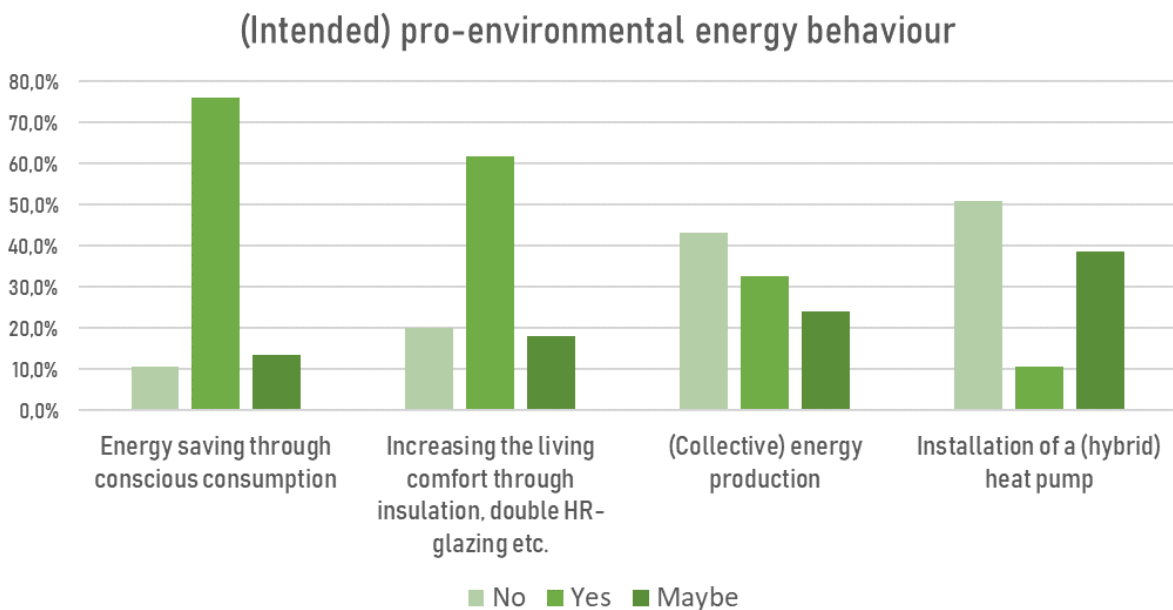

Figure 12 (Intended) pro-environmental energy behaviour of Groningen homeowners

To bring some nuance in the data and give some more in-dept information on the lower pro-environmental energy behaviours, here are some responses that people gave when filling in the survey:

"I know it is necessary and urgent, but who is going to pay for it? It will cost ten thousands of euro's to get my house off gas..." (anonymous respondent).

"I do not believe Groningen will really get completely off gas. It's insane! We have always used natural gas, just as the earthquakes have always been here. I do not think this is going to change" (anonymous respondent).

"It takes at least nine years to earn back your investments... I will be dead in nine years" (anonymous respondent).

"I just invested in a new boiler a few years ago, I am not planning to buy a new one in the near future" (anonymous respondent).

"What if I make all sorts of adjustments on my house now, and then in a few years the municipality tells me I can be connected to a (residual) heat network?" (anonymous respondent).

"Groningen should have taken an example of America. There the government and companies will not simply diminish gas extraction or wrecking. People know they live in a dangerous area and they are compensated for that" (anonymous respondent).

Most of these comments reflect a cost-benefit analysis, however, others show some sort of discontent about the method of working by the municipality or government.

The researched pro-environmental energy behaviour slightly affects the (determents of) acceptability of Groningen homeowners that has been discusses in the former subchapter. See table 6 for the found relations and the corresponding values. A relation is found between the installation of a heat pump and acceptability. It is 8.325 times more likely that homeowners that have installed a heat pump, also think the measure to terminate natural gas consumption is acceptable. Also, these homeowners think the measure is necessary to stop the earthquakes. However, with a Phi & Cramer's V score of 0,221 this relation is weak. Furthermore, homeowners that do not produce renewable energy, also do not think they will be better off when they have to stop consuming natural gas.

Chi Square energy behaviour * determining factors of acceptability		
	p-value	*Phi & Cramer's V*
Energy production*better of	0,030	0,222
Heat pump*stop earthquakes	0,026	0,221
Logistic regression energy behaviour * acceptability		
	p-value	*Exp. (B)*
Heat pump	0,049	8,235

*Tabel 6 Pearson Chi Square & Logistic regression energy behaviour * (determining factors of) acceptability*

The analysed behaviours have been combined to shape a total score for pro-environmental energy behaviour of max 10. A score of 10 stands for the most pro-environmental energy behaviour, whereas a score of 0 stands for no pro-environmental energy behaviour at all. The mean score amongst Groningen homeowners is 3,39, with a mode of 3. This means, most homeowners do not come further than conscious consumption and insulation. Just 2,9% of Groningen homeowners score the maximum score of 10, and a quarter stays below or on 2. Women score significantly

higher than men. Table 7 shows a mean difference in their scores of 1,077. This can be explained by the given that women are more likely saving energy through conscious consumption than men (chi square test, p = 0,005). When talking to respondents who filled in the survey, some of the men seemed proud of their not-so pro-environmental energy behaviour, whereas the women seemed proud when they told they already have a heat pump/solar panels, etc. This are observations of a few respondents and therefore not representative or all Groningen homeowners, nevertheless it is noteworthy.

t-test energy behaviour * gender		
	Mean score	*Std. deviation*
Male	2,82	2,681
Female	3,89	2,176
P - value	0,027	
Mean difference	1,077	

Tabel 7 Independent *t*-test energy behaviour amongst gender

4.4 Contextual factors

4.4.1 Current contextual factors

Contextual factors are said to have a large influence on the motivation behind environmental behaviour (Steg & Vlek, 2009; Steg et al., 2015). However, research lacks in information on which contextual factors precisely, and how they affect behaviour. Therefore, the goal was to analyse whether the contextual factors as explained in chapter 2 have an effect on the behaviour and acceptability of Groningen homeowners.

The analysed contextual factors are:
- Economic factors (like one's own budget, but also subsidies and loans)
- The facing or being afraid of damage through earthquakes caused by natural gas extraction
- Cues of the presence of pro-environmental energy behaviour in the neighbourhood
- Access to information on how to get the house gasless
- Access to services to get the house gasless

At first, the effect of the current contextual factors is analysed. Thereafter the effect of possible future contextual factors is discussed. The graph in figure 13 shows the contextual factors that Groningen homeowners contemporary face. 'Access to services' was not questioned, as this factor is approached as a possible future contextual factor. As can be seen, there are no extreme outliers, however, there are some differences. At first, it is alarming that more than half of Groningen homeowners have faced or are afraid of damage due to earthquakes. It is remarkable that Groningen homeowners who are afraid of earthquake damage or have faced earthquake damage, live in a house that is mean 10,7 years younger than homeowners that have not (see table 8). Less remarkable is that homeowners that see many solar panels in their street, live in a house that is 11,3 years younger than homeowners with no or few solar panels in their street (also table 8).
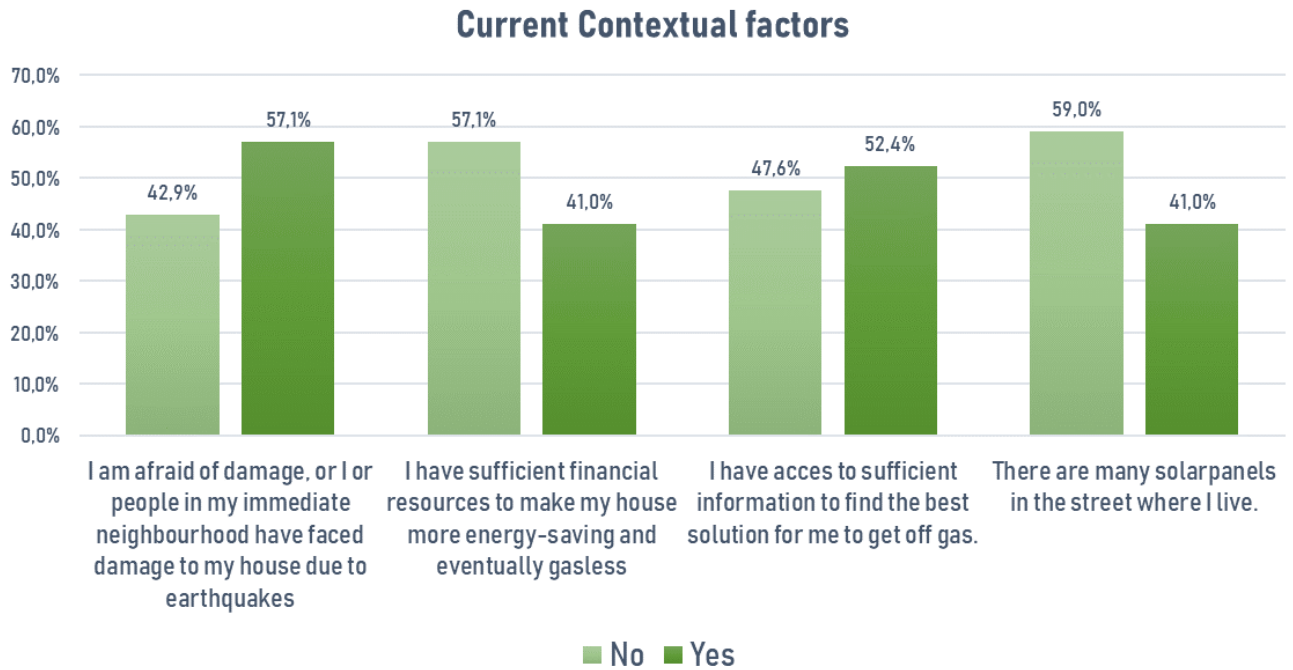
Current Contextual factors

Figure 13 Current contextual factors of Groningen homeowners

(*Afraid of*) *earthquake damage*	*Mean house age in years*
No	58,05
Yes	47,34
p – value	0,043
Mean difference	10,706
Presence of solar panels	*Mean house age in years*
No	56,56
Yes	45,17
p – value	0,033
Mean difference	11,391

*Tabel 8 Independent t-test contextual factors * house age*

No moderate or strong relations have been found between the researched contextual factors and acceptability. Thus, for instance there cannot be said that Groningen homeowners that face earthquake problems think the measure is more acceptable than people who have not faced earthquake problems. However, Groningen homeowners that have access to sufficient information on how to get their house off natural gas, also think they will be better off when making their house gasless. With a Phi & Cramer's V of 0,201, though, this relation is weak.

On the other hand, the contextual factors do affect the energy behaviour of Groningen homeowners, as can be seen in table 9. Homeowners that state they do not have sufficient financial resources or access to sufficient information to make their house more energy-saving and eventually gasless, more likely do not produce renewable energy. Also, homeowners that do not have many solar panels in their street, more likely do not produce renewable energy. Groningen homeowners that state they do have access to sufficient financial resources and information and

do have many solar panels in their street, therefore score significantly higher on pro-environmental behaviour, as can be seen in table 10.

	Contextual factors * energy behaviour	
	p-value	*Phi & Cramer's V*
Financial resources * energy production	0,029	0,216
Sufficient information * energy production	0,036	0,206
Presence of solar panels * energy production	0,001	0,331
Sufficient information * heat pump	0,042	0,199

*Tabel 9 Pearson Chi Square contextual factors * current energy behaviour*

Financial Resources	*Mean score on pro-environmental energy behaviour*
No	2,9
Yes	4,05
p – value	0,022
Mean difference	-1,147
Sufficient information	
No	2,82
Yes	3,91
p – value	0,025
Mean difference	-1,089
Presence of solar panels	
No	2,76
Yes	4,3
p – value	0,002
Mean difference	-1,544

*Tabel 10 Independent Samples t-test contextual factors * score on energy behaviour*

The graph on pro-environmental energy behaviour in paragraph 4.3 (figure 12) showed that Groningen homeowners are doubting about producing renewable energy and/or install a heat pump. Unfortunately there is no link between homeowners that answer "maybe" to certain energy behaviour and the current contextual factors.

Finally, it is shown in the beginning of this paragraph that the age of the house has a connection to the contextual factors. On the other hand, no significant relation has been found between the age of the house and acceptability or behaviour. Thus, it has to be assumed that the age of a house does not affect the owners energy behaviour or his/her acceptance of the measure to determinate gas consumption in households.

4.4.2 Possible contextual factors

Besides the contextual factors that Groningen homeowners are currently facing, it is questioned to what extent possible future contextual factors would influence people's behaviour and acceptability. The question asked in the survey was: "*Will the following hypothetical situations increase your acceptance of the measure to determinate gas consumption in households, and contribute to making your house gasless?*" The graph in figure 14 shows the outcome.

Contribution of hypothetical contextual factors to acceptability and pro-environmental behaviour

- Seeing many houses in my street becoming gasless
- Total package from energyprovider to make my house gasless
- Sufficient information from municapility
- Subsidies
- Loans with favourable terms
- Rapid increase in natural gas price
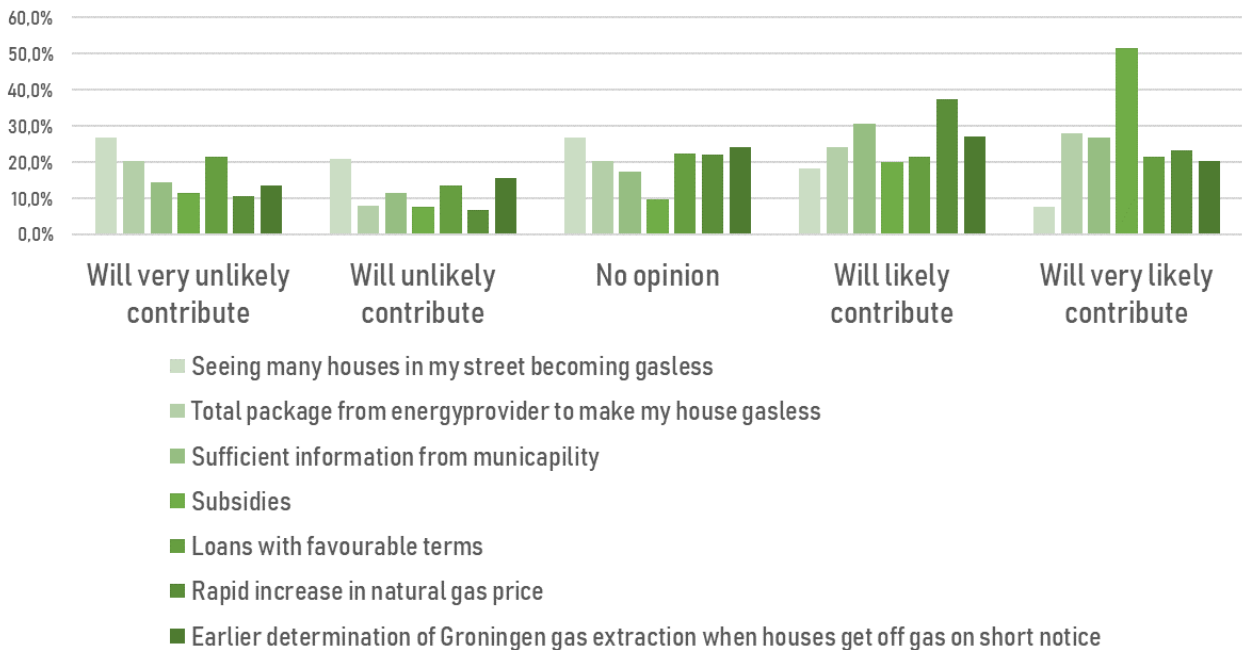- Earlier determination of Groningen gas extraction when houses get off gas on short notice

Figure 14 Contribution of possible contextual factors to acceptability and pro-environmental behaviour

Homeowners state that seeing other people making their house gasless will (very) unlikely contribute to making their own house gasless, whereas there is a relation found between environmental cues like these and current energy behaviour (see also paragraph 4.4.1). Even though it is not certain or proven that this relation is causal, it does have an influence. Ordinarily, people tend to follow group behaviour and to act appropriately, conform social rules and norms, as is also discussed in chapter 2. The graph shows that the other factors will more likely contribute to a higher acceptance. Especially the provision of subsidies, a pull measure, is said to be a high motivator.

There are no significant relations between the current contextual factors and these possible contextual factors. Thus, the contextual factors someone is facing now, will probably not affect their expected behaviour when they face other possible contextual factors. This means that it must be adopted that there is no difference between for instance the answer on "subsidies" or "loans with favourable terms" by someone who does not have sufficient financial resources and someone who does. The current energy behaviour of Groningen homeowners also did not influence their opinion on these possible contextual factors.

The current acceptability of Groningen homeowners did affect their opinion on these possible contextual factors, as can be seen in table 15. Especially people who think termination of natural gas consumption in households is necessary to stop the earthquakes and will have positive effects for the environment and future situations, also think that seeing other people making their house gasless will contribute to their acceptance and behaviour. Besides, people who think that termination of natural gas consumption is necessary to stop the earthquakes, also are more than 3,5 times more likely thinking that loans with favourable terms and an earlier ending of gas extraction when a lot of houses are off gas soon will contribute to their acceptance and behaviour.

	Seeing houses becoming gasless		
	p-value	Nagelkerke R2	Exp.(B)
Termination of natural gas consumption is necessary to stop the earthquakes	0,002	0,128	4,638
Positive effects for environment and future generations	0,004	0,114	4,287
Sufficient information provided by the municipality			
Equal affection to everyone	0,009	0,085	3,000
Positive effects for environment and future generations	0,019	0,069	2,589
Favourable terms on loans			
Termination of natural gas consumption is necessary to stop the earthquakes	0,002	0,121	3,692
Earlier ending of gas extraction when a lot of houses are off gas soon			
The measure is detrimental for me, but everyone will profit	0,020	0,067	2,526
Termination of natural gas consumption is necessary to stop the earthquakes	0,002	0,114	3,478
Positive effects for environment and future generations	0,035	0,056	2,351

Figure 15 Logistic regression possible contextual factors * determining factors of acceptability

Some recurring comments that were made by respondents when filling in the survey can give deeper insights on peoples thoughts and opinions:

"I do not trust the government" (anonymous respondent)

"I am afraid that information from the municipality will neither be neutral, nor sufficient. They of course work together with companies of their preference that can make my house gasless, but that does not per se mean it will be the best solution for me" (anonymous respondent)

4.5 Groningen energy transition

The transition from houses that consume natural gas for heating and cooking to sustainable housing that will not use natural gas, as part of the total energy transition, is currently in the pre-development phase. In chapter 2.4 it was explained that the take-off phase of a transition is reached when adjustment of developments takes place at both micro- and macro-level, reinforcing each other (Van der Brugge et al., 2005). In Groningen (and the rest of the Netherlands, or actually the whole world), an important factor on macro-level is climate change. This is a slow trend, which has very large consequences. Following this trend, there is a growing demand for more sustainable ways of living. The COP21 in 2015 brought a worldwide agreement to keep global temperature rise amply below 2 °C (Ministerie van Economische Zaken, 2016). Another important factor on macro-level are the earthquake issues caused by gas extraction. There is an increasing dissatisfaction on the effect the gas extraction has on people living in the surrounding areas, and the way the government deals with these issues. All these factors exert pressure on the regime.

On the other side, on micro-level individual persons and/or organisations are working. This can for instance be foundations or federations, which work on the instigation of sustainable housing and collective energy. But also energy providers and especially developers of installations based on or producing renewable energy have a big role here. The municipality of Groningen realizes the energy transition is a task they, or the national government, cannot deal with on their own. Therefore a collaboration with and contribution from companies, institutions, and also private homeowners is expected (Gemeente Groningen, 2018a).

The regime-level comprises amongst others the institutions and norms. The national government obligates all municipalities to have established a heat transition plan for every neighbourhood before 2021, and the municipality of Groningen desires this to be a complete energy plan (Gemeente Groningen, 2018b). The municipality of Groningen is already quite active in planning on how to get the municipality off natural gas. As it wants to be carbon dioxide neutral before 2035, the urgency is higher than in most of the rest of the Netherlands. The municipality of Groningen states that public acceptability is necessary and has added it to the agenda (Gemeente Groningen, 2018a). However, the documents that have been analysed did not, or just minorly, show how the municipality is planning to create or increase public acceptability. The focus is more on implementation and behaviour. The municipality of Groningen was the first that started a collaboration with an energy network company in order to finish transition plans for seven neighbourhoods in Groningen in 2018 (Gemeente Groningen, 2018b). In some of these plans local citizen participate actively, in others participation has a less important role. This experimenting must lead to a standardized manner to develop transition plans for all, more than fifty neighbourhoods. These are called Energietransitieplannen (ETP's), which will be an important instrument for all existing neighbourhoods (Gemeente Groningen, 2018a). The municipality is however struggling in how to fit this into the new Omgevingswet. Therefore, an approved experiment on how to do this is desired by the municipality (Gemeente Groningen, 2018b). Other instruments that can be used to get houses off natural gas are amongst others (Gemeente Groningen, 2018a):

- "Groningen Woont SLIM", a box-office which stimulates and provides information on energy saving measures in houses;
- 'Masterplan verduurzamen corporatiewoningen'; a collaboration with housing corporation to when and how the rental housing stock will be without natural gas;
- Subsidies through "050-hybride", for a hybrid heatpump in 50 owner occupied houses;
- "WarmteStad"; heat networks

The municipality of Groningen acknowledges that the focus is less on owner occupied houses, as these owners can act and are acting individually and can be motivated by the ETP's (Gemeente Groningen, 2018a). However, the municipality admits that this probably will not be enough to reach intermediate targets (Gemeente Groningen, 2018a). Therefore, possible instruments that can also be used are the providing of loans on favourable terms or collective purchase of sustainable arrangements (Gemeente Groningen, 2018a). Besides these possibilities, the municipality calls for further innovation of heat pumps, as the current pumps do not meet the demands of most homeowners, since they are loud, expensive and big (Gemeente Groningen, 2018a).

An available national instrument is a shift in energy taxes: an increase in natural gas taxes and an decrease on electricity taxes (Ministerie van Economische Zaken, 2016). This is called a push measure, and will make it more attractive for homeowners to switch to a heat pump and quit consuming gas. Another instrument is 'building-bound financing', in which the investment will be paid off by savings on the energy bill (Gemeente Groningen, 2018a).

5. Discussion and conclusion

5.1 Introduction

The former chapter discussed the results and analysis, This chapter analyses the results that have been discussed in chapter 4. Furthermore, it presents the conclusions of the research, by answering the research questions. Also, recommendations are being made for the municipality and for further research.

5.2 Research questions

To answer the main research question, six secondary research questions have been deployed, which will be answered in this subchapter.

1. *How does public acceptability work and why is it important?*

Unfortunately the document analysis did not really provide an answer to this question. Governmental institutes do acknowledge the importance of public acceptability, but there is not emphasized why this is important or how this works in the case of Groningen homeowners. Also there is little attention on how acceptance is included in the plans, especially not when focussing on homeowners. The literature research and the data collected in the survey did however provide enough information to answer this question.

Public acceptability refers to behaviour of not very active members of environmental citizenship, that do (or do not!) accept public policies. Even though this behaviour is non-activist, it influences implementation of policies (Steg et al., 2013). Public acceptability also refers to the attitude of people towards these policies. As attitudes are important determinants of behaviour, acceptability strongly influences the decision-making process around the implementation of environmental policies (Schuitema & Jakobsson Bergstad, 2013, Bristow et al., 2010). As low acceptability can cause policies to be less effective or not to be implemented at all, public acceptability is very important. Policies can be less effective or not implemented when citizen actively (protest, demonstrations) or non-actively (not complying to the policiy) oppose it.

Public acceptability is determined by the expected individual policy outcomes, the expected collective outcomes, and a fair distribution of outcomes (Schuitema & Jakobsson Bergstad, 2013). Furthermore trust and procedural fairness are important conditions for success.

2. *What is the current public acceptability of the measure to terminate natural gas consumption in Groningen?*

As explained in chapter 2 acceptability has three interdependent dimensions, being socio-political acceptance, community acceptance and market acceptance. When we relate the results showed in chapter 4 to theory, we can conclude that socio-political acceptance is relatively high, as Groningen homeowners overall think the measure to terminate natural gas consumption is necessary and acceptable. However, community acceptance is not that high, as trust in the municipality is said to be low and it is unclear what the plans per neighbourhood and the financial picture will be. Also, market acceptance can be better. The document analysis showed that the current heat pumps do not meet the demands of a lot of homeowners yet. Also, the comments made during the survey shined light on the cost-benefit considerations of people. The government can have an important role in the innovation of heat pumps, as they can push developers by raising the norms and/or giving subsidies.

These uncertainties causes people to wait and see, whereas time is short. As over 47.000 houses in the municipality of Groningen are owner occupied (CBS, 2018), the graph on acceptability in chapter 4.2 means that there will be 9.000 homeowners that do not accept the measure to quit natural gas consumption for households, and another 10.000 that still needs to be convinced. As 2035 is already in 16 years, time is short. Therefore it is urgent and necessary to give clarity on what will happen per neighbourhood as soon as possible.

3. *Which factors determine this public acceptability and is there a relation to contextual factors?*

The literature discussed in chapter 2 showed that a fair distribution of outcomes, and especially the intergenerational distribution of outcomes, is a very important determining factor of acceptability. This research confirms this theory as there is a strong relation found between acceptance and caring about future generations and the environment.

The results in chapter 4 show that contextual factors do not affect acceptability. It must therefore be concluded that having faced earthquake problems or sufficient financial resources, does not automatically mean that these homeowners more or less accept the measure to terminate natural gas consumption.

4. *How pro-environmental is the current energy behaviour of Groningen homeowners?*

The results that have been demonstrated in chapter 4 show that the current energy behaviour of Groningen homeowners is regularly restricted to conscious energy consumption and increasing the living comfort through proper insulation or triple glazing. Some homeowners do not care about their energy behaviour at all. A lot of people are doubting to install for instance solar panels or a heat pump.

5. *Which contextual factors affect the motivations of homeowners in Groningen to show pro-environmental energy behaviour?*

The current energy behaviour of Groningen homeowners is affected by contextual factors. A lack of access to sufficient information or financial resource in Groningen leads to less production of renewable energy. Besides, when there are not many solar panels visible in the street, homeowners less likely will produce renewable energy themselves.

A lot of people are doubting to install for instance solar panels or a heat pump. Unfortunately, no relations have been found between this "maybe" and the chosen contextual factors. However, from the qualitative data through the comments and document analysis it became clear that people are waiting for the plans of the municipality, and that they are not convinced of the efficiency of heat pumps yet.

A popular answer to the effect of possible future contextual factors on behaviour and sustainability was that subsidies would motivate the homeowners. Also an increase in gas price would probably contribute. A combination of this pull and push measures is recommendable. In this, it must be kept in mind that people most often mention finances if you ask them directly what motivates them, however, financial incentives do not always have the expected effect on public acceptability (Perlaviciute et al., 2018).

6. *What are the possibilities to adjust contextual factors?*

The government can possibly have a big influence on contextual factors, to manipulate these factors in a way that will positively contribute to people's acceptance and motivation to behave pro-environmentally. As can be read in chapter 4.5, the instruments the municipality of Groningen has available are minorly focussed on owner occupied housing. The document analyses showed that the municipality is able to offer loans on favourable terms or subsidies, which are ways to influence the financial contextual factor.

Subchapter 4.4.2. explained that environmental cues do have a relation with pro-environmental energy behaviour of Groningen homeowners, even though a lot of people do not admit this or agree on this. The government unfortunately cannot influence this contextual factor directly, but it can in itself work as an accelerator. Increasing the environmental cues in a street can be done by encouraging or fostering collective renewable energy production or collective acquisition and

installation of heat pumps. This can be an extra motivation for Groningen homeowners and work as an environmental cue itself.

5.3 Efficient approaches to increase public acceptability and instigate pro-environmental behaviour

The discussion and answers to the secondary research questions in chapter 5.2 helped and contributed to answering the main research question:

What are efficient approaches for the municipality of Groningen to increase public acceptability and instigate pro-environmental behaviour of homeowners in order to successfully get the present owner-occupied housing stock in Groningen off natural gas before 2035?

Because of the strong relation that has been found between acceptance and caring about future generations and the environment, it is recommendable for the municipality to stress the urgency of the termination of natural gas consumption and emphasize on what the positive outcomes for Groningen environment and future generations will be. As more homeowners will be convinced of this urgency and positive intergenerational outcomes, public acceptability might rise.

As much people argue that acceptability or pro-environmental energy behaviour is major a cost-benefit consideration, a combination of push and pull measures is recommendable (an increase in natural gas price and subsidies or loans with favourable terms). However, on its own, this instrument will not be enough.

To increase market acceptance, further development of heat pumps or other options that can replace natural gas is necessary. The municipality of Groningen or the national government can push this innovation by subsidizing developers or mandatory norms which these innovations have to comply to. Community acceptance can be improved by increasing trust. Also, transparency in the development of the ETP's will help to take away some insecurities. Trust will rise if people get the opportunity to participate in these developments.

5.4 Suggestions for further research

The scope of this research was limited, as the main focus was on the effect of contextual factors. It might be interesting to research whether the acceptability of Groningen homeowners is different amongst people with different characteristics, like age, education, living conditions, social norms, etc. Also if there is more time for data collection, I would recommend to research whether there are differences per neighbourhood, as this information would be really helpful in the developing of the ETP's.

The measured public acceptability is a snapshot, one particular moment in time. Furthermore, as explained, this moment in time is full of uncertainties. It would be interesting to perform a research like this again, after the ETP's for every neighbourhood have been developed, to see if acceptance has changed.

6. Reflection

In this chapter I will reflect on the process of collecting data and writing my master thesis, as well as on the thesis itself. Personally, I am happy with the final product, but as with every research there can be made some critical comments. I am most content with the literature review. Much articles can be found on behaviour, transitions and acceptability. However, as instigating people to transform their home to a sustainable house that does not need natural gas is quite a new topic, it was sometimes not easy to translate the information to this specific situation. I really learned a lot on environmental psychology and I enjoyed diving in to the theory. I think the gathered

knowledge is a valuable addition to the knowledge retrieved in the Master of Environmental and Infrastructure Planning. If I could do the thesis again though, I would really force myself to work faster in the beginning, so that I would have more time to catch unexpected situations.

Overall, the data collection went well. The collection in the first weeks unfortunately took a lot of time. Probably because I let respondents fill in the survey right away, instead of using the 'drop-off and pick-up' method, which worked very well during my bachelor thesis. With hindsight, I should have switched method earlier, to win back some time. However, this method also had some advantages. As I was with the respondents when they filled in the survey, I could clarify questions that respondents found confusing. And since the survey was digital, I could adjust a confusing question straight away if necessary. Moreover, respondents had the opportunity to react and explain their answers. A lot of people really felt this need, and a big disadvantage from surveys is the limited information you get and the missing possibility to dive deeper into a certain part. This way, I got some extra qualitative information, which gave more nuance to the data. It must however be kept in mind that not all respondents gave extra information and it is therefore less representative than the actual data itself.
Furthermore, the survey was filled in by 105 respondents, which should be enough to run statistical tests on. However, to be able to apply statistical analyses it was sometimes necessary to combine some answer categories. If there was more time and resources for this research, I would have collected much more data and pick respondents from every neighbourhood, in proportion to the share of owner occupied houses. This would give a truly representative image and probably more and stronger significant relations. Also, this would give the opportunity to analyse data per neighbourhood. However, in the frame of a master's thesis by one person in a limited time frame this is not realistic. Furthermore, I asked very few characteristics to the respondents, in order to keep the survey as short as possible, but also because these are less important in this research. However, with hindsight it might have been interesting to do add more questions on characteristics, because when the expected relations have not been found, you can look for other explaining factors. This would have also made it easier to check whether the sample is representative.

 I had fun in analysing the data in SPSS and am happy with the presentation of the results. The connection from this results to the theory and translation to practice and recommendations was a bit of a challenge. I was surprised and actually a bit disappointed that 'earthquake problems' and the age of a house did not really affect Groningen homeowners' behaviour or acceptability. This because I did expect it would have an effect, and especially the earthquakes were reason for me to pick Groningen. Maybe this would have been different if I had collected more data, but maybe it would not, I guess I would never know. The rest of the outcomes seems convincing to me, and more or less in line with theory. Unfortunately, this thesis brought no unexpected new information or shiny innovative interventions, but I do think it is an adequate research.

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Appendices

Appendix 1. Data collection tool: Survey

rijksuniversiteit groningen / faculteit ruimtelijke wetenschappen

Groningen van het gas af

De overheid heeft de ambitie om in 2050 alle huizen in Nederland van het gas af te hebben. Dit omdat het gebruik van aardgas slecht voor het milieu is en het gas een keer opraakt, maar ook omdat aardbevingen in Groningen ervoor zorgen dat de gaskraan sneller dicht moet. Gas wordt in huizen gebruikt om de woning te verwarmen, voor warm water en om op te koken. Er zijn aanpassingen aan de woning nodig om zonder gas te kunnen, zoals bijvoorbeeld goede isolatie of het plaatsen van een warmtepomp. Wat overal precies mogelijk is wordt nog uitgebreid onderzocht en besproken.

Voor mijn afstudeerscriptie aan de Rijksuniversiteit Groningen (Msc Environmental & Infrastructure Planning) onderzoek ik de rol van Groningse woningeigenaren in deze energietransitie. Hiervoor houd ik een enquête onder woningeigenaren in de gemeente Groningen en ik zou het erg waarderen als u me wilt helpen. De uitkomst van dit onderzoek wordt gebruikt voor mijn scriptie en zou kunnen bijdragen aan een betere afstemming tussen het beleid van de gemeente en haar bewoners. Er zal vertrouwelijk worden omgegaan met uw gegevens en u blijft volledig anoniem. Als u geïnteresseerd bent naar de resultaten van het onderzoek, kunt u contact met mij opnemen via h.s.loos@student.rug.nl. Onder alle inzendingen wordt een Keuze Cadeaukaart t.w.v. €10,- verloot.

Alvast bedankt! Met vriendelijke groet, Serena

1. Wat is uw geslacht?
- ○ Man
- ○ Vrouw
- ○ Zeg ik liever niet/anders

2. Wat zijn de cijfers van uw postcode? (Deze worden alleen gebruikt om de resultaten per wijk te kunnen analyseren)

[   ]

3. Wat is het bouwjaar van uw woning (ongeveer)?

[   ]

4. In hoeverre vindt u het acceptabel voor woningeigenaren dat de overheid in de toekomst alle woningen van het gas af wil halen?

	1	2	3	4	5	
Zeer onacceptabel	○	○	○	○	○	Zeer acceptabel

Wat is voor u van toepassing?

5. Ik ben bang voor schade/ik heb schade aan mijn woning door aardbevingen, of mensen in mijn directe omgeving hebben schade ondervonden door aardbevingen
- ○ Ja
- ○ Nee

6. Ik beschik over de financiële middelen om mijn huis energiezuiniger en uiteindelijk gasloos te maken
- ○ Ja
- ○ Nee

7. Ik heb toegang tot voldoende informatie om uit te zoeken wat in mijn geval een passende oplossing is om van aardgas af te stappen
- ○ Ja
- ○ Nee

8. In de straat waarin ik woon staan veel huizen met zonnepanelen
- ○ Ja
- ○ Nee

Wat doet u zelf, heeft u gedaan of bent u van plan om op korte termijn te doen om uw huis energiezuiniger te maken?

9. Energie besparen door er bewuster mee om te gaan (korter douchen, de kachel een graadje lager, spaarlampen, etc.)
- ○ Ja
- ○ Nee
- ○ Misschien

10. Verhogen van het comfort van de woning door bijvoorbeeld (beter) isoleren of HR beglazing
- ○ Ja
- ○ Nee
- ○ Misschien

11. Zelf of gezamenlijk energie opwekken (met bijvoorbeeld zonnepanelen)
- ○ Ja
- ○ Nee
- ○ Misschien

12. Het plaatsen van een (hybride) warmtepomp, waardoor ik flink minder (of geen) gas verbruik voor verwarming
- ○ Ja
- ○ Nee
- ○ Misschien

In hoeverre bent u het eens met de volgende stellingen over het doorvoeren van de maatregel om alle woningen (huur en koop) gasloos te maken?

13. Ik denk dat deze maatregel nadelig voor mij als individu zal zijn, maar als iedereen het moet doen zal heel Nederland er van profiteren

	1	2	3	4	5	
Helemaal mee oneens	○	○	○	○	○	Helemaal mee eens

14. Ik denk dat deze maatregel nodig is om de aardbevingen te stoppen

	1	2	3	4	5	
Helemaal mee oneens	○	○	○	○	○	Helemaal mee eens

15. Ik denk dat wanneer ik mijn woning gasloos moet maken, ik beter af zal zijn dan in mijn huidige situatie

	1	2	3	4	5	
Helemaal mee oneens	○	○	○	○	○	Helemaal mee eens

16. Ik denk dat deze maatregel voor iedereen even positief of negatief is, ik word als Groningse woningeigenaar dus niet meer of minder bevoordeeld of benadeeld dan andere mensen in Nederland

	1	2	3	4	5	
Helemaal mee oneens	◯	◯	◯	◯	◯	Helemaal mee eens

17. Ik denk dat de gevolgen van het doorvoeren van deze maatregel (zeer) positief zullen zijn voor het milieu en toekomstige generaties

	1	2	3	4	5	
Helemaal mee oneens	◯	◯	◯	◯	◯	Helemaal mee eens

Zouden de volgende situaties eraan bijdragen dat u uw woning gasloos maakt en de maatregel om alle woningen gasloos te maken acceptabel vindt?

Let op, hoewel sommige van deze situaties in één of andere vorm bestaan, zijn ze puur hypothetisch. Het is dus niet gezegd dat dit echt gaat gebeuren.

18. Ik zie dat veel mensen in mijn straat hun woning gasloos maken.

	1	2	3	4	5	
Draagt zeer onwaarschijnlijk bij	◯	◯	◯	◯	◯	Draagt zeer waarschijnlijk bij

19. Mijn energieaanbieder komt met een "ontzorgpakket", waarbij de energierekening gelijk blijft om dit te financieren. Ze zoekt uit wat voor mij de beste oplossing is en laat dit uitvoeren in mijn woning. Hierdoor heb ik er geen omkijken naar.

	1	2	3	4	5	
Draagt zeer onwaarschijnlijk bij	◯	◯	◯	◯	◯	Draagt zeer waarschijnlijk bij

20. De gemeente draagt zorg voor relevante en betrouwbare informatie voor mijn situatie, waarmee ik zelf kan uitzoeken wat ik het beste vind voor mijn woning.

	1	2	3	4	5	
Draagt zeer onwaarschijnlijk bij	◯	◯	◯	◯	◯	Draagt zeer waarschijnlijk bij

21. De overheid draagt bij aan de kosten voor het gasloos maken van mijn woning in de vorm van subsidies.

	1	2	3	4	5	
Draagt zeer onwaarschijnlijk bij	◯	◯	◯	◯	◯	Draagt zeer waarschijnlijk bij

22. Er komt een regeling waarbij een lening afgesloten kan worden of een hypotheek verhoogd kan worden tegen gunstige voorwaarden (bijvoorbeeld een hele lage rente).

	1	2	3	4	5	
Draagt zeer onwaarschijnlijk bij	◯	◯	◯	◯	◯	Draagt zeer waarschijnlijk bij

23. De prijs van aardgas wordt jaarlijks fors hoger.

	1	2	3	4	5	
Draagt zeer onwaarschijnlijk bij	◯	◯	◯	◯	◯	Draagt zeer waarschijnlijk bij

24. Als op korte termijn een groot deel van de Nederlandse huishoudens al geen gas meer gebruikt, zal de gaswinning in Groningen eerder stoppen dan het beoogde 2030.

	1	2	3	4	5	
Draagt zeer onwaarschijnlijk bij	◯	◯	◯	◯	◯	Draagt zeer waarschijnlijk bij

Ontzettend bedankt voor het beantwoorden van de vragen.

Wilt u meedingen naar de Keuze Cadeaukaart t.w.v. €10,-? Zo ja, vult u dan hier uw emailadres in. U ontvangt alleen bericht als u de winnaar bent. Uw emailadres wordt losgekoppeld van uw antwoorden en zal niet gebruikt worden voor andere doeleinden.

25. Wat is uw emailadres?