

STUDENTS' PERCEIVED POTENTIAL TO REDUCE NATURAL GAS USAGE: A QUALITATIVE RESEARCH



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Abstract

Burning natural gas emits greenhouse gases which contribute to global warming leading to extreme weather, ecosystem damage and food insecurity. Because of the natural gas production decrease in Groningen, the Netherlands became more energy-dependent on other countries for natural gas. At the same time, the variable natural gas consumer prices have strongly increased in the past year. Therefore, a reduction of natural gas usage in households contributes to a solution for climate change and energy affordability. I conducted one focus group discussion with three participants and one interview with HBO/University students studying in Leeuwarden (Friesland) using the Social Practice Theory (SPT). This study questions how students perceive their potential to reduce natural gas usage. The reasons in favour of their perceived potential included meanings, competences, and materials as well as a socio-demographic factor (paying per usage). The reasons for a lack of potential included meanings, materials, competences, socio-demographic factors (with an additional socio-demographic factor which is non-helping landlords). This study suggests that SPT is applicable to research on how students perceive their potential to reduce natural gas usage and that socio-demographic factors are also essential contributors to how this is perceived. In addition, several solutions were mentioned in the additional brainstorming sessions and are recommendations for policymakers.

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1. Introduction

Burning natural gas emits greenhouse gases which contribute to global warming (Siddik, Islam, Mostafa Zaman, & Hasan, 2021). Global warming causes extreme weather, droughts, and floods (United Nations, 2018). This leads to liveable land loss, forest and ecosystem damage and food insecurity (Hui-Min, Xue-Chun, Xiao-Fan, & Ye, 2021). Stopping to utilise fossil fuels would avoid the death of 3.61 million people each year (Lelieveld et al., 2019), hence when households reduce natural gas usage it is a life-saving activity. Although, depending on the method of production, the intrinsic carbon content (kg CO₂ per Giga Joule of energy produced and used) of natural gas differs.¹

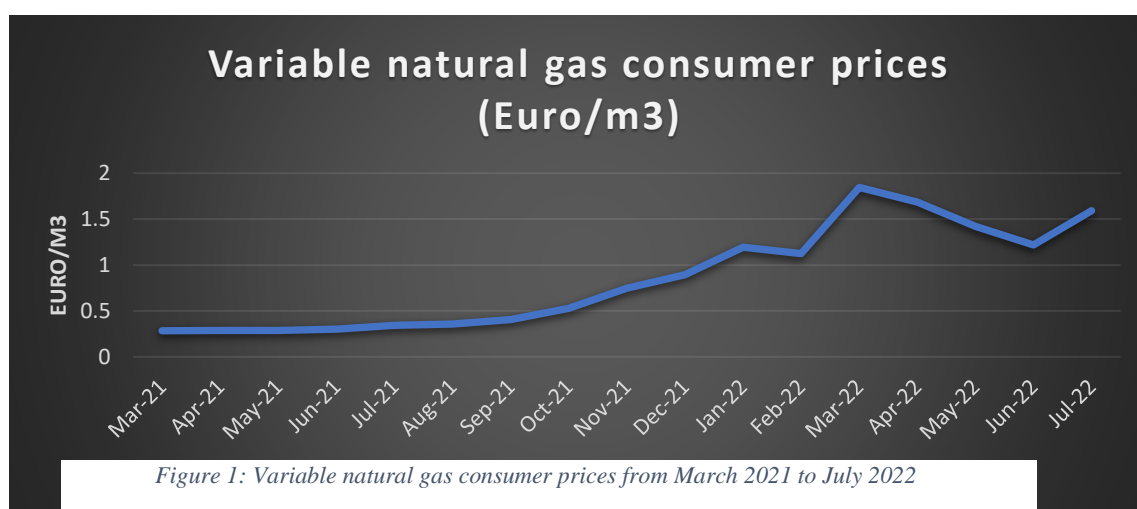
Citizens in the Netherlands become more and more dependent on natural gas supplies from other countries (Stephen Chong, 2020). The Netherlands used to have a production in Groningen of low-caloric natural gas (which is used in households). However, the government decided to reduce the low-caloric production in Groningen from 2013 onwards because of the risk of earthquakes (Stephen Chong, 2020). As a result, the Netherlands became a net importer in 2018 (Stephen Chong, 2020), becoming more and more dependent on other countries. Moreover, in 2019, the Netherlands imported 30% of their imported natural gas from Russia (Table 1; (Stephen Chong, 2020)). In the current geopolitical tensions, the conflict between Russia and Ukraine and the European sanctions against Russia, the possibility that Russia closes the gas tap in response is a threat to our energy security. This is a problem because when the national energy security declines, the risk of power outages and an energy crisis becomes higher.

¹ For example, if natural gas is produced by hydraulic fracturing (also referred to as shale gas), its intrinsic carbon is higher than conventional methods such as the production by a drilling platform (Mathur et al., 2022). Hydraulic fracturing does extended harm compared to conventional methods since this uses a lot more water with chemicals that contaminate groundwater (Mathur et al., 2022).

Table 1: Natural gas numbers of import, export, usage, and production in the Netherlands (Stephen Chong, 2020)

Main countries import (billion m3) (2019)		Main countries export (billion m3) (2019)		Usage (billion m3) (2019)		Other measures (billion m3) (2019)	
Norway	21.550	Germany	28.543	Energy sector	14.597	Production:	32.324
Russia	16.849	Belgium	13.990	Industry	11.362	Production - usage	-10.011
UK	7.638	UK	1.659	Households	8.667		
Denmark	0.337			Others and agriculture	7.709		
LNG imports from other countries	9.880						
Total:	56.254	Total:	45.170	Total:	42.335		

Energy affordability in the Netherlands has declined rigorously in the past year, as energy prices increased strongly (Figure 1; (CBS, 2022)). This increases the risk of energy poverty² in Europe and in the Netherlands. In the winter of 2021, the world's gas demand was higher than expected because of global cold weather (International Energy Agency, 2022). A lower-than-required supply and the post-covid recovery of the economy lead to an initial increase in natural gas market prices, especially in Europe (International Energy Agency,



² TNO defines energy poverty as the state of not having enough money for energy to have a comfortable living situation (TNO, 2020).

2022). Currently, the consumer prices of natural gas increase even more because of the uncertainty of energy supply (among which natural gas) due to the conflict between Russia and Ukraine and the sanctions in response, as Russia is a major natural gas supplier in the world.

The Dutch government attempts to reduce natural gas usage in the energy sector and the industry by replacing natural gas with renewable energy sources such as hydrogen (Wiebes, 2020). However, the hurdle of a natural gas demand lock-in takes its toll as companies have already invested in their infrastructure and current expert knowledge (Brauers, 2022; Unruh, 2000). In addition, since 2022, April 2, the Dutch government is campaigning to nudge citizens to reduce natural gas usage, named “Zet ook de knop om”, meaning ‘Flip the switch, too’ (Ministry of Economic Affairs & Climate Policy, 2022)³. They state to promote natural gas usage reduction in households because of (1) the increasing energy prices for consumers, (2) to become sooner independent from Russia, and (3) to counter climate change. In this campaign, the government gives different behavioural advice together with an estimation of the cost reduction per year when the behaviour will be changed (Table 2).

Table 2: The main message of the campaign "Zet ook de knop om"

Behavioural advice	Cost reduction per year
Put the thermostat maximally at 19 degrees Celsius	200 EURO per degree centigrade
Shower a maximum of 5 minutes (instead of 9 minutes)	130 EURO
Do only heat the rooms where you are in your house	550 EURO
Put the thermostat on 15 degrees Celsius in the evening	260 EURO
Put the thermostat on 15 degrees Celsius when you are not home	210 EURO (4 days a week away from home)

In the Netherlands, the fossil fuel natural gas is the most used primary energy source (CBS, 2020). The main contributors to natural gas demand in the Netherlands are the energy sector (34.5%), followed by the industry (26.8%), households (20.5%), and agriculture and others (18.2%) (Table 1; (Stephen Chong, 2020). Households use nearly a fifth of the total natural gas usage. When households will change, the technology and behavioural changes to reduce natural gas usage can be cheap compared to changes in the industry (or in the case of human behaviour change even free in the long run). Partly because of this reason, in this study,

³ The governmental campaign “Zet ook de knop om”: <https://www.zetookdeknopom.nl/>

I chose to look at households' natural gas consumption, which is a considerable part of the total natural gas usage.

I aim with this contribution to widen the understanding of the reasons for residents to perceive the ability to reduce natural gas consumption in their households. This understanding might be needed for policymakers to reduce climate impact and increase energy affordability. built on the Social Practice Theory (SPT) and contribute to understand more of the applicability of the theory. From the results, I derive recommendations for policymakers for the reduction of natural gas usage in households. In this thesis, I focus on households of HBO/University students and how students perceive their potential to reduce natural gas usage. Hence, my research question is:

How do HBO/University students perceive their potential to reduce natural gas usage in their households?

In Chapter 2. Theoretical Framework, I created a research framework using SPT to find the questions to ask the students. In Chapter 3. Methods, I wrote what I have done for the recruitment and in the focus group and interview, and how I implemented ethical considerations and my positionality. In Chapter 4. Results, I describe my observations and compared the results of the focus group and interview, and based on the results, in Chapter 5. Discussion, I list and link the reasons of the perceived ability of students to reduce natural gas usage to the theory and reflected on the limitations of this study. Finally, in Chapter 6. Conclusions, I drew conclusions on why students perceive (or do not perceive) the potential to reduce natural gas usage and how this relates to the introduction and derived recommendations for policymakers to induce change towards a reduction of natural gas usage among students. In addition, in chapter 6, I made suggestions for future research.

2. Theoretical Framework

The research question targets why Dutch students perceive (or do not perceive) the potential to reduce natural gas usage in their households. In this paper, I use “perceived potential” as the perceived ability and possibility in the present and/or future circumstances. To start with, the presence of gas-powered infrastructure in a household is a precondition to a household’s natural gas usage. Examples of gas-powered infrastructure are a gas-powered central heating or hot tap water system, a gas stove, or a gas oven. For this study, the reasons for using gas-powered technology are important. Therefore, different theories of the relationship between human behaviour and technology are discussed below, finding Social Practice Theory (SPT) as a result.

2.1. Social Practice Theory

The relationship between human behaviour and technology is formulated in different theories that have different points of focus. There is the theory of Sociotechnical Imaginaries (Jasanoff & Kim, 2015) with focus on the meaning of technology in populations, and the theory of Sociotechnical transitions (Geels, 2002) with focus on the timeline and phases of a technical transition in relation to populations, or the theory Social Construction of Technology (Bijker, Hughes, & Pinch, 2012) which provides a model for the relationship between technology and social structures. One other theory for the relationship between human behaviour and technology is SPT with a focus on why and how social practices take place. In this thesis, I use SPT because it considers why practices take place. This theory is first described by Schatzki (1996) and developed by Shove, Pantzar, & Watson (2012) based on Schatzki’s work and that of others. SPT is also used by Hess, Samuel, & Burger (2018), which inspired me to include socio-demographic factors and to use psychology-based theory for social norms and values.

SPT comprises three components described by Shove et al. (2012): Materials, competences and meanings (see Figure 3: Social Practice Theory Figure 3). Materials have been defined as all technologies, materials of which objects are made and tangible physical entities (Shove et al., 2012). Competences have been defined as skills, know-how and techniques a person has (Shove et al., 2012), and meanings have been defined as symbolic meanings, ideas and aspirations (Shove et al., 2012). The specific configuration of these components shapes a social practice. Examples of social practices in a household are eating together, partying, and gathering. Other (social) practices that support these practices are cooking or doing the dishes, making a comfortable room temperature, and making oneself clean using a shower. In the case of the presence of gas-powered technology for heating and making hot tap water, these

practices have the hidden attribute of natural gas usage. In the following paragraphs, I describe for each component of the Social Practice Theory the concepts concerning natural gas usage and how I came to the questions given in Table 3.

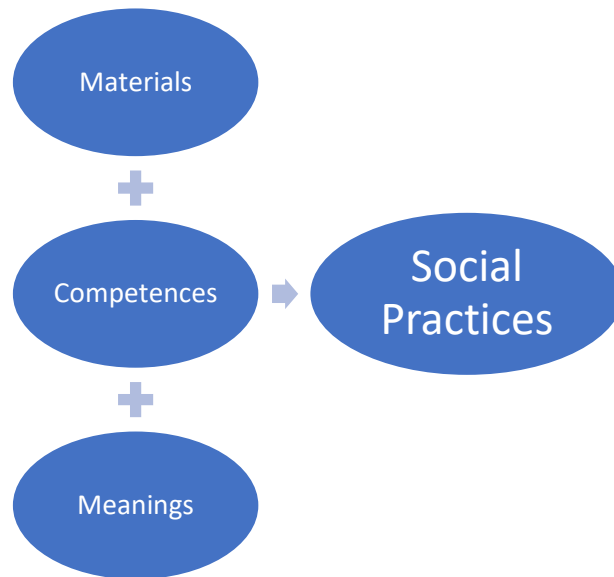


Figure 3: Social Practice Theory (Shove et al., 2012)

Table 3: The theoretical framework and linked example questions

Component	Theorised concepts	Questions
Materials	Type of heating system, presence of natural gas boiler, natural gas oven and natural gas stove, type of natural gas measurement instrument, location of measurement system display, type of thermostat and boiler, frequency of using a certain material	What devices? How often do you use them? What kind of measurement system do you have? Where is the measurement value displayed? Do you have a programmable thermostat?
Competences	Awareness, knowledge of effects	Are you aware of your natural gas usage? What is the effect of using natural gas on the planet?
Meanings	Norms, values, practice-specific wants	Why do you use natural gas? In what circumstances do you use natural gas? For whom do you use natural gas? What is the role of your roommates in natural gas usage? Why is that important? What do you want to achieve using natural gas?
Interaction between components	E.g., reasons for awareness	Why are you aware of your natural gas usage? Why do you prefer one technology over the other?
Socio-demographic factors	Study year, age, gender, temperature preferences, fixed natural gas price/variable natural gas price, income, DUO loan, the absolute price	Age? Hormonal system (gender)? Temperature preference? Which tariff method? What is the absolute

of natural gas use, household area, dwelling placement, energy label, number of housemates, number of children, shared or individual thermostat, region (province).

price of natural gas usage?
What household area? What income? How much do you loan at DUO? What energy label? How many housemates? Shared/individual thermostat? Which province do you live in?

2.1.1. Materials

The materials are an important requirement for natural gas usage. If there are no gas-powered materials available, or others are used instead, no natural gas is used. For this, I ask the students how often they are using systems using natural gas, such as a gas stove or a gas-powered central heating system, or if they use different energy sources. Also, the type and location of the measurement instruments of natural gas usage may influence the natural gas usage, for example, if the display is clearly visible and easy to read or not. Therefore, I ask the students the type and location of the measurement instruments. Finally, I ask them if they have a programmable thermostat, which has an impact on the convenience of setting the thermostat once with no need to set it again.

2.1.2. Competences

Competences are important for the potential to reduce natural gas usage. According to literature, on the one hand, one study suggests that students do not perceive the need for a low-carbon society (Kaczmarczyk & Urych, 2022). Similarly, Whitmarsh, Seyfang, & O'Neill (2011) find evidence using a survey in the UK for the fact that people generally know that reducing carbon would be a good practice, but do not act on that. Despite that, not all knowledge is present regarding natural gas, as Burger, Nakata, Liang, Pittfield, & Jeitner (2015) suggest that students lack knowledge about hydraulic fracturing. However, Daskolia (2022) found that University Students from Greece hold several misconceptions about climate change contributors, but they generally know the impact of CO₂ as a greenhouse gas. Furthermore, studies suggest that environmental insights increase energy-saving behaviour (Azar et al., 2022; Chandrasenan, Kuleenan, Yesodharan, & Varghese, 2022). This way, knowing the effects on the planet might be a motivator to reduce social practices that use natural gas. In addition, Tobler, Visschers, & Siegrist (2012) find that more knowledge about climate issues is strongly associated with pro-environmental values, which makes it likely that environmental knowledge strengthens environmental values. Therefore, I ask if they are aware of their usage and if they know the effect of natural gas usage on the planet.

2.1.3. Meanings

Meanings are also important for the reasoning behind the frequency of social practices that use natural gas. I ask the students the reasons why they use natural gas, the circumstances in which they use natural gas and for whom they use it. Similarly, I ask them why it is important to use natural gas usage and what they want to achieve using it. This way, I can list the social practices that are powered by natural gas and the meaning for students doing that. The reasons can be norms, values, and practice-specific wants. Norms are a standard setting, which can be self-induced (a personal norm) or set by a group of people (a social norm) (Hess et al., 2018). People's behaviour is influenced by social norms because they will feel rejected when not complying with a social norm (Elster, 1989; Giguère, Sirois, & Vaswani, 2016), or feel approved when they act like the social norm (Steg, Perlaviciute, & Werff, 2015). Moreover, Ayres, Raseman, & Shih (2009) show that peer comparison can reduce residential energy usage. In the case of students, I consider the social norms of roommates in the households important as well as the peer comparison within households. Therefore, I ask about the role of the student's roommates in natural gas usage.

Values can be reasons for what people or groups strive for in life, affecting a range of attitudes, beliefs, and actions (Piscicelli, Cooper, & Fisher, 2015; Steg et al., 2015). In addition, values can influence what debates people attend and what knowledge they consider (Steg, Perlaviciute, Werff, & Lurvink, 2014). I drew additional importance of values from the value-belief-norm theory, stating that values are the most stable element in the ordered causal relationship chain of values, beliefs, and norms (Stern, Dietz, Abel, Guagnano, & Kalof, 1999). For example, the reason is a value when people value in-home thermal comfort and use natural gas when the temperature is below their standards. Another example is that people value nature and therefore try to use less natural gas.

Practice-specific wants are the goals a person wants to achieve with a certain social practice. Regarding reasons to use natural gas, this can be the want for a comfortable in-home temperature or a warm food dish on the table.

2.1.4. Interaction between components

Shove et al. (2012) describes that social practices are shaped by the interaction of the three elements materials, competences and meaning. Accordingly, there should not only be asked about certain components but also the interaction of components. This means that a typical ordering of questions might provide insights into how social practices are shaped. Therefore, I start with "are you aware?", and follow up with "why are you (not) aware?". In

addition, if technologies come up, I can ask: “Why do you prefer one technology over the other?”. Also, to measure the influence of materials or technology on their knowledge of their actual natural gas usage, I ask the students about the type and location of the measurement system and if they know how much they use on average per day, month, or year.

2.2. Socio-demographic factors

The important demographic variables for this study are divided into internal and external socio-demographic factors that influence absolute natural gas usage. The internal socio-demographic factors are the individual attributes age, gender, income, and payment-related matters. The external socio-demographic factors are the housing circumstances which include the energy label of the dwelling, a shared or individual thermostat, the number and age of housemates, and the province a person lives in.

The internal socio-demographic factors can influence natural gas usage through individual differences. The gender of a person might make a difference as a literature review by Karjalainen (2012) found that women are more likely to express thermal dissatisfaction than men in the same thermal circumstances. Therefore, gender and thermal preferences are important. The student’s year group age might influence natural gas usage or awareness through life experience and knowledge differences. But the clearest individual difference would be income and the method of payment for natural gas. The students have a certain income, possibly a student loan or job income in combination with a fixed or variable tariff (payment per unit of natural gas). Having a student loan from the government⁴ or otherwise, a job income might influence how much students value the energy bill. The loan is paid back later when the income is expected to be higher resulting in fewer money worries, whereas only having a job income would probably increase the value of the energy bill. If the payment is per unit of natural gas usage and not a fixed amount per month, the price a person pays for natural gas is essential to natural gas usage or saving. Literature suggests that if a person does save money by saving energy, the person’s energy savings increase (Al-Marri, Al-Habaibeh, & Abdo, 2017; Susanti, Fithri, & Bestarina, 2015). Another factor is if the price increases, as it did last year, the natural gas usage can also decrease. For example, research in Ukraine suggests

⁴ A student loan from the government is provided by Dienst Uitvoering Onderwijs (DUO), which provides a maximum of 1023,20 (January until August 2022) euros per month to Dutch students as a loan. This loan must be paid back monthly depending on income after studying when students start working and earning (good) money.

a decrease in natural gas usage when natural gas prices increase (Alberini, Khymych, & Šcasn, 2020).

The external socio-demographic factors can influence natural gas usage in different ways through different circumstances. The dwelling a student lives has a certain living surface, indicating the quantity of energy necessary to heat the entire space. In addition, it has an energy label, which indicates the insulation quality. Also, the location of the dwelling, if it is detached, semi-detached, between houses or a house on the corner, makes a difference because more closed walls mean better insulation. The number of housemates that share a central heating system or a shower plays a role in natural gas usage through social norms. In addition, the number of children in a household can influence natural gas usage behaviour because different age groups have different needs regarding heating (Brounen, Kok, & Quigley, 2012). The region influences natural gas usage as well because of the weather difference between the northeast and the southwest provinces (Brounen et al., 2012).

3. Methods

For the methods, I started with the recruitment of participants and held focus groups, after which I did data analysis to get to a conclusion and recommendations for policymakers. See Figure 4 for an overview. In addition, in this chapter, I described the contextual factors to

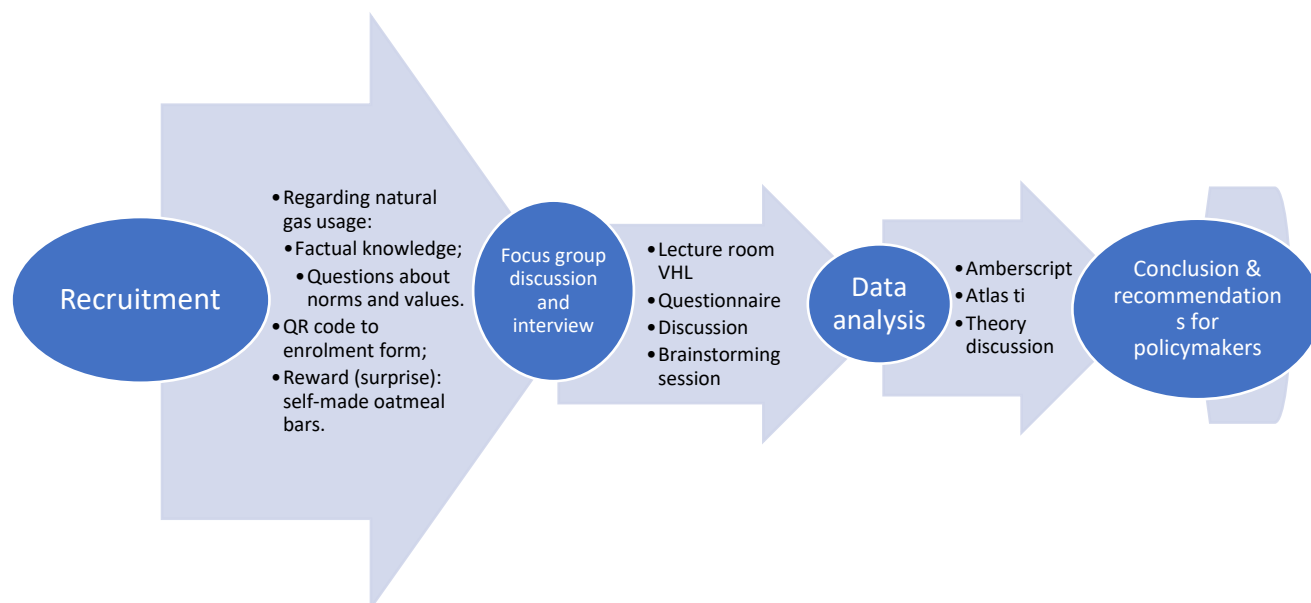


Figure 4: Overview of methods

make the results more valuable and applicable (Orvik, Larun, Berland, & Ringsberg, 2013). These are the characteristics and positionality of the moderator (paragraph 3.3) and the lecture room setup (paragraph 3.1.3).

3.1. Data collection

I conducted one focus group discussion (3 participants) on June 9, 2022 (14:00 – 15:30), (3 participants), and one interview (1 participant) on June 16, 2022 (14:00 – 15:30), to collect qualitative data. The lecture room B3.14 of Het Van Hall Larenstein Leeuwarden (HVHL Leeuwarden) was used for the group discussion. This is the lecture room in which the lectures of the master Environmental & Energy Management are given. Qualitative data collection enables to increase the understanding of people's perceptions with a strong potential to reveal the complexity of the real world (Leech & Onwuegbuzie, 2007). Using focus groups and interviews, researchers can take into account the contexts and setting where the data is collected, which strengthens the applicability of the collected data (Leech & Onwuegbuzie, 2007). Another reason for collecting the data in a focus group is that literature suggests that people open up more when being interviewed in a group compared to a personal interview

(Guest, Namey, Taylor, Eley, & McKenna, 2017). In addition, my native tongue is Dutch and therefore all parts of the research, the recruitment, the focus group discussion, and the interview were carried out in Dutch.

3.1.1. Target group

The target group is Dutch University or professional higher education (HBO) students who are eighteen years old or more and have lived most of their life in the Netherlands. Although any population group would have been interesting for researching the behaviour of reducing social practices for natural gas reduction in a household, this study is about Dutch University/HBO students. I chose Dutch HBO/University students because of the access I had to the educational buildings in Leeuwarden, and the classroom of MEEM which was known by the students of HVHL Leeuwarden already. It turned out that only students in Leeuwarden joined my focus group, but I was targeting broader via social media to get more participants.

3.1.2. Recruitment

I created an enrolment form in Microsoft Forms (Appendix B) for the students to enrol in my study which I used for online and offline recruitment. The first recruitment was done online via WhatsApp groups of students, and later also via my personal Facebook and the Facebook page of Het Van Hall Larenstein Leeuwarden (HVHL Leeuwarden). The messages are in Appendix A. I mentioned that I could use their help on the date of the focus group (and added location as well) if they are Dutch and in the target group of University/HBO students. I added that there would be a brainstorming session and a nutritious snack as a reward. In addition, I wrote a section in the message in which I tried to convince them to help me as this would be a good example for others they might know to help them with their future research.

I also recruited 3 parts of the days in person on different locations: HVHL Leeuwarden, NHL Stenden Leeuwarden, and Campus Fryslân in Leeuwarden. I got permission at each entrance desk to recruit in the educational building. In both NHL Stenden and HVHL, I recruited in the lobby. In Campus Fryslân, I recruited at non-silent study places as there was not a similar lobby. I used a printed A4-format paper for this (Appendix C), which described the research type, target group, and some questions about factual knowledge and that the questions will be about norms and values. I added the date and time, and that there would be a brainstorming session and a nutritious snack as a reward. I also added a QR code to scan to go to the enrolment form and my personal data including the study program and track I did. Verbally I said that the questions would start with “Are you aware of natural gas usage? And why is that so?”.

Afterwards, I sent kind invitations and reminders to the students enrolled (Appendix G). I reminded them of the time and the date, and that they should let me know if they were unwanted or unexpected in circumstances that made them unable to come. I also reminded them of the healthy, nutritious snack as a reward for joining the session.

3.1.3. Focus group discussion

I planned both focus groups in a lecture room, B3.14 of HVHL Leeuwarden. The room setup (Figure 5) was the same for both the focus group and the individual interview. I recorded the audio and prepared two audio recording devices to have a backup if any unexpected errors would occur. I divided the chairs into two rows of chairs, ‘yes- and ‘no-chairs’. I implemented the chairs as an assignment to keep the participants engaged (Orvik et al., 2013) and to sit at an angle to the participants to make them feel more comfortable sharing thoughts (Stickley, 2011). The whiteboard was used to describe and link in a list (focus group) or mind map (interview). I noted what I heard to make the participant feel heard. The beamer in the lecture room was used to show the website of “Zet Ook de knop om”, the governmental campaign introduced in Chapter 1 Introduction in Table 4. To remind me, I used a printed A4-format paper during the group discussions with the order of announcements and questions (Appendix F). An overview of the timing of planned activities is in Table 4.

Table 4: Schedule of the focus group

Time	Planned activity
14:00	Possibly wait for others and snack time
14:05	Signing consent form (Appendix D)
14:12	Questionnaire part 1 (Appendix E)
14:22	Discussion questions (Appendix F)
14:42	Ask if a toilet break is needed
14:42 or 14:47 when a break is needed	Governmental campaign and questions (Appendix F)
15:07	Questionnaire part 2 (Appendix E)
15:17	Brainstorming session
15:27	Finalizing session, offering another snack.

When the participants came into the lecture room, I greeted them and shake their hands as appropriate in the Netherlands to make the participants feel more comfortable and welcome as also described by Orvik et al. (2013). After that, I share the snack while waiting for possible late participants. After I said to respect everyone’s opinion during the whole session, I ask them to sign the consent form (Appendix D) to participate. I collected the consent forms after the participants signed. Next, I introduced the topic mentioning that it is about their perceived potential to reduce natural gas usage in their household. In addition, I introduced questionnaire

part 1 (Appendix E) about personal usage and living/social situation (socio-demographic factors) and stated that it will help them to get involved in the topic and handed out the paper questionnaires.

After the participants filled out the questionnaire, I explained how the yes/no chairs were meant and on which they need to sit when answering either yes or no (Figure 5). In the picture, sitting on the row on the left meant that a student answered “yes” and sitting on the



Figure 5: The lecture room setup (left the yes/no chairs, the whiteboard and the projection screen in the back)

row on the right “no”. This way, I designed it in a way to make the participants more engaged through the need of moving to another seat when they had a different answer.

I started the conversation with a question about awareness: “Are you aware of your natural gas usage?”. After that, to stay open-minded to find out the reasons for (non)-awareness, I asked each participant this question about meaning: “Why are you aware or not aware of using natural gas?”, and to stay generally open-minded and ask for more information: “In what circumstances do you use natural gas?” Next, about social norms, I use the question to each participant “For whom do you use natural gas?”, “What role do your housemates play in using natural gas?”, and “Do you know someone who acts the same as you?”. Afterwards, I ask each participant a question regarding practice-specific wants: “What do you want to achieve by using natural gas?”, and regarding the energy bill: “What role does the energy bill play in how aware you are of natural gas?”. I also ask them: “Do you know something about the effect of natural gas usage on the earth? And if yes, what do you know about that?” Finally, if

technologies come up, I ask for the interaction between materials and meaning: “Why do you prefer a certain technology over the other?”.

After the general discussion, because of the possibility of extra insights, I asked the participants if and why they do (not do) the behaviours proposed by the government with the campaign “Zet ook de knop om” (Ministry of Economic Affairs & Climate Policy, 2022) (Table 2), followed with the same questions as for the general discussion, but then natural gas replaced by the behavioural advice (e.g., “In what circumstances do you put the thermostat at 19 or lower?”). Upon the closing of the discussion part, I gave them questionnaire part 2 (Appendix E) which asked about demographics (for gender I used the translation of “sex (hormonal system)”⁵), if they had something to add to the group discussion, and improvement points for next time. For inclusion of participants’ opinions, I added a final question to this of what the participants would like to see changed when a similar focus group would be conducted in the future.

Finally, I asked the participants to brainstorm about possible solutions for students to reduce natural gas usage and posed the following question: “Regarding all elements and reasons for natural gas reduction we have identified, what would help to reduce the natural gas usage for students?”. The ideas in red underneath this question on my printed paper were meant to suggest when no ideas came up, e.g., “Would an application work for students?”. I let them brainstorm in groups of 2-4 depending on the number of participants (so with the three of them in the focus group) because smaller groups are considered to go more deeply into the topic (Cortini, Galanti, & Fantinelli, 2019).

3.1.4. Data analysis

I transcribed, analysed, and noted down the results of the focus group and the interview. I transcribed the focus group by hand taking around 10 hours. I learned afterwards that Amberscript⁶ was available to use at BMS Lab which provided the automatic transcription of the interview in 5 hours. For systematic investigation of the findings, I used the qualitative data analysis tool Atlas.ti 22 to conduct a Constant Comparison Analysis as described by Leech & Onwuegbuzie (2007). Constant comparison analysis is a three-step analysis: transcribing the audio, finding relevant chunks, and coding them while comparing the chunks for similarity (i.e., if the information’s theme is similar, I coded them the same) (Leech & Onwuegbuzie,

⁵ This is to avoid any misconceptions or confusion related to gender identity and sex to ask about their true sex, and not how they feel about gender.

⁶ Amberscript: <https://bmslab.utwente.nl/info-hub/audio-transcription/>

2007). So, first, I coded the underlying themes inductively, meaning that I coded while reading the observations in chapter 4.1 through. Afterwards, I listed the ideas together with their reasoning during the brainstorming session and added them to chapter 4.1. Second, I compared the focus group and interview for differences and similarities (chapter 4.2). Third, I analysed why students perceive (or do not perceive) the potential to reduce natural gas usage and how this relates to the SPT in chapter 5.1. Fourth, I reflected (chapter 5.2) on how the interactions went during recruitment and in the sessions regarding the neutrality of questions and follow-up questions.

3.2. Research ethics and integrity

This research design has been approved by the Ethical Committee of the UT on April 20, 2022. First, for ethical reasons, I considered respecting everyone's opinion and the possibility of data deletion as I described in my information brochure and consent form (Appendix D, and also included in the Enrolment form, Appendix B). First, to make the participants aware of what to expect, I added that the questions were themed on the underlying reasons for using natural gas and that I would facilitate a brainstorming session at the end.

Second, I described that I am an 'environmentalist' having the mindset that natural gas should be reduced. I stated that I knew that the way that I set up this research would likely be biased, hence I stated that I attempted to avoid posing unbiased questions, which probably allows me to find anyone's opinion.

Third, for privacy reasons, I mentioned in the information brochure that students take part voluntarily in this research and that they can always (also during the session) ask for data deletion. For informing the students well, I stated in the information brochure that the session was audio-recorded and that I would use all data just for this study and delete it two weeks after my report is finished, and that the answers can be recalled at any time. For integrity, I assured anonymity, for which I stated in the information brochure that the names will not be linked with any data collected in the published version of my thesis.

3.3. Positionality

The positionality of the researcher supports the reader with context and comprises the generation, citizenship, class, gender, ethnicity, living experiences, and attitudes (Vong, 2021). I am a Dutch 23-year-old man from a middle-class family. I am aware that I am an environmentalist, and that I have a very positive attitude towards the reduction of natural gas consumption. In addition, I was raised in a Dutch middle-class family, and I never had monetary problems in the past and was always able to pay the energy bills, making me less

empathic towards poor residents. On the one hand, this can put me in a position of influencing participants in a way people try to align with me as I have another status in the group leading the discussion and I can be seen as an expert in the field writing my master thesis about natural gas (Matelski & Hogg, 2015; Orvik et al., 2013; Vicsek, 2007). On the other hand, as they are all students, they might think similar and may identify themselves as one group making them feel related to each other and making it easier for them to speak up (Cortini et al., 2019). In any case, to prevent aligned responses or avoid that I am influencing participants, I keep my questions neutral (i.e., without bias or prejudice), and in the preparation, I reviewed my questions multiple times to ensure that my questions do not include a sentence conveying that students are ought to “reduce natural gas usage”.

4. Results

First, in Table 5, a summary of the participant's characteristics is given. The participants are close to each other in age. Three out of four participants were male and three out of four lived in shared student accommodations.

Table 5: Summary of the participant's characteristics

	Number of participants	Age	Sex	Studies	Accommodation	Gross annual income (Euros)
Focus group discussion	3	20-27	Male (3)	Technical business administration (NHL Stenden) and Zee-en Kustmanagement (HVHL Leeuwarden) (2)	Own studio and Shared student accommodation (as tenants) (2)	0 – 1000 (2) and 3000 (1)
Interview	1	23	Female	Global Responsibility & Leadership at the Rijksuniversiteit Groningen (RUG), at Campus Fryslân	Shared student accommodation (as tenants)	0-1000

4.1. The focus group

Description of participants

The focus group was a session with three male participants. The first student is 27 years old and in his fourth year of Technical Business Administration at NHL Stenden (NHL), in Leeuwarden. He lives in his own studio of 20 m² situated on the ground floor with an upper neighbour in Friesland. His heating method is a natural gas fireplace without a thermostat for his whole studio of two rooms, namely the bedroom, living room and kitchen as one room and the pantry and shed as another room. He can monitor his natural gas usage in an app that talks to a smart meter and looked it up on his mobile phone during the meeting. He uses on average 192 m³ of natural gas per year. He pays per m³ natural gas he uses (apart from the fixed yearly

costs) while having a full student loan from DUO and a gross annual salary of 0-1000 euros per year. For hot tap water, he uses an electric boiler.

The second and the third student are both 20 years old, study Zee-en Kustmanagement at Van Hall Larenstein (HVHL) in Leeuwarden and are first- and second-year students. They live both in different student accommodations between houses in Friesland (80 and 100 m² respectively), and their costs of natural gas are included in their rent. The second has his own thermostat in his room, while the third student noted down to have a central heating system with a central thermostat. The heated spaces in the second student's house are the bedrooms, a toilet, and the hallway. For the third, these rooms were the bedrooms, the kitchen, a bathroom, a toilet, and the hallway. The second does not have a student loan and has a gross annual salary of 3000 euros a year, while the third uses some student loan, and has a gross annual salary of 1000-3000 euros a year. The second knows that the display is in the meter cabinet and did not know his usage. The third did not know how it was measured or displayed, nor his usage. The three participants did not know their energy labels. They all cooked on natural gas (they all indicated using it every day for cooking) and owned an electric oven and no gas oven. The second and third indicated having a gas boiler for hot water (although one of them hesitated about this later during the group discussion). The first has a neutral stance towards the importance of comfort temperature (3), the second finds that not so important (2), and for the third, it is important (4). Their comfort temperatures were 19, 20, and 21 degrees Celsius, respectively. The participant without a thermostat did not fill out his preferred thermostat temperature, but of the participants having a thermostat, one did not know what temperature he preferred it to be during the day, and the other did not know as he never looked at his thermostat. Lastly, they rated the importance to keep an eye on their energy bill a 4, 2, and 4 (out of 5), respectively.

Reasons for (non-) awareness

All students of focus group 1 were aware of their natural gas usage. The first reasons that came up for being aware were to refrain from wasting money and to not spoil nature. Refraining from wasting money was not a shared reason with the students who paid for natural gas, electricity, and water inclusive in their rent. The spoilage of nature was mentioned by the participant who confused natural gas with crude oil. One student did not know if being aware would be possible if nobody around him was aware of natural gas usage: "At least I know that others are aware of it", this student mentioned. Furthermore, another student mentioned that

studying at Wageningen University created awareness through knowledge that was shared by peers about sustainability.

Competences

Several perceived issues regarding natural gas usage in a household were stated or discussed. One student explained that CO₂ emissions cause a greenhouse effect which induces the ice to melt, hence causing a sea-level rise that hurts human settlements when flooded. Another student added to this that sea-level rise increases the area of barren land due to salination. They added to this story that the land animals would get less space and the fish more because of sea-level rise. One student thought that the production using drilling platforms is destructive to nature, but it soon became clear that he confused natural gas with crude oil. The students concluded that natural gas production is only destructive to nature when there is a leakage at the drilling platform. In addition, one student mentioned that the production of natural gas causes soil subsidence and earthquakes damaging houses in Groningen (Author: the province under which the biggest gas well in the Netherlands). Although a drilling platform was also perceived as a disturbance to nature because people are now reaching almost everywhere in nature, they mentioned that offshore drilling platforms were a basis for shellfish to flourish, which was mentioned to increase populations of other marine life as well as some fish eat shellfish. For example, the students concluded that because of these disturbances people are against drilling for natural gas in the nature conservation area 'Wadden Sea'. In addition, one student mentioned hydraulic fracturing or shale gas production and described it as the use of water with chemicals to break up stone layers, setting free natural gas, while contaminating groundwater.

They mentioned that in general, not enough knowledge about natural gas usage is widespread. Regarding their own energy usage, one of the students did not know how water is heated at home. In addition, the two participants paying rent including the energy bill were not aware of the gas price increase (in contrast with the one paying a variable tariff for natural gas), and they perceived that their price might still be low because their landlords might have a cheap contract paying a fixed amount per cubic meter of natural gas. Furthermore, one student mentioned that he did not know about hydraulic fracturing. Besides, the question came up if natural gas was also produced during the refinement of crude oil, to which none of the group knew an answer (including me). Regarding the pipelines, the students could not identify where the pipelines are in the Netherlands, making them think they are buried in the ground. The question came up about how harmful the outsides of the pipelines could be for the soil, on

which they expected some harmful chemicals. Concerning general knowledge, they mentioned that they did not know what the most efficient way of using a central heating system is. The question came up if they wanted to reach the most natural gas efficient practice, whether they should always put the thermostat on 18 degrees Celsius or put the thermostat higher in the morning and lower at night. One student believes that this knowledge needs to be spread to be able to reduce natural gas usage. He perceives that now, the most efficient way is not widely known, resulting in everyone just practising what he/she thinks is best. Nobody in the group knew the most efficient way. After I said that it should be easy to measure the most efficient way for your house in a mobile application or similar, at least one of the group members clearly agreed and the others did not counterargument it. Somewhere during the conversation, they mentioned that they could reduce their natural gas usage for heating, but not for cooking.

Meanings

They try to restrict their natural gas usage because of intrinsic motivation (one student mentioned this), for society (one student mentioned this), and because of parental influences (all three of them mentioned this). They did not further elaborate on doing it for society and intrinsic motivation. The parental influences included that as a child, the students saw the thermostat temperature going up in the morning, and down in the evening. In addition, the parents of one of the students were not using the upstairs radiators and said that they did that because the radiators could not work separately. The student did not know if that was a myth or truth. This student remembered that it always being cold upstairs and that guests did mention the cold as well. They mentioned several practices for the reduction of natural gas usage. Only in winter, because of the cold temperatures, natural gas is used for heating. Throughout the whole year, during nights or when they are away from home, the heater is put off (or to a lower degree). No unused spaces were heated by them individually, although shared spaces in one student accommodation were mentioned to be heated even when nobody used them. However, in one setting, even in winter there was no need to put on the radiator in his bedroom because somehow his bedroom was always a comfortable temperature. The heat which provided this was perceived to come from other rooms because of bad insulated walls and floors in the house. Because of this reason he never looked at his thermostat, finding him without any idea if the thermostat was off during the nights or when everybody was away. In this particular student accommodation reside four people, of who two were internationals who were not going to their parents, so the student had no experience of a time when everyone was away. One student mentioned that he tries to use as little natural gas as possible. For example, by using the kettle

to first boil the water and after that cooking the pasta in it while on the gas stove with the fire being on. He also tries to not shower too long to restrict hot water usage. Besides, this student mentioned: “My parents in the past told me that I should not shower too long when I was standing there a long period to enjoy my hot shower”. When they have visitors mentioning that they are cold in the house, two students mentioned putting on the heater, although they would not have done it for themselves. One student living in a student house mentioned leaving the shared spaces being heated because of his housemates. However, whenever he experiences a guest putting the heater on in the toilet on the highest level for that short time of a toilet visit (because the window in that toilet can not be closed, it is always cold there), he puts off the radiator. After showing the first part of the campaign: “Put the thermostat maximally at 19 degrees Celsius”, all three of them mentioned choosing to wear a sweater or thicker socks when they were cold instead of putting the thermostat on a higher temperature. One student never looked at his thermostat so he did not know the temperature, but if he had a choice, this student would be fine with putting the thermostat from 21 (like it was at his parent’s place) down to 19 degrees Celsius. Regarding showering, one of the students showered every day (heated by electricity), another showered every other day (he only suspected his heating mechanism is powered by natural gas), and one of them showered two times a week (heated by natural gas). After showing the behavioural code of the governmental campaign of showering for less than five (5) minutes, one student who was not sure how his water was heated said to need a long more than 5 minutes for cleaning. The one who knew the water at home was heated by natural gas added to this that he tries not to shower too long to restrict hot water usage. This student mentioned: “In the past, my parents told me that I should not shower too long when I was showering for a long time to enjoy my hot shower”. He added that 5 minutes would be too short for him to wash himself using soap. After one participant mentioned that his water was heated by electricity, I did not ask any follow-up questions, and he stopped participating in the discussion about showering time.

Additions from the questionnaire

On the questionnaire, one of the students indicated that he wanted to add to the discussion that natural gas usage could also be about the extent of feeling responsible for it. He did feel little responsibility because his landlord pays for the actual usage.

Brainstorming session

During the brainstorming session, several topics were discussed. The underlying themes are about making information available for students about natural gas and changing or renovating the built environment.

- To empower students to reduce natural gas it could help to have a program or application that calculates the most efficient way of using space heating in a building.
- To raise awareness about usage, there should be an obvious display in the household to show a household's natural gas usage.
- To raise awareness of the contribution of people to the environment when they reduce natural gas usage, a website could be developed with an interactive map showing the total system of natural gas infrastructure including all consequences for each part of the value chain.
- There could be built more house complexes for students. They can be built close to each other to have less contact with the cold on the outside compared to other houses and to allow direct usage of each other's rest heat for heating, reducing the usage of the energy source such as natural gas.
- To reduce natural gas usage, existing student houses with gas-powered systems should be renovated. For this, the municipality (not the students, as it was agreed on the fact that the landlords do tend not to listen to students) should motivate landlords more, for example, by using attractive subsidies (or adding more subsidy choices) or presenting an overview of costs and benefits for specific houses. Another way would be that students should be made more able to make choices regarding insulation. However, the first obstacle that was mentioned is that they do not have the money for it.

4.2. The interview

Description of participant

The interviewee was a 23-year-old female (hormonal) third-year student of Global Responsibility & Leadership at the Rijksuniversiteit Groningen (RUG), at Campus Fryslân in Leeuwarden. She lives in a corner house of 120 m² in the province of Friesland with an energy label of around E together with 4 other students. The residents share a central heating system with a programmable thermostat. Using this central heating system, they heat their individual bedrooms and shared spaces, which are a living room, kitchen, bathroom, toilet, and pantry.

She preferred a thermostat temperature of 19 degrees Celsius when at home, 15 when not at home, and her comfort temperature is 20 degrees Celsius. She rates the importance of the comfort temperature with 1.5 out of 5 (almost not important). In this house, they have their contract with an energy supplier, and they pay a variable tariff for natural gas. She did not know her usage on hand, but she noted that the website of the energy supplier can provide this usage and cost information. Her gross annual salary is 0-1000, and she loans the full amount from DUO. She finds it important to keep an eye on the expenses regarding energy use (4 out of 5). In this house, next to a central heating system, they use a wood burner three times a year. Regarding cooking, there is a gas stove (she indicated to cook every day) and an electric oven. In addition, she was not sure if they use natural gas for hot tap water but suspected it to be natural gas.

Reasons for (non-) awareness

She thinks to be aware of her natural gas usage. She chose her study to become more aware in life and after three years of studying her colleagues helped her grow awareness. She mentioned that being able to ask her peers how they do live more sustainably is more valuable than reading tips and tricks on the internet. This is because she finds human interaction more motivating than reading online, even though she thought the internet might give better advice. In her house, she lives together with three Germans and one Italian. Because of this, being the only Dutch-speaking person, she took the responsibility for the energy bill. This bill is important because her contract with the energy supplier allows her to get money back when they use less than paid in advance. In the past, she had the experience of paying 100 euros per person extra for one year. She perceived it as painful, reasoning that in general students do not have this money available. She added to this that she and her housemates know that their dwelling has not been built recently, meaning that they know that if they will not keep an eye on their energy use, the energy bill might be unpleasantly high at the end of the year.

Competences

She showed some knowledge about negative consequences on the earth. She mentioned that in Groningen, because of the natural gas production, the people who live there are bothered by earthquakes and get stress and damage to their houses because of this. Even though the government agreed to close the gas production in Groningen, they opened it again, which she finds unjust. In addition, she mentioned that one issue is that the “creation of natural gas” needs a lot of time, which means that this resource will get exhausted at some point in time. Furthermore, she explained that natural gas emits CO₂ when it is burned, which leads to global

warming due to the greenhouse effect, which brings ecosystems in disbalance. Besides, she said that if you have bad luck, you live in a country at the height of the Netherlands, making the sea-level rise a threat to your home. Second to last, she knew about the price increase and the amount of money that is at stake for governments. Lastly, she mentioned that the money the governments make by trading natural gas can be used for positive investments such as improving education. For this, after I explained to her about exports to neighbour countries, she mentioned that natural gas is a very politically charged subject. As a final note, she mentioned that her peers were also valuable for acquiring knowledge about natural gas.

Meanings

She mentioned several practices to reduce natural gas usage in a household. First, if a housemate felt cold and put the central thermostat without mentioning it to others at 21 degrees Celsius, she would ask this housemate to use an electric heater in their bedroom. She mentioned doing this not only because of awareness (this might imply awareness about the negative consequences of using natural gas) but also because she wanted a lower energy bill. Another thing she mentioned is that her housemates are in the same study programme and are aware of natural gas usage, but some value their comfort temperature more than others. Second, she would put on thicker socks and a sweater when she was cold. She illustrated that changing clothing is not a bad option for a person who is always cold, because she had seen such a person working in an office where no heating was used. This person wore three layers of clothing and exercised occasionally to keep herself warm. She said that therefore everyone can find a way to deal with less heating, but that effort is needed to get there. Thirdly, she mentioned that their thermostat is programmable, which allows for conveniently setting the times when they want the temperature to change. If this were not the case, she believes that the housemates would not always put the temperature down at night. Fourthly, between 10 PM and 7 AM, the thermostat is put at 16 degrees Celsius. She mentioned that it was in negotiation with their housemate who did not like 15 degrees Celsius, so they agreed now to set it at 16 degrees Celsius. In contrast, during the day, the thermostat is only off when all housemates are away, which only happens when they go away together for a weekend. Fifthly, in her student accommodation, they keep the doors close to keep the cold out. In addition, she was thinking of some natural gas-saving practices for the future. The first practices that came to her mind were a water-saving shower head and using a small tap instead of the shower when she would shave her legs. Furthermore, if she will live together with her partner and this partner wants to

reduce energy use, it would be easier for her to reduce natural gas usage. This is because she will then see the energy bill become lower by doing natural gas-reducing practices.

On the contrary, she mentioned some practices that increase natural gas usage. First, the shared spaces have several radiators with their own knobs to turn. She said that it took too much effort to put the knobs on different radiators before going away from individual shared spaces. She mentioned that during the day, there is always somebody home because of different schedules, so they just leave the thermostat at the same temperature during the day. Second, she thinks taking shorter showers is difficult. The first reason is that since all people in the house share the energy bill and shower for long durations, even though she will make a difference in usage, which is demotivating for her to reduce the duration of her own shower, as their payment, in the end, will not be lower than what others will pay. She said that for this exact issue, a condition is to pay a variable tariff and not a fixed amount a month for energy usage. The second reason is that for her the shower is a pleasure and a way to shower away their stress. Third, she said she and her housemates still preferred cooking on a gas stove, because of the possibility to produce a lot of heat. Fourth, she mentioned also that when she does good practices regarding second-hand buying, she experiences less guilt in taking longer showers. In addition, she mentioned that probably because the price became higher recently, students will start to reduce their usage. Finally, she said that if you want to change to a more sustainable lifestyle, it costs you either more money or more time, especially to start with it.

Brainstorming session

From this session, the following brainstorming ideas came up. The underlying themes were a way to improve the current campaign of the government and to persuade students more.

- For campaigns, reaching students through platforms like Instagram would be an improvement.
- For catching the attention of students, it would be good to use the fact that it saves money to reduce natural gas usage because money is generally scarce among students. In addition, it would catch more attention and make it more tangible to use a catchphrase such as “you can spend the saved money on ten beers each month”.
- Next to a campaign, there should be specialized ambassadors that can spread the tips and tricks personally. This might reach more people and might get students to talk about it to each other.

- Such an ambassador might want to organise a group discussion with students about natural gas usage. This discussion can be used to start the movement among students, with questions such as “how can I communicate effectively with my landlord?” and “What can we do more to reduce natural gas usage?”.
- The idea to make natural gas more expensive was discussed. She reasoned that if students needed to pay more for their natural gas, students might want to reduce their usage. But as I was the only one in the room, I made clear my belief that making natural gas more expensive has other consequences, such as low-income groups that have even less to spend and that all products will get more expensive as natural gas is used in many value chains.

5. Discussion

5.1. How students perceive their potential to reduce natural gas usage

Based on the results, I found that there are situations and contexts of students in which the four HBO/University students perceived it as difficult to reduce natural gas usage and situations in which they perceived this as easy. The participants perceived reducing natural gas usage as easier when they were living alone or when they were living together with a partner sharing the goal to save energy. In other situations, when they were living together with multiple housemates and sharing a thermostat or sharing the energy bill, they perceived reducing natural gas usage as difficult. In addition, some behaviours were perceived as difficult to change (e.g., taking hot showers, and cooking on a natural gas stove).

To start with, the reasons why the participants perceived reducing natural gas usage as easy, especially when living alone or with a motivated partner: (1) the participants perceived the need to reduce natural gas usage when they pay per usage, which made it easier to reduce natural gas usage, (2) regarding technology a programmable thermostat for day and night settings or being able to diversify materials (e.g., the use of an electric heater) supported natural gas usage reduction. Other reasons were a positive attitude towards lowering the thermostat to 19 degrees Celsius, being able to wear thicker clothes or doing exercises to keep warm, parental and societal influences, and intrinsic motivation supported attempts among the participants to reduce natural gas usage. I found no specific reason for intrinsic motivation. How knowledge about natural gas (and about its effects on the environment) reduces natural gas usage was discussed in the theory in chapter 2.1.2., but there is no further evidence found for this. One other reason for the perception of reducing natural gas as easy came up for cooking, which is the skill of cooking water for pasta first with a kettle instead of the gas stove.

I put the reasons for the participants to perceive natural gas reduction as easy, especially when living alone or with a motivated partner and the link to the theory of chapter 2 in Table 6. The number of participants for who this was applicable (out of four) is added indicating significance among students and based on this the table is sorted from the highest significance to lower significance. Paying a variable or fixed tariff depends on the socio-demographic factor of living in a household with a certain energy contract, and two out of four participants were paying a variable tariff. Whether a household has a programmable thermostat depends on the available equipment in the household (materials), but it also depends on what existing technology was in a household before a new tenant comes, pointing at a socio-demographic factor as well (the case of one participant). Similarly, the possibility to diversify energy

technology, i.e., using technology powered by other energy sources, is linked to the materials and socio-demographics (the case for one participant). In addition, because the students needed to remind each other to use a different energy technology, this is also a social norm (meanings). The positive attitude towards lowering the thermostat to 19 degrees Celsius and the positive attitude towards wearing thicker clothes or doing exercises to keep oneself warm are categorised into meanings because of the attitude and in competences because it requires know-how (four out of four participants had these). Parental (which was mentioned by all three students of the focus group and did not come up in the interview) and societal influence (mentioned by one student) are social norms, which are linked to meanings of the SPT. Intrinsic motivation would also be a positive attitude towards natural gas usage reduction is categorised as meanings (which one participant of the focus group mentioned). Finally, the skill of boiling water first with the kettle for pasta depends on having a kettle (materials) and the know-how (competences).

Table 6: The reasons for the participants to perceive natural gas usage reduction as easy and the link to the theory of chapter 2

Reasons to perceive natural gas reduction as easy when living alone or with a motivated partner	Number of participants for who this was applicable (out of four)	Link to the theory of chapter 2
A positive attitude towards wearing thicker clothes	4	Meanings (values), Competences (know-how)
Parental influence	3	Meanings (social norms)
Paying a variable tariff	2	Socio-demographic factor
A positive attitude towards lowering the thermostat to 19 degrees Celsius on the day	2	Meanings (values)
Having a programmable thermostat	1	Materials, socio-demographic factor
Possibility of diversifying materials and energy sources	1	Materials, socio-demographic factor, meanings (social norms)

(with the need to remind others to use them)		
A positive attitude to the possibility of doing exercises to keep oneself warm	1	Meanings (values), Competences (know-how)
A positive attitude towards natural gas usage reduction	1	Meanings (values)
For society	1	Meanings (social norms)
The skill of cooking water first with the kettle for pasta	1	Competences (know-how), materials

Turning now to the reasons that made it difficult for the participants to save natural gas, especially when living together with housemates, were (1) social norms that tell the participants to make it convenient for housemates, (2) the effort needed for turning down all separate radiator knobs (especially if a group would need to take care of that), (3) the non-helping landlords while living in poorly insulated houses, (4) the preference for cooking on a natural gas stove rather than electric because of the perceived exclusive possibility to produce a lot of heat, (5) compensating behaviour (for example, if one of the participants would buy at a second-hand store, she felt less guilt for taking longer showers), and (6) peer comparison (through comparing showering time and still showering longer as housemates are doing the same, especially when the energy bill is shared in a household). There are several other more case-specific reasons. First, the comfort temperature was not significantly valued by the participants who were Dutch, although foreign housemates might influence the temperature setting of the thermostat through negotiations setting a social norm. Second, the lack of feeling responsible for natural gas usage because the landlord is paying for it. Third, for showering time, it is perceived as difficult to shower for five minutes (as the government advised) not only because of peer comparison and comfort but also because of the perception of not being able to clean oneself properly within five minutes.

I put the reasons that made it difficult, especially when living together with housemates and the link to the theory of chapter 2 in Table 7. Similar to Table 6, the number of participants for who this was applicable is given (out of four) and based on this the table is sorted from the highest significance to lower significance. The reasons to make it more convenient for housemates (mentioned by two participants), the negotiations with foreign housemates

(mentioned by one participant), and the peer comparison (mentioned by one participant) link to the component meanings (social norms) of the SPT. These negotiations also need certain know-how which points at competences. The lack of a feeling of responsibility induced by the landlord paying for the natural gas used depends on the value a person gives to natural gas usage in general and the value of money, which is categorised as meanings (values). The comfort of a hot shower and cleanliness (through taking showers) are also categorised as meanings (values) (both mentioned the same participant). The preference for cooking on a gas stove is an interaction between meaning and materials because it is about how much a person values the gas stove over an electric one (mentioned by one participant). The reason that it takes too much (group) effort to turn the separate radiator knobs on and off can be categorised in meanings because it depends on how much a person values this effort, which is categorised as meanings (mentioned by one participant). The factor of non-helping landlords while living in a badly insulated house is an additional socio-demographic factor because non-helping landlords were not theorised, and the insulation quality depends on the energy label (socio-demographic factor) (mentioned by all participants). The compensating behaviour that allows natural gas usage when doing other environmentally friendly actions is linked to meanings (personal norm) because it is about one's self-induced standards (mentioned by one participant).

Table 7: The reasons for the participants to perceive natural gas usage reduction as difficult and the link to the theory

Reasons to perceive natural gas reduction as difficult especially when students live together with housemates	Number of participants for who this was applicable (out of four)	Link to the theory of chapter 2
Non-helping landlords while living in a badly insulated house	4	Additional socio-demographic factor, socio-demographic factor
To make it more convenient for housemates	2	Meanings (social norms)
The comfort of a hot shower	2	Meanings (values)
Too much (group) effort to turn the separate radiator knobs on and off	1	Meanings (values)

Preference for cooking on a gas stove over an electric stove	1	Meanings (values), Materials
Compensating behaviour that allows natural gas usage because of doing something else environmentally friendly	1	Meanings (personal norms)
Peer comparison (comparing showering time)	1	Meanings (social norms)
Negotiations with foreign housemates	1	Meanings (social norms), competences (know-how)
Lack of responsibility for natural gas usage because the landlord pays for it	1	Meanings (value), socio-demographic factor
Cleanliness (through taking showers)	1	Meanings (values)

Based on Table 6Table 7, I made several observations. The most significant reasons for students to find it easy are social norms and values. In addition, the socio-demographic factors contribute also significant to why students perceive it difficult or easy to reduce natural gas. All reasons could be linked to the theory but one: the non-helping landlords. This is an additional socio-demographic factor. To conclude this section, the specific details collected in this study contribute to the understanding of how HBO/University students perceive their potential to reduce natural gas usage.

5.2. Limitations

Recruitment challenges

I start with the following challenges because it provides constructive advice for future research. In the beginning, I invited students from the Dutch studies Global Responsibility & Leadership (Campus Fryslân) (Rijksuniversiteit Groningen, Campus Fryslan, n.d.), and Electrical Engineering (University of Twente) (University of Twente, n.d.). Each study would have a separate focus group for comparison. I tried to recruit them by contacting them via one

student of each study (via Scintilla⁷ for Electrical Engineering, and an acquaintance for Global Responsibility & Leadership) using the texts in Appendix G, but I did not have any success. At the time I thought I needed to enlarge my target group, so I headed in that direction for the focus group I eventually conducted. However, in hindsight, I think it was because face-to-face recruitment worked out better than WhatsApp messages.

Recruitment

For the focus group I conducted, I recruited online and in-person in Leeuwarden in both HBO schools NHL Stenden and HVHL (using Appendix B), and the University of Groningen (Campus Fryslân). During the face-to-face recruitment students rejected to participate because of the following reasons: (1) they were not available, (2) they thought they were not skilled enough at group discussions, (3) they said to not know enough about natural gas, or (4) because they just said “no”. This implies that the results might be biased as the people that perceived themselves as not skilled enough or as not having enough knowledge did not enrol for the focus group. In addition, the students that rejected to join might not be interested in natural gas usage because they might not perceive the issues of climate change or energy affordability. This way, the participants of this study are students who have knowledge about natural gas usage and are pro-environmentally minded. Therefore, I believe I would have been able to recruit more participants and get a deeper understanding if I focused first on social practices in general and during the session switched to natural gas usage (or even only switch to natural gas for the brainstorming session).

Recruitment of the second focus group

Eventually, ten face-to-face recruited students enrolled for the set date. Of those ten, seven did send me reasonable reasons (e.g., unexpected classes or meetings) to not come to the focus group discussion, while three came. After that, I still found time to plan another one, but I had no time to recruit new people. I solved this by inviting all people that could not make it to the first one (see Appendix G), which ended up with an interview of one participant, and two out of seven notified me about not being able to come to the focus group discussion. More research time would have allowed for another recruitment session. I also could have planned several dates on which the focus group could take place beforehand. Already from the beginning of the recruitment, planning several dates could have recruited students who were

⁷ Scintilla is the study association of Electrical Engineering at the University of Twente (<https://www.scintilla.utwente.nl/home>)

not available for that one date I proposed. I believe that this would have enlarged the number of people that were available to participate.

Limitations

As a result of the recruitment hurdles stated above and having only ten weeks, I conducted only one focus group of three participants and one interview. Because of limited access to face-to-face recruitment spaces (only in Leeuwarden), the group of participants was tiny compared to the total number of Dutch students studying at an HBO or a university. Because of limited time, the codes are not member-checked, i.e., the codes were not validated by going back to the participants to ask how accurate they are (Leech & Onwuegbuzie, 2007). However, for both sessions, the observations were sent to the participants stating that if they had any comments they could say so. Until today, no comments were made. Furthermore, regarding the analysis, I did not conduct methodological triangulation (using multiple methods of data analysis), nor I did implement investigator triangulation (checking the consistency among researchers) (Leech & Onwuegbuzie, 2007), which would have improved the quality of the analysis. Taken together, I argue that this study should be regarded as a pilot test to set up a study with more participants regarding natural gas usage amongst students. The results can be useful to get insight into what kind of questions should be asked in the future. For example, the quality of the data could be improved by asking for each component whether a participant changed a certain behaviour because of that particular component, finding more correlations between components and their influence on natural gas usage. In this study, I observed that the correlation between knowledge and behaviour is missing in the results, which could have been asked. Similarly, the reason for intrinsic motivation and societal influence could have been asked to know why they were intrinsically motivated or influenced by society. As a final note, regarding data capturing, I had two audio devices to record the session: my laptop and my mobile phone. The laptop failed and gave an error, but the phone did all the work. It was helpful to have an available backup device.

Reflection of researcher's "performance"

Because I said at the beginning of the focus group discussion and interview that all answers were respected, and I prepared neutral questions because throughout the research I reflected on how my positionality might influence the results (see chapter 3.4 positionality), I seem to have avoided bias. However, in contradiction to what I planned, somewhere to the end of the focus group and interview, I mentioned that I do not take hot showers and that I am aware that through consumption you might use more natural gas than in a household. Looking

back at the results, I do not think this has affected it, for the students were consistent in their answers before and after I told them about myself. Turning now to how the participants reflected on the focus group. Two participants answered the question on the paper questionnaire (Appendix E) if such a focus group would be done again in the future, what they would like to be changed. The first answer was: “Fine, I got nothing to remark about it”, and the second was: “Nothing, I did like it in this way”. Having said the above, I look back at the focus group and interview positively.

6. Conclusions

How students perceive their potential to reduce natural gas usage

In my thesis, the research question is how HBO/University students perceive their potential to reduce natural gas usage in their households. In the following paragraphs, I will answer my research question based on this study, give the most important limitations, give suggestions for future research, and give recommendations for policymakers.

Three students joined the first focus group, and one student joined the second planned focus group which made it an interview. The results were transcribed and analysed. The detailed information collected in this study is a contribution to the understanding of HBO/University students and their perceived potential of natural gas usage reduction. The analysis showed that materials, competences and meanings of the SPT are important for whether a student finds it difficult or easy to reduce natural gas usage. In addition, the socio-demographic factors were essential to this (paying per usage made it easier, and non-helping landlords made it more difficult). This study suggests the importance and applicability of SPT to conduct research on the potential of natural gas usage reduction of HBO/University students. In addition, the socio-demographic factors were also essential and should be included in future research as well.

Limitations

There were several limitations in this study concerning lack of time and access. The most important limitations were the lack of access to participants (especially when they were recruited online) and the lack of non-environmentally minded students. Only four environmentally minded students studying in Leeuwarden who were recruited face-to-face joined the session in this study.

Future research

For future research, I suggest using this study as a pilot study for a more extensive study on students and natural gas usage. From the limitations of this study, I suggest recruiting participants in person and not online, without saying the study's focus is factual knowledge about natural gas, but just as a topic in general. I propose to use social practices as the main topic instead, deriving afterwards how these relate to natural gas usage. For any other target group, the social practice theory might help to research natural gas usage in a household. Since I missed the connection between knowledge and action, an interesting focus point could be how knowledge and/or education influence the target group's decision-making. For the

framework for such research, I recommend looking into the key terms ‘carbon literacy’ and ‘carbon capability’ in combination with the ‘value-action gap’ (Whitmarsh et al., 2011).

Recommendations for policymakers

Based on this study and the brainstorming session, I provide the following advice for adjustments in policies for policymakers or workers at the municipality to reduce the natural gas usage of students. The outcomes of this study suggest that some adjustments in a student’s living situation could have an impact. First, natural gas consumption could be reduced by replacing traditional thermostats with programmable ones, or to give students alternatives to central natural gas heating systems using other energy sources (e.g., electric heaters). Second, this study suggests that there is a need to motivate landlords to renovate the insulation of the students’ accommodations, as there was agreement among the students that landlords tend not to listen to students. Participants suggested that the municipality should do this by offering interesting subsidies or offering complete information on savings as a result of the renovation. Another solution would be to hire an ambassador who facilitates a focus group discussion with students about how to reach their landlords, making it easier for the students to talk to the landlords making them potentially more helpful. Third, natural gas consumption could be reduced by deciding that all students who pay a fixed amount per month switch to paying variable costs for natural gas usage, which would make them perceive a higher need for reducing natural gas usage. Fourth, there should be a (social) solution for the students living in shared student accommodations who share the energy bill. To decrease the effects of peer comparison among them and with that motivate them to individually save natural gas, they should be able to pay more fairly for their own usage.

Additional ideas for policymakers

During the brainstorming session, I found several other ideas to contribute to natural gas usage reduction amongst students that might help policymakers in their policies. To start with, there were two ideas to raise awareness. The first idea is the development of a website that illustrates the whole system of the natural gas value chain, including the consequences for the environment. Second, the idea of an ambassador to speak to students in person to improve their energy savings. Furthermore, because students were uncertain how to manage natural gas best in their households, the idea came up to develop an application for calculating how to manage natural gas usage most efficiently in a specific household. Finally, the idea to build complexes to share rest heat was proposed. These ideas can shape guidelines for policymakers to improve the situation regarding students and natural gas usage.

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Appendix A: Online recruitment messages (Dutch)

Focus group invitation for WhatsApp:

Beste student,

Hallo, ik ben Jarl Witt en ik doe mijn master thesis nu van Environmental & Energy Management (Universiteit Twente in Leeuwarden) en daar kan ik jouw hulp goed bij gebruiken! Ben jij Nederlands en student HBO/universiteit, dan zou ik je graag willen uitnodigen op 9 juni '22 van 14:00 tot 15:30 in Van Hall Larenstein lokaal B3.14 voor een groepsinterview over aardgasverbruik met een staartje van brainstormen over oplossingen wat betreft gedrag-> *eigen ideeën zijn tijdens deze sessie dus ook zeer welkom.* Er zit ook nog een gratis en gezonde, voedzame, snack bij. De link naar het aanmeldingsformulier met onder andere een beschrijving van de vragen en alvast het toestemmingsformulier is hier: <https://forms.office.com/r/izeqcQvZ0Z>

Wat fijn dat ik dit bericht mocht sturen en dat het jou mocht bereiken. Mensen bereiken is een hele kunst en ik hoop dat je deze kans grijpt; want *later bij jouw scriptie wil jij toch net zo goed geholpen worden met deelnemers voor jouw onderzoek*. Achter dit bericht schuilt dus een mooie kans om als onderzoeker een collega te helpen voor zijn master scriptie over een belangrijk onderwerp in de huidige tijd vanwege prijsstijgingen en afhankelijke import. Het gaat hier dus over het *transparante goud*, aardgas. Contact: j.e.witt@student.utwente.nl

Focus group invitation for Facebook (without the signs to format pieces of texts for WhatsApp). I did not format the email:

Beste student,

Hallo, ik ben Jarl Witt en ik doe mijn master thesis nu van Environmental & Energy Management (Universiteit Twente in Leeuwarden) en daar kan ik jouw hulp goed bij gebruiken! Ben jij Nederlands en student HBO/universiteit, dan zou ik je graag willen uitnodigen op 9 juni '22 van 14:00 tot 15:30 in Van Hall Larenstein lokaal B3.14 voor een groepsinterview over aardgasverbruik met een staartje van brainstormen over oplossingen wat betreft gedrag-> eigen ideeën zijn tijdens deze sessie dus ook zeer welkom. Er zit ook nog een gratis en gezonde, voedzame, snack bij. De link naar het aanmeldingsformulier met onder andere een beschrijving van de vragen en alvast het toestemmingsformulier is hier: <https://forms.office.com/r/izeqcQvZ0Z>

Wat fijn dat ik dit bericht mocht sturen en dat het jou mocht bereiken. Mensen bereiken is een hele kunst en ik hoop dat je deze kans grijpt; want later bij jouw scriptie wil jij toch net zo goed geholpen worden met deelnemers voor jouw onderzoek. Achter dit bericht schuilt dus een mooie kans om als onderzoeker een collega te helpen voor zijn master scriptie over een belangrijk onderwerp in de huidige tijd vanwege prijsstijgingen en afhankelijke import. Het gaat hier dus over het *transparante goud*, aardgas. Contact: j.e.witt@student.utwente.nl

Appendix B: Enrolment form (Dutch)

Inschrijven voor groepsinterview over aardgasverbruik

De enquête duurt ongeveer 5 minuten om te voltooien.

Hallo allemaal! Ik ben Jarl Witt en ik ben bezig met mijn master scriptie Environmental & Energy Management aan de UT in Leeuwarden; in het gebouw van Van Hall Larenstein. Ik doe het over menselijk gedrag en aardgasverbruik onder Nederlandse studenten.

Het nu geplande groepsinterview zal plaatsvinden in Van Hall Larenstein lokaal B3.14 op donderdag 9 juni van 14:00 tot uiterlijk 15:30.

Wees van harte welkom bij het groepsinterview over aardgasverbruik. Mijn doelgroep zijn mensen van 18 jaar of ouder met Nederlandse ouders die voor het grootste gedeelte van hun leven in Nederland hebben gewoond.

Tijdens dit groepsinterview leid ik een groepsdiscussie waarbij de gesprekken worden verzameld als data om de hoofdvraag van mijn scriptie te beantwoorden, namelijk in welke mate studenten denken dat ze bij kunnen dragen aan het verminderen van hun huishoudelijke aardgasverbruik. De verzamelde gegevens zullen gaan over de mate waarin mensen bewust omgaan met aardgas, op welke wijze ze dat doen, en waarom ze dat doen. Daarnaast zou ik nog graag willen brainstormen over oplossingen. Als beloning krijg je er een kleine, gezonde en voedzame, snack als beloning voor je deelname (glutenvrij maar bevat wel lactose).

Dit formulier is geheel vrijblijvend en is alleen ter indicatie dat je bereid bent deel te nemen aan het groepsinterview. In het eerste gedeelte geef je je naam, e-mailadres en studie. Deze gegevens worden gebruikt om eventuele praktische informatie te verstrekken en je op de hoogte te houden of het doorgaat en mogelijke datumveranderingen. In het tweede gedeelte kan je alvast de informatiebrochure en toestemmingsformulier doorlezen die je ook op locatie krijgt om dan te tekenen.

Ter informatie: Het is ook mogelijk dat door te weinig inschrijvingen het groepsinterview

* Required niet doorgaat. Zou je in dat geval bereid zijn om een individueel interview te doen? Vul dan bij de laatste vraag een voorkeursdatum en -tijd in.

1. Naam en achternaam *

2. E-mailadres *

3. Welke studie doe je? *

4. Zou je de studieresultaten toegestuurd willen krijgen als het onderzoek klaar is? *

- Ja, stuur mij de studieresultaten als ze er zijn via het hier gegeven e-mailadres.
- Ja, maar dan via een ander e-mailadres, graag invullen bij de volgende vraag
- Nee

5. Voor als je "via een ander e-mailadres" hebt ingevuld bij de vorige vraag, welk e-mailadres mogen de resultaten naartoe?

6. Het is ook mogelijk dat door te weinig inschrijvingen de groepsinterviews niet doorgaan. Zou je in dat geval bereid zijn om een individueel online interview te doen? Vul dan hieronder je voorkeursdatum en -tijd in (in deze vraag de datum, en in de volgende vraag de tijd). Ik ben bijna altijd wel beschikbaar, dus het gaat er echt om wanneer jij kunt. Ik neem contact met je op zodra ik persoonlijke interviews ga doen. De laatste datum dat ik beschikbaar ben is 24 juni.

7. Voorkeurstijd:

Informatiebrochure en toestemmingsformulier

Het doel van dit onderzoek is om drijfveren en redenen voor aardgasverbruik onder Nederlandse studenten uit te diepen. Als je dit leest ben je één van de gevraagde studenten. Deze informatie is om je van tevoren te informeren. Tijdens de sessie krijg je een papieren formulier met dezelfde informatie die je dan mag tekenen.

Deelname aan dit groepsinterview is volledig vrijwillig en vrijblijvend. Ten eerste betekent dit dat je er geen vergoeding voor krijgt. Ten tweede betekent dit dat je niet verplicht bent om deel te nemen en op elk moment kan zeggen dat je er mee wilt stoppen of dat je de desbetreffende vraag niet wilt beantwoorden. Ten derde mag je genoemde antwoorden herroepen, dus je mag achteraf laten weten dat je iets/alle antwoorden niet meer in de resultaten wilt zien. Ik zal dan het uitgeschreven verslag samen met je doornemen om de herroepingen eruit te halen.

In het groepsinterview krijg je een aantal vragen op papier, waarna ik vragen zal stellen aan de groep. De vragen op papier zijn anoniem. Deze gaan over je kennis van je huidige aardgasverbruik in je huishouden, de mate dat jij invloed hebt op je verbruik, je leeftijd en andere demografische gegevens. De vragen tijdens het groepsinterview gaan over de onderliggende normen, waarden, of andere redenen om aardgas te verbruiken. Aan het einde van het groepsinterview wil ik nog graag met jullie brainstormen over ideeën om zuiniger om te gaan met aardgas gebaseerd op de eerder gegeven antwoorden.

Om het groepsinterview in goede banen te leiden doe ik er alles aan om een open sfeer te creëren en vragen op een neutrale manier te stellen. Ik ben zelf een “environmentalist” dus ik zal zelf van mening zijn dat aardgasverbruik verminderd moet worden, en als dat door menselijk gedrag kan vind ik dat een oplossing. Ik heb er aandacht aan besteed om dat niet in mijn vraagstelling te laten doorklinken, maar ik ben mij bewust van het feit dat dit hele onderzoek dat doet doorklinken. Ondanks dat ben ik op zoek naar ieders mening, en zal ik geen afwijkende mening afkraken. Ook zal ik zelf af en toe wat delen over mijn ervaringen om me ook echt als gelijke op te stellen.

De audio van het groepsinterview zal worden opgenomen met behulp van twee microfoons op twee punten in het klaslokaal en zal uitsluitend gebruikt worden voor het verwerken van het onderzoek. Er zullen geen video's worden gemaakt van het groepsinterview. De audiobestanden zullen worden opgeslagen op mijn harde schijf tijdens de

onderzoekperiode en twee weken nadat het verslag klaar is worden verwijderd. In de uitgeschreven versie van het audiobestand verwerk ik geen persoonlijke gegevens en zullen de participanten worden genummerd om onderscheid te maken wie er in de discussie sprak, maar op geen enkele manier gelinkt worden aan de resultaten van het ingevulde papier of de gegevens van de opgave van deelname via dit formulier. Er zal dus geen persoonlijke informatie van jullie gedeeld worden in mijn verslag om jullie privacy te waarborgen.

Als er vragen zijn of herroepingen na dit onderzoek dan ben ik bereikbaar via mail of telefoon:

j.e.witt@student.utwente.nl

0681992529

8. Heb je het bovenstaande gelezen? *

Hierbij geef ik aan dat ik bovenstaande heb gelezen.

9. Indien je bezwaren hebt, geef die dan hieronder aan. Er zal mogelijk contact met je worden opgenomen hierover.

10. Nog andere dingen waar ik van moet weten wat betreft het onderzoek?

11. Ga je akkoord voor nu? *

Ik ga akkoord met dit formulier en ik ben bereid om dit aan het begin van het onderzoek op papier te tekenen.

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.

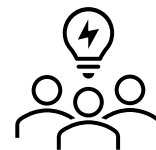


Appendix C: Printed paper for face-to-face recruitment(Dutch)

I used the folder of my master's Environmental & Energy Management as an introduction to what I am studying, and a printed version of the page below (in Dutch).



Onderzoek naar huishoudelijk aardgasverbruik onder studenten



Opdracht: Master thesis energy track Environmental & energy management
(University of Twente)

Type onderzoek: Groepsinterview/groepsdiscussie

Doelgroep: Nederlandse HBO/universiteit studenten van 18 jaar en ouder die het grootste gedeelte van hun leven in Nederland hebben gewoond.

Soorten vragen: Feitelijke kennis over aardgasverbruik en vragen over normen en waarden wat betreft aardgasverbruik.

Extraatje: Een kleine brainstormsessie over oplossingen om aardgasverbruik te verminderen.

Beloning: Je krijgt een kleine, gezonde en voedzame snack als beloning voor je deelname (glutenvrij maar bevat wel lactose en noten).

Datum*	Tijd*	Locatie
9 juni 2022	Van 14:00 tot uiterlijk 15:30	Van Hall Larenstein lokaal B3.14

*Datum en tijd kunnen eventueel veranderen, maar dat het 1,5 uur duurt dat is zeker.

Aanmelding: Dit kan via het aanmeldingsformulier, je komt er door de onderstaande QR code te scannen:



j.e.witt@student.utwente.nl

Tel. 0681992529

Naam: Jarl Witt

Studie: Environmental & Energy Management

Woonplaats: Leeuwarden

Opdracht: Master thesis energy track

Appendix D: Information brochure and consent form on paper (Dutch)

Informatiebrochure en toestemmingsformulier

Onderwerp: een groepsinterview en discussie met Nederlandse studenten over aardgasverbruik.

Het doel van dit onderzoek is om drijfveren en redenen voor het gebruik van aardgas wat betreft Nederlandse studenten uit te diepen. Nu is het moment om dit toestemmingsformulier te tekenen en dan de onderliggende vragenlijst verder in te vullen, dit formulier mag je eerst inleveren en staat een naam op, maar de vragenlijst blijft anoniem en wordt niet met dit papier gelinkt.

Om de groepsdiscussie in goede banen te leiden doe ik er alles aan om een open sfeer te creëren en vragen op een neutrale manier te stellen. Ik ben zelf een “milieuactivist” dus ik zal zelf van mening zijn dat aardgasverbruik verminderd moet worden, en als dat door menselijk gedrag kan vind ik dat een oplossing. Ik heb er aandacht aan besteed om dat niet in mijn vraagstelling te laten doorklinken, maar ik ben mij bewust van het feit dat dit hele onderzoek dat doet doorklinken. Ondanks dat ben ik op zoek naar ieders mening, en zal ik iedereen mening respecteren.

Deelname aan dit groepsinterview is volledig vrijwillig en vrijblijvend. Ten eerste betekent dit dat je er geen vergoeding voor krijgt. Ten tweede betekent dit dat je niet verplicht bent om deel te nemen en op elk moment kan zeggen dat je er mee wilt stoppen of dat je de desbetreffende vraag niet wilt beantwoorden. Ten derde mag je genoemde antwoorden herroepen, dus je mag achteraf laten weten dat je iets/alle antwoorden niet meer in de resultaten wilt zien. Ik zal dan het uitgeschreven verslag samen met je doornemen om de herroepingen eruit te halen.

In het groepsinterview krijg je een aantal vragen op papier, waarna ik vragen zal stellen aan de groep. De vragen op papier zijn anoniem. Deze gaan over je kennis van je huidige aardgasverbruik in je huishouden, de mate dat jij invloed hebt op je verbruik, je leeftijd en andere demografische gegevens. De vragen tijdens het groepsinterview gaan over de onderliggende normen, waarden, of andere redenen om aardgas te verbruiken. Aan het einde van het groepsinterview wil ik nog graag met jullie brainstormen over ideeën om zuiniger om te gaan met aardgas gebaseerd op de eerder gegeven antwoorden.

De audio van het groepsinterview zal worden opgenomen met behulp van twee microfoons voor en achter in het klaslokaal en zal uitsluitend gebruikt worden voor het verwerken van het onderzoek. Er zullen geen video's worden gemaakt van het groepsinterview. De audiobestanden zullen worden opgeslagen op mijn harde schijf tijdens de onderzoeksperiode en twee weken nadat het verslag klaar is worden verwijderd. In de uitgeschreven versie van het audiobestand verwerk ik geen persoonlijke gegevens en zullen de participanten worden genummerd om onderscheid te maken wie er in de discussie sprak, maar op geen enkele manier gelinkt worden aan de resultaten van het ingevulde papier of de gegevens van de opgave van deelname via dit formulier. Er zal dus geen persoonlijke informatie van jullie gedeeld worden in mijn verslag om jullie privacy te waarborgen.

Als er vragen zijn of herroepingen na dit onderzoek dan ben ik bereikbaar via mail of telefoon:

j.e.witt@student.utwente.nl

0681992529

Naam: Jarl Witt

Studie: Master Environmental Energy Management (MEEM)

Woonplaats: Leeuwarden, Friesland

Hierbij ga ik akkoord met het feit dat de audio van het groepsinterview zal worden opgenomen.

Hierbij zeg ik dat ik het bovenstaande toestemmingsformulier heb gelezen en dat ik ermee akkoord ga.

Naam deelnemer

Handtekening deelnemer

Datum

Appendix E: Questionnaire on paper

Wat weet jij over je aardgasverbruik?

Deel 1: De volgende vragen gaan over jouw kennis over zaken die te maken hebben met je persoonlijk aardgasverbruik.

Omcirkel wat van toepassing is:

Ik betaal voor aardgas: naar verbruik/een vast bedrag per maand/ik betaal niet voor aardgas/weet ik niet.

Ik heb een vast contract met vaste aardgasprijs/ik betaal elke (maand/jaar) een ander bedrag per m³/weet ik niet/of anders: _____

Ik woon in een: Rijtjeshuis midden/rijtjeshuis hoekhuis/vrijstaand huis/twee-onder-een-kapwoning/flat/of anders: _____

Ik: heb een eigen thermostaat op mijn kamer/deel onze centrale thermostaat met huisgenoten/ of anders (meerdere antwoorden zijn mogelijk):

Ik heb een: Centrale gewone thermostaat/programmeerbare thermostaat/aparte thermostaat(knop) in elke kamer/of anders:

Mijn energielabel is (A-G): ____ of weet ik niet.

1. Woonoppervlakte (slaapkamer, woonkamer, keuken, badkamer, wc, bijkeuken, schuur): ____ m², of

weet ik niet. 2. Omcirkel in de bovenstaande zin in welke kamers zich een radiator bevindt en doorkruis de ruimten die je niet gebruikt. Andere ruimte(s) met radiator:

Wij wonen in totaal met ____, waarvan ____ minderjarigen/kinderen. Ik woon alleen.

Als ik thuis ben, zet ik zelf (graag) de thermostaat op: ____ °C, of weet ik niet.

Als ik niet thuis ben, dan staat/zet ik de thermostaat op: ____ °C, of weet ik niet.

Mijn comfort temperatuur (de temperatuur die ik het fijnste vind in huis): ____ °C, of weet ik niet.

Hoe belangrijk vindt je het om die comfort temperatuur in huis te hebben op een schaal van 1-5, (met 1 onbelangrijk en 5 erg belangrijk): ____

Vul bij elk van de volgende tijdsaanduidingen jouw aardgasverbruik thuis in en daarnaast jouw gemaakte kosten of het vaste bedrag, en waar je het verbruik afleest. betekent weet ik niet.

Per:	Aardgasverbruik (m ³)	Kosten (€)	Waar lees je het verbruik af? Voorbeelden: aan de muur, in de meterkast of via een app.
Week:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Maand:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Jaar:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-------	--------------------------	--------------------------	--------------------------

Mijn inkomen is bruto in Euro's per jaar (geen DUO), omcirkel: 0 - 1000/1000 - 3000/3000 - 10000/meer dan dat. Ik leen van DUO (ongeveer) op een schaal van 0-5. (0 betekent niets en 5 alles):

Ik vind het belang om te letten op mijn uitgaven voor energiegebruik (hetzelfde principe, 1-5):

Welke apparaten gebruik je (nog meer) om je huis te verwarmen? **Omcirkel:** Elektrische kachel(s)/warmtepomp/houtkachel/weet ik niet/niets

Of anders:

Ga verder op de achterkant.

Gebruiksfrequentie van apparaten die gas verbruiken en reden van (geen) gebruik.

	Nooit	Elke dag	Elke week	Niet in huis	Reden van (geen) gebruik (ook als je het niet in huis hebt):
Gasketel voor centrale verwarming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Gasketel voor warm water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Gasfornuis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Gasoven	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Losse gaskachel/gashaard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Einde deel 1: Nu gaan we door naar de discussievragen. Deze vragenlijst vullen we later verder in.

Deel 2 (vragen aan het einde van de groepsdiscussie): De volgende vragen gaan over jouw demografische gegevens.

Leeftijd: _____

Studie: _____ School (afk.): _____

Studiejaar: _____

Geslacht (je hormoonsysteem): _____ of dat wil ik liever niet zeggen.

Provincie van je huidige woonplaats: _____

Als er later nog een keer een groepsdiscussie wordt gehouden, wat zou je dan liever anders zien?

Zijn er nog dingen die je zou willen toevoegen aan de discussie?

Einde deel 2. Einde vragenlijst. Dankjewel voor het invullen!

Appendix F: Focus group questions and planning (Dutch)

I used a printed version of the following text including planned timings during the focus group discussion and the interview. The red part in the end I only said when no ideas came up.

Voorbereiding: Twee kampen maken van tafels en stoelen. 1 tafel voor de opname op mijn mobiel. Op het whiteboard de belangrijkste vragen listen. Een rij tafels van het aantal deelnemers om eerst het consent form in te vullen. Op iedere tafel daarna de vragenlijst.

Groepsinterview en brainstorm

Tijdens de sessie noteer ik op het whiteboard/op een opschrijfpapiertje/ in mijn University of Twente Bambook.

Snack (14:00)

Voordat ik het toestemmingsformulier uitdeel: Iedereens mening wordt gerespecteerd, het maakt niet uit of je voor of tegen het verminderen van aardgas bent of hoe je er ook over denkt. Ook als je het ergens niet mee eens bent mag je het zeggen.

Toestemmingsformulier (14:05)

Aardgas is volgens mij een belangrijk onderwerp om het over te hebben. We richten ons op aardgasverbruik in het huishouden omdat dat iets is waar wij studenten iets aan kunnen bijdragen. Ik wil het dus hebben over hoe wij de mogelijkheden van verminderen beschouwen, en daarvoor heb ik eerst een vragenlijst over je huidige verbruik en aspecten daaromheen om een beetje in het onderwerp te komen.

Vragenlijst deel 1 (14:12)

Kwalitatieve vragen (14:22)

Nu wil ik het hebben over normen en waarden met betrekking tot aardgasverbruik. Bij de ja/nee vragen wil ik jullie vragen om de rechterkant gaan staan als je antwoord ja is, en aan de linkerkant als je antwoord nee is. Ik zal het er nog bij zeggen.

Startvraag: (vaardigheden): Ga jij bewust om met aardgas? Waarom wel/niet?

In welke omstandigheden verbruik je aardgas?

Doe je het (niet) voor iemand? En zo ja, voor wie dan? Ja of nee, waarom (niet)? Bijvoorbeeld als doorvraag: Welke rol spelen je huisgenoten in je aardgasverbruik?

Doorvragen?: Of doe je het omdat iemand anders die je kent het ook zo doet?

Gewoon in het algemeen: wat wil je bereiken met aardgas?

Speelt de aardgasrekening ook een rol in hoe bewust je met aardgas omgaat? Waarom wel/niet?

Weet je iets van het effect van aardgasverbruik op de aarde? Zo ja, wat weet je er dan van?

Als er iemand zegt dat hij wel wil veranderen: Geloof jij erin dat je dat kan doen of veranderen? Waarom wel/niet?

Vervolg vragen (Pauze van 5 min om 14:42)

Kent iemand de campagne “zet ook de knop om”? Zo ik wil elk gedragsadvies van de overheid van ‘zet ook de knop om’ bij langs gaan en vragen of ze dat wel/niet doen en dan voor zowel als ze het wel als dat ze het niet doen dezelfde vragen stellen.

Letterlijk van de website: (Projecteer dit op de beamer)

Redenen: Onze energierekening stijgt, we moeten nu minder afhankelijk worden van gas uit Rusland en we willen klimaatverandering tegengaan.

- 1. Zet je thermostaat op maximaal 19 graden/ Besparing €200 per graad minder dan je eerder deed.**
- 2. Douche maximaal 5 minuten/ Besparing €130 per jaar**
- 3. Verwarm alleen de ruimtes waar je bent/ Besparing €550 per jaar**
- 4. Zet ‘s avonds de thermostaat op 15 graden/ Besparing €260 per jaar**
- 5. Niet thuis? Zet de thermostaat op 15 graden/ Besparing €210 per jaar**

Vragen over betekenis:

Ik wil jullie vragen om rechts te gaan staan als je dit doet, en links als je dit niet doet.

In welke omstandigheden doe je dit of doe je dit juist niet?

Doe je het (niet) voor iemand? En zo ja, voor wie dan? En waarom? Bijvoorbeeld als doorvraag: Welke rol spelen je huisgenoten in je aardgasverbruik?

Of doe je het omdat iemand anders die je kent het ook zo doet?

Speelt de aardgasrekening ook een rol in hoe bewust je met aardgas omgaat? Waarom wel/niet?

Vragen over vaardigheden:

Weet je iets van het effect van aardgasverbruik op de aarde? Zo ja, wat weet je er dan van?

Als er iemand zegt dat hij wel wil veranderen: Geloof jij erin dat je dat kan doen of veranderen? Waarom wel/niet?

Vragenlijst deel 2 (15:07)

Brainstorm (15:17)

Kent iemand de campagne “zet ook de knop om”? Zo ja, waarom heeft de overheid die campagne? En in het algemeen, denken jullie dat we ons aardgasverbruik zouden moeten verminderen?

Ik zou jullie nu willen vragen om groepjes van 2 of 3 te maken. Één van jullie mag dan de ideeën opschrijven en die mag je dan later ook aan mij geven. Deze worden meegenomen in de resultaten.

Brainstormvraag:

Gezien de elementen en redenen voor aardgasverbruik die we hebben geïdentificeerd, wat voor iets zou helpen om ons gasverbruik te verminderen? Ideeën:

[interventie/apparaat/communicatiemethode/app/](#)

Appendix G: The invitations and reminders for the focus groups (Dutch emails)

First reminder for the first focus group (03/06/2022)

Subject: [UT master onderzoek] aanmelding groepsdiscussie aardgasverbruik

Beste deelnemer,

Hartelijk dank dat jij je hebt aangemeld voor mijn groepsdiscussie over aardgasverbruik die ik houd in verband met mijn UT master Environmental & Energy management scriptie, met hoofdvraag: "Hoe beschouwen studenten hun potentie om hun aardgasverbruik te verminderen?".

Hierbij ook een herinnering van de tijd en locatie dat het zal plaatsvinden. Zet hem dus nog even in je agenda. Ik ben tussen de voorbereidingen door ook aan het uitzoeken welke gezonde, voedzame snack ik ga uitdelen, dus dat je het even weet 😊.

Datum: donderdag 9 juni 2022

Tijd: 14:00 – 15:30

Locatie: Van Hall Larenstein, lokaal B3.14 (bij de ingang aan de zijde van het kerkgebouw naar rechts en dan naar de derde verdieping).

Agora 1, 8934 CJ Leeuwarden (<https://goo.gl/maps/JB9epMZnoFPYzYlm6>)

Mocht je onverhoopt niet kunnen, stuur me dan even een mailtje of berichtje naar 0681992529

Tot volgende week donderdag!

Met vriendelijke groet,

Jarl Witt

j.e.witt@student.utwente.nl

Tel. 0681992529

University of Twente (lokaal B3.14 in VHL Leeuwarden), Student Environmental & Energy management

Second reminder for the first focus group (08/06/2022)

Subject: [UT master onderzoek] Herinnering groepsdiscussie aardgasverbruik

Hallo allemaal!

Super fijn dat jullie mee willen doen aan de groepsdiscussie over aardgasverbruik. Hierbij even een herinnering dat het morgen (donderdag 9 juni 2022) zal plaatsvinden van 14:00 tot 15:30 in lokaal B3.14. Wees welkom en je krijgt een gezonde, voedzame snack als beloning. Laat het ook nog even weten als je onverwachts toch niet kunt komen.

Een goede dag gewenst en tot morgen!

Jarl Witt

j.e.witt@student.utwente.nl

Tel. 0681992529

University of Twente (lokaal B3.14 in VHL Leeuwarden), Student Environmental & Energy management

Invitation for the second focus group (10/06/2022)

Subject: [UT master onderzoek] uitnodiging 2e keer groepsinterview aardgasverbruik.

Beste deelnemers die niet konden,

Ik heb besloten om nog een groepsinterview te plannen. Wederom in lokaal B3.14 in HVHL en op donderdag 16 juni om 14:00 tot 15:30. Zouden jullie dan mee kunnen doen? Stuur dan even een mailtje als je komt. Vanwege tijdgebrek komt er dit keer geen gezonde snack bij, maar afgelopen donderdag was een mooie interactieve sessie over aardgasverbruik en een kleine brainstorm. Dus kom vooral en deel kennis. We maken er een interessant groepsinterview van.

Met vriendelijke groet,

Jarl Witt

j.e.witt@student.utwente.nl

Tel. 0681992529

University of Twente (lokaal B3.14 in VHL Leeuwarden), Student Environmental & Energy management

Reminder for the second focus group (14/06/2022):

Subject: [UT master onderzoek] herinnering uitnodiging aanstaande donderdag

Hallo allemaal!

Ik heb jullie afgelopen vrijdag uitgenodigd om mee te doen met mijn tweede groepsinterview. Afgelopen donderdag was goed bevallen, en dit keer kunnen we er weer een interessante sessie van maken.

Datum en tijd: a.s. donderdag, 16 juni 22, van 14:00 tot 15:30

Locatie: lokaal B3.14, HVHL

Als het lukt zullen er toch nog gezonde snacks bij zijn!

Stuur even een mailtje als je wel of niet komt, dan weet ik hoeveel mensen ik kan verwachten,

Met vriendelijke groet,

Jarl Witt

Appendix H: Recruitment messages of failure (Dutch)

Trying to reach Electrical Engineering (via WhatsApp):

Beste student,

Wat fijn dat ik dit bericht mocht sturen en dat het jou mocht bereiken, want mensen bereiken is een hele kunst en ik hoop dat je deze kans grijpt; want *later bij jouw scriptie wil jij toch net zo goed geholpen worden met deelnemers voor jouw onderzoek*. Achter dit bericht schuilt dus een mooie kans om als onderzoeker een collega te helpen voor zijn master scriptie over een belangrijk onderwerp in de huidige tijd vanwege prijsstijgingen en afhankelijke import. Het gaat hier dus over het *transparante goud*, aardgas.

Ben jij Nederlands en student bachelor Electrical Engineering, dan zou ik je graag willen uitnodigen op 31 mei '22 van 14:00 tot 16:00 in RA 1501 (Ravelijn) voor een groepsinterview over aardgasgebruik met een staartje van brainstormen over oplossingen met betrekking tot gedrag-> *eigen ideeën zijn tijdens deze sessie dus ook zeer welkom.* De link naar het aanmeldingsformulier met onder andere een beschrijving van de vragen en alvast het toestemmingsformulier is hier: <https://forms.office.com/r/xYnBSvAaYt>

Trying to reach Global responsibility & Leadership (via WhatsApp):

Beste student,

Wat fijn dat ik dit bericht mocht sturen en dat het jou mocht bereiken. Mensen bereiken is een hele kunst en ik hoop dat je deze kans grijpt; want *later bij jouw scriptie wil jij toch net zo goed geholpen worden met deelnemers voor jouw onderzoek*. Achter dit bericht schuilt dus een mooie kans om als onderzoeker een collega te helpen voor zijn master scriptie over een belangrijk onderwerp in de huidige tijd vanwege prijsstijgingen en afhankelijke import. Het gaat hier dus over het *transparante goud*, aardgas.

Ben jij Nederlands en student Global Responsibility & Leadership, dan zou ik je graag willen uitnodigen op 24 mei '22 van 14:00 tot 16:00 in Van Hall Larenstein lokaal B3.14 voor een groepsinterview over aardgasgebruik met een staartje van brainstormen over oplossingen met betrekking tot gedrag-> *eigen ideeën zijn tijdens deze sessie dus ook zeer welkom.* De link naar het aanmeldingsformulier met onder andere een beschrijving van de vragen en alvast het toestemmingsformulier is hier: <https://forms.office.com/r/xYnBSvAaYt>