

TNO report

TNO 2020 P11521

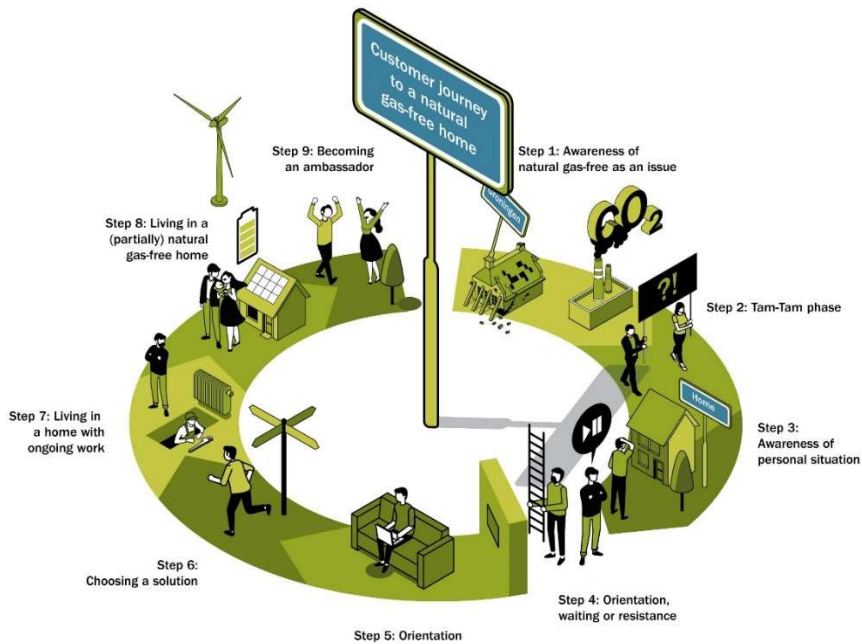
**Natural gas-free homes: drivers and barriers
for residents**

Energy Transition

Radarweg 60
1043 NT Amsterdam
The Netherlands

www.tno.nl

T +31 88 866 50 10



Date	28 January 2020
Author(s)	Nicole de Koning, Renee Kooger, Laurie Hermans and Casper Tigchelaar
Number of pages	80 (incl. appendices)
Number of appendices	1
Sponsor	PMC Cluster Successful neighbourhood approach
Project name	Natural gas-free homes: the resident decides
Project number	060.38255

All rights reserved.

No part of this publication may be reproduced and/or published by print, photoprint, microfilm or any other means without the previous written consent of TNO.

In case this report was drafted on instructions, the rights and obligations of contracting parties are subject to either the General Terms and Conditions for commissions to TNO, or the relevant agreement concluded between the contracting parties. Submitting the report for inspection to parties who have a direct interest is permitted.

© 2020 TNO

Energy Transition
Radarweg 60
1043 NT Amsterdam
The Netherlands

www.tno.nl

T +31 88 866 50 10

Preface

The report “*Natural gas-free homes: drivers and barriers for residents*” presents the study results of the typical journey towards natural gas-free homes, as citizens experience it in the Netherlands. This report has been recognized within the Netherlands as valuable resource for stakeholders that normally do not, or have difficulties to, reason from the perspective of citizens or residents with whom they work in different projects.

This report has been translated into English because of its impact and value of gaining insights into how citizens or residents experience the journey towards a natural gas-free home. In terms of barriers as well as drivers. In both the [POCITYF](https://pocityf.eu/) (https://pocityf.eu/) and [Making City](https://makingcity.eu/) (https://makingcity.eu/) projects TNO is building upon the results published in this report by formulating a **new unified citizen engagement strategy**. Such a unified citizen engagement strategy will enable the various stakeholders involved in the energy transition to better align their journeys and effectively collaborate towards the actualization of sustainable innovative solutions incorporated into energy neutral and positive energy neighbourhoods and districts.

Summary

Natural gas-free homes and the role of the resident

According to the government of the Netherlands, all Dutch homes must be natural gas-free by 2050. (Rijksoverheid, 2019). The aim, as set out in the coalition agreement, is to make 200,000 homes natural gas-free every year from 2021 onwards. (VVD, CDA, D66 en ChristenUnie, 2017). This calls for changes to the supply of renewable energy, infrastructure, the heating system in the home and the insulation of the home. In addition to these technical aspects, it also leads to social issues relating to cost distribution and freedom of choice. A successful neighbourhood approach requires these issues to be tackled in a well-coordinated way.

Because residents are key to a successful neighbourhood approach, the drivers, values and resistance factors which are important to them must be clear, as well as how these can be linked to the neighbourhood approach. In other words: how do you generate enthusiasm about switching from natural gas to another form of heating?

Residents go through different steps towards a natural gas-free home. We call this the customer journey to a natural gas-free home (Tigchelaar, et al., 2019). In this study, an analysis was made of the drivers and barriers that residents experience at the different steps of the customer journey to a natural gas-free home. Both energy and non-energy motives were examined. Energy drivers are related to energy. Examples include saving energy and reducing the use of fossil fuels. Non-energy drivers are not directly related to energy. Examples include increasing comfort in the home and saving costs.

In this study, the target group of owner-occupiers of private homes was chosen. Homeowner association members are not part of this target group. Unlike tenants (of housing associations and commercial landlords), homeowners can decide for themselves what measures they take in their homes.

We are also interested in the differences between residents in municipalities that are already active and municipalities that are less active in making neighbourhoods natural gas-free. For this reason, we have selected one neighbourhood that falls under the government's 'proeftuinen voor aardgasvrije wijken' ('testing ground for gas-free neighbourhoods') programme (Rijksoverheid, 2019) and one neighbourhood in which the move to natural gas-free housing has not yet actively begun. Besides this difference, we searched for neighbourhoods that correspond as closely as possible to important properties. To investigate the drivers and barriers of owner-occupiers, we conducted fieldwork in two comparable neighbourhoods in the Netherlands: Overwhere-Zuid in Purmerend and Wijk 03 Noord in Zwijndrecht.

Various methods have been used to gain insights into the drivers and barriers that residents experience in the transition to natural gas-free. Discussions were held with employees of the municipality and (street) interviews were conducted with residents. There were also two working sessions with a member of the Gasvrij Purmerend ('Gas-Free Purmerend') team to identify the Purmerend approach.

Customer journey to a natural gas-free home

The customer journey to a natural gas-free home consists of nine steps (see Figure 1).

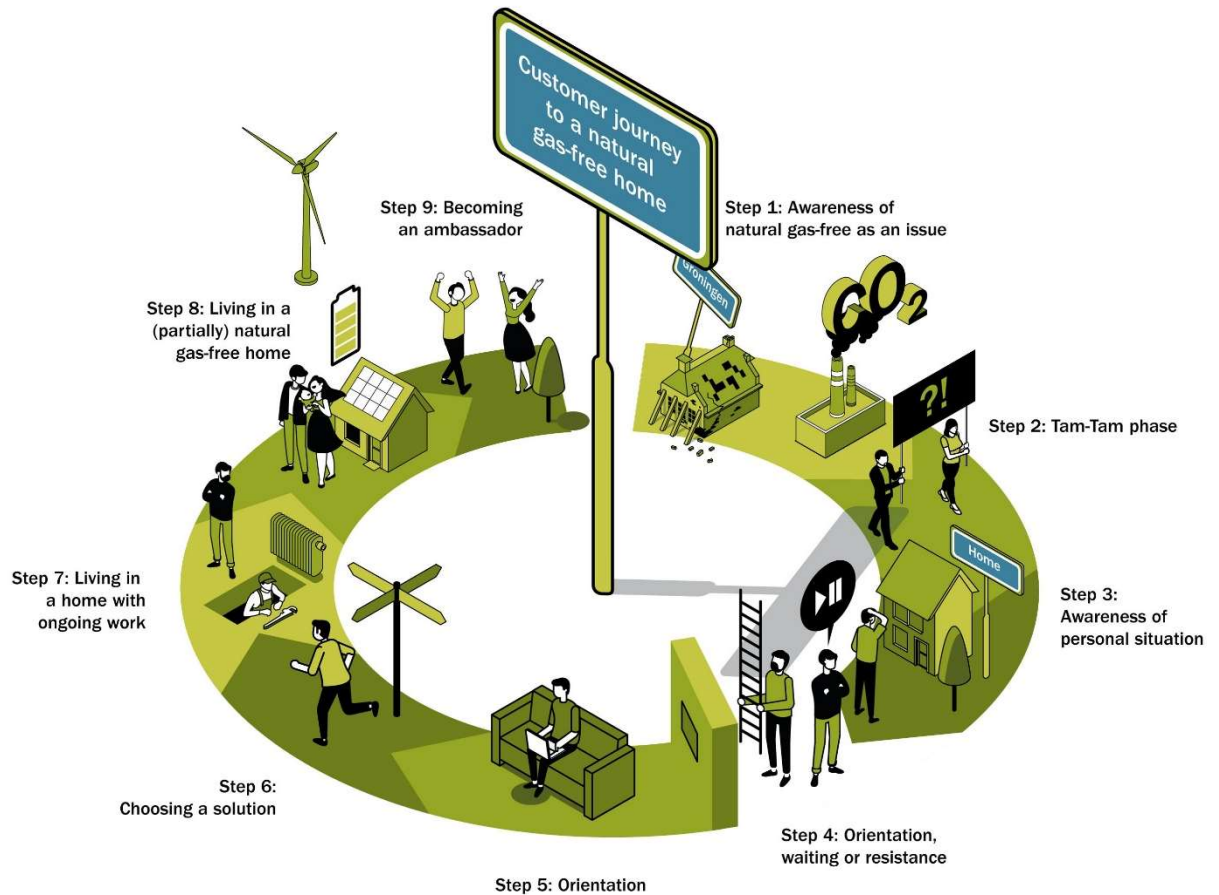


Figure 1: Customer journey to a natural gas-free home.

Residents can get stuck at each step if there is not enough of a reason to move on to the next one. This is most likely to happen from Step 4 onward, when real action is needed. The customer journey offers starting points to stimulate residents to go to the next step.

We have linked the drivers and barriers that play a role in the different steps of the customer journey to the CONsumer DEcisions Comprehended (CODEC) model. The CODEC model is a computational model developed by TNO. CODEC can calculate the adoption rate of a specific sustainable innovation. The model does this by identifying the factors that play a role in consumers' considerations on whether or not to embrace this sustainable innovation.

In this case, however, we are only using the theoretical framework of this model, which is composed of several psychological theories (Brunsting, S., et al., 2018). In a previous TNO study (Tigchelaar, et al., 2019), the three components of the CODEC model were elaborated to cover the process of making a home natural gas-free (see Figure 2).

CODEC model: CONsumer DEcision Comprehended

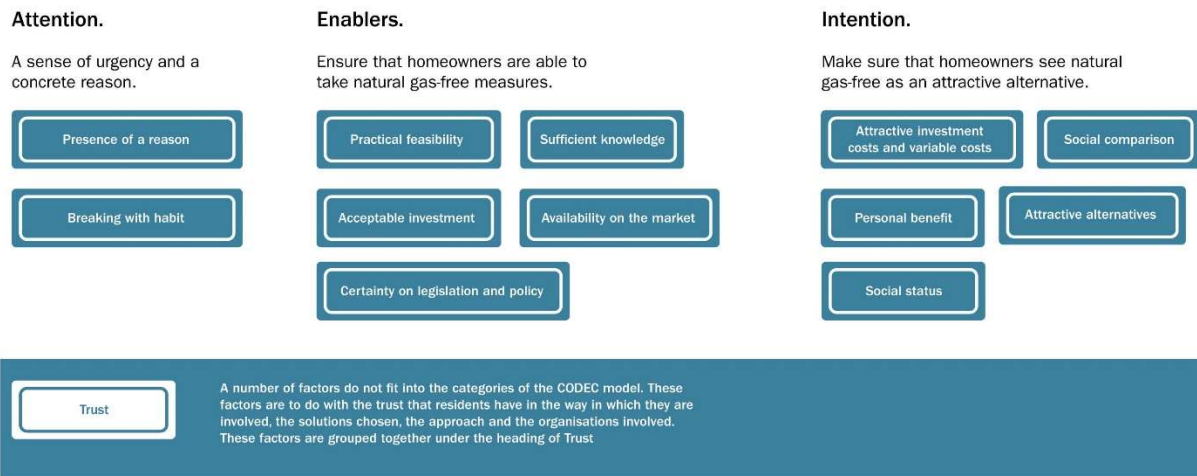


Figure 2: The different factors which are important to natural gas-free homes (based on the CODEC model).

The demand from homeowners for natural gas-free concepts is determined by three main elements of behaviour which form the basis for the CODEC model (Brunsting, S., et al., 2018):

- **Attention:** this component focuses on whether residents are considering natural gas-free alternatives at all. A reason is needed to make a new purchase. When that time comes, it is important that people start considering natural gas-free alternatives rather than buying the same as they're used to (e.g. buying a new gas-fired boiler).
- **Enablers:** even if people are open to natural gas-free alternatives, they must be practically capable of taking these measures. It's all about what people need as a basis to be able to achieve a natural gas-free home. This is independent of people's preferences, which are dealt with under 'Intention'.
- **Intention:** homeowners should see natural gas-free homes as an attractive alternative. This has partly to do with costs and benefits, but status, social comparison and non-financial benefits (such as comfort) can also play a role.

This report contains a description of the drivers and barriers at the different steps of the customer journey towards natural gas-free homes.

Conclusions

Based on the analysis of the drivers and barriers in the neighbourhoods in Purmerend and Zwijndrecht, we have drawn the following conclusions.

Drivers and barriers at the different steps of the customer journey

Making a neighbourhood natural gas-free is a process in which residents go through different steps individually. This process begins with 'Becoming aware of natural gas-free as an issue' (Step 1) and ends with 'Becoming an ambassador' (Step 9). Residents find themselves at different steps of the customer journey. They can get stuck at each step if there is not enough of a reason to move on to the next one. The distribution of drivers and barriers across the different steps of the customer journey provides starting points on the type of information and support that residents need.

Attention to the earthquakes in Groningen, the decision to discontinue gas production in Groningen and climate change have all contributed to residents becoming aware of the natural gas-free issue. Residents in this study consider it necessary to make the neighbourhood natural gas-free. This can be a driver if this 'must' stems from a felt responsibility for the environment and sympathy with residents in Groningen. It can also be a barrier if it is felt by residents to be an obligation imposed by the government while they themselves are not convinced of the necessity. For example, residents may regard natural gas as a clean fuel, comment on alternatives to natural gas-free or wonder why the Netherlands (as a small country) should take steps while Germany, for instance, is opting for natural gas. There is still a lack of clarity for residents on the chosen solution direction. This ambiguity plays a role in Step 1 'Becoming aware of natural gas-free as an issue' and Step 2 'Tam-tam phase'. Residents have all kinds of ideas and opinions on natural gas and the chosen solutions. From the interviews, it emerges that it is mostly negative images that circulate in these steps.

A pilot was started in Purmerend a number of years ago and a 'Natural Gas-Free Neighbourhoods' testing ground is now taking place in Purmerend. In Zwijndrecht, fewer initiatives have taken place in this area. The residents in Purmerend and Zwijndrecht are at different stages of the customer journey. In the first step in particular, a number of the same drivers and barriers emerge.

In Purmerend, an intensive process has been started to involve residents. This may explain why residents in Purmerend have slightly more ideas about the consequences for their personal situation and are orientating themselves towards the options while this is less the case in Zwijndrecht.

Possibilities to improve the neighbourhood or the home through the transition to natural gas-free are hardly mentioned by residents. In Zwijndrecht, the possibility of improving the neighbourhood is occasionally mentioned. This hardly ever happens in Purmerend. In general, the decision on whether or not to switch to a natural gas-free home is a decision made by the residents based on their personal situation and their home.

Behaviour comes about through Attention, Enablers and Intention. The CODEC model helps to identify which categories the drivers and barriers are related to. Through this, it becomes clear which drivers need to be addressed and which barriers need to be removed so that residents will pay attention to natural gas-free homes, are able to make their homes natural gas-free and are willing to do so. In this way, a neighbourhood approach to natural gas-free homes can ensure that Attention, Enablers and Intention all receive sufficient attention.

The role of information and trust

Interviews in the neighbourhoods studied show that trust plays an important role in the opinions and choices of residents. In the 'Tam-tam phase', a lack of trust is an important barrier for residents to participate in the neighbourhood approach. This can be a concrete lack of trust in the heat supplier or the approach chosen by the municipality, but also more general such as 'feeling fooled'.

Although the sample is too small to draw definitive conclusions, it seems that a more intensive, personal approach in the next steps of the customer journey leads to more trust. In contrast to Zwijndrecht, trust is also mentioned as a driver for participation in the neighbourhood approach in Purmerend. For example, interviewees mention 'honest communication', 'personal approach' and 'trust in the Aardgasvrij ('Natural Gas-Free') team' as positive aspects of the neighbourhood approach. This applies to residents who are already further along in the customer journey and who have had conversations with the team about their personal situation. In the street interviews in Purmerend and Zwijndrecht, where interviewees were probably less informed, trust is not mentioned as a positive point.

Costs and hassles

Alongside other studies, such as those of the Netherlands Institute for Social Research (Steenbekkers & Scholte, september 2019), this research shows that costs play an important role for residents. Costs come up in all kinds of forms in the answers given by residents: as a barrier because people are worried about costs and are uncertain about them or because they think that costs will never be recouped. But costs (and benefits) can also be a driver. In Purmerend, (part of) the costs will be reimbursed in the pilot neighbourhood. For residents in that neighbourhood, there is a 'now or never' feeling. Not participating in the pilot now probably means that the costs will not be reimbursed later on. Residents also cite an increase in the value of the home and savings on energy bills as important drivers for becoming natural gas-free.

For residents who have not yet received a concrete offer, the uncertainty regarding the costs also leads to concerns. Is it not going to cost much and can I pay for it? Will I ever recoup the investment?

In addition to costs, the organisation and all of the hassles involved are important concerns for residents. The mess – "all those people passing through" - is something that scares people away.

Secondary issues are often the main issues

During the discussions with residents, various subjects that receive little attention in government texts, such as the Climate Agreement, came to the fore. However, these 'secondary issues' are often 'main issues' for residents. One resident liked to go to residents evenings because it was fun. Another resident is just too busy with other things to put time and effort into making the home natural gas-free. Yet another is reluctant because she feels that she's out on her own after the death of her husband. All of these are not subjects for which policy instruments have been devised. It is also very difficult to set up a policy for this because these aspects are very specific to each resident.

It is also often not (only) about the content of the offer but also about the way in which it is presented. While most residents like to receive a concrete offer, there are also those who have already studied their options themselves. One resident did not feel that he was taken seriously when his own technical input was not heard by the neighbourhood team.

Recommendations

Based on the above conclusions, we make the following recommendations.

Develop a neighbourhood approach that responds to the different steps of the customer journey towards natural gas-free homes.

Residents find themselves at different steps of the customer journey. The barriers and drivers that residents experience are also different at each step of the customer journey. By addressing this, residents can be assisted throughout the customer journey.

Ensure that residents pay attention to natural gas-free, have the opportunity to live natural gas-free and want to live natural gas-free.

How homeowners make choices about making their homes natural gas-free depends on many factors. To visualise these factors, we have used the COConsumer DEcisions Comprehended (CODEC) model as a framework. We linked the drivers and barriers that emerged from the research to this model. In order for residents to move towards natural gas-free, a neighbourhood approach is needed that ensures that residents pay attention to natural gas-free, have the opportunity to live natural gas-free and want to live natural gas-free.

Based on the answers in this study, there should be a consideration of extending the CODEC model to include trust as an element in the analysis of consumer decisions.

Trust is not part of the CODEC model used in this study to analyse decision-making behaviour. Further research is needed to determine whether and how trust can be placed in the CODEC model.

Clarify the costs (and benefits) of natural gas-free and what it will mean for residents as soon as possible.

Uncertainty regarding costs leads to resistance. It is not yet possible to determine what the costs will be for every home in the Netherlands. However, agreements can be made in principle about the extent to which residents will have to incur costs themselves. The precondition that it must be possible to carry out natural gas-free in a 'costs of living-neutral' manner (Government, 2019) must be put in concrete terms. Does this mean that no household will be disadvantaged or does this principle apply to the average resident? Which subsidy measures and other financial arrangements will be put in place and under what conditions?

Support the development of relief products to reduce 'hassle'.

Various market parties are developing one-stop-shops and other relief concepts. This is important because such products can reduce an important barrier. Government support should therefore not only focus on information and cost limitation but also on practical support.

Take individual wishes and objections into account in neighbourhood approaches.

What often seems to be a secondary issue for municipalities and market parties may turn out to be a key issue for residents. If this is not taken into account, it can lead to resistance.

Contents

	Summary	4
1	Introduction.....	12
1.1	Natural gas-free homes and the role of the resident	12
1.2	Scope of this investigation	12
1.3	Method	13
1.4	Reading guide.....	17
2	Customer journey to a natural gas-free home.....	18
2.1	Steps on the customer journey to a natural gas-free home	18
2.2	Factors that play a role during the customer journey	21
3	Results from Purmerend.....	25
3.1	Natural gas-free Purmerend Overwhere: a pilot and a testing ground.....	25
3.2	The Purmerend approach.....	26
3.3	Results: drivers	33
3.4	Results: barriers.....	37
4	Results from Zwijndrecht	44
4.1	Perception of Zwijndrecht-Noord by residents	44
4.2	Wishes for the neighbourhood.....	45
4.3	Results: drivers	46
4.4	Results: barriers.....	48
4.5	Approach	52
5	Analysis	54
5.1	The entire customer journey: attention, enablers and intention	54
5.2	The first steps of the customer journey (Step 1 to Step 3).....	56
5.3	Underway on the customer journey (Step 4 to Step 6)	58
5.4	The final steps of the customer journey (Step 7 to Step 9)	59
5.5	Analysis of the Purmerend approach per step of the customer journey	60
6	Conclusions and recommendations.....	66
6.1	Conclusions	66
6.2	Recommendations.....	68
	References.....	70

Appendices

A The Purmerend approach

1 Introduction

1.1 Natural gas-free homes and the role of the resident

According to the government of the Netherlands, all Dutch homes must be natural gas-free by 2050. (Rijksoverheid, 2019). The aim, as set out in the coalition agreement, is to make 200,000 homes natural gas-free every year from 2021 onwards. (VVD, CDA, D66 en ChristenUnie, 2017). This calls for changes to the supply of renewable energy, infrastructure, the heating system in the home and the insulation of the home. In addition to these technical aspects, it also leads to social issues relating to cost distribution and freedom of choice. A successful neighbourhood approach requires these issues to be tackled in a well-coordinated way.

Because residents are key to a successful neighbourhood approach, the drivers, values and resistance factors which are important to them must be clear, as well as how these can be linked to the neighbourhood approach. In other words: how do you make them enthusiastic about switching from natural gas to another form of heating?

Residents differ in terms of the extent to which they are dealing with climate change and, more specifically, the transition to a natural gas-free home. Two-thirds of Dutch people are concerned about the climate (Kanne, Hofweegen, Kooiman, & Engeland, 2019).

Some residents know that the transition to natural gas-free homes is imminent but are not directly affected yet. Other residents are already exploring what the transition will mean for their own home. They are doing this on their own or are living in one of the 27 testing grounds for natural gas-free neighbourhoods (Rijksoverheid, 2019) and thus see concrete plans for new heating solutions. Over the past five years, more than four in ten Dutch people have done something themselves to make their homes more energy efficient. (Kanne, Hofweegen, Kooiman, & Engeland, 2019).

In short, residents go through several steps towards a natural gas-free home. We call this the customer journey to a natural gas-free home (Tigchelaar, et al., 2019). The customer journey is further explained in Chapter 2.

1.2 Scope of this investigation

In this study, an analysis was made of the drivers and barriers that residents experience at the different steps of the customer journey to a natural gas-free home. Both energy and non-energy motives were examined. Energy drivers are related to energy. Examples include saving energy and reducing the use of fossil fuels. Non-energy drivers are not directly related to energy. Examples include increasing comfort in the home and saving costs.

In this study, the target group of owner-occupiers of private homes was chosen. Homeowner association members are not part of this target group. Unlike tenants

(of housing associations and commercial landlords), homeowners can decide for themselves what measures they take in their homes.

1.3 Method

1.3.1 *Neighbourhood selection*

To investigate the drivers and barriers for owner-occupiers, we conducted fieldwork (including interviews) in two comparable neighbourhoods in the Netherlands. We are also interested in the difference between residents in municipalities that are already active and municipalities that are less active in making neighbourhoods natural gas-free. This is why we have selected one neighbourhood that falls under the government's 'testing grounds for gas-free neighbourhoods' programme (Government, 2019) and one neighbourhood in which a transition to natural gas-free homes has not yet actively begun. Besides this difference, we searched for neighbourhoods that correspond as closely as possible to important properties. We looked at the following selection criteria:

- **Districts must have a high percentage of owner-occupied homes**
The study focuses on owner-occupiers because they, more so than tenants, have to deal themselves with the demands placed on their homes.
- **High percentage of single-family homes**
In the case of multi-family homes, homeowner associations (VvEs) play an important role in making homes more sustainable. They form an intermediary between municipalities and owner-occupiers. As we are particularly interested in owner-occupiers who are directly affected by making their homes natural gas-free, we wanted to investigate a neighbourhood with a high percentage of single-family homes.
- **Medium income**
In neighbourhoods with many low-income households, other barriers and specific problems regarding the affordability of the processes play an important role. In the case of relatively high incomes, more expensive solutions will fall more within the interviewees' reaches. In the selection, we looked for a neighbourhood with medium incomes; not extremely high or low.
- **Mainly homes built before 2000**
In most existing homes, measures still need to be taken to make the home natural gas-free. Relatively new homes are much better insulated. In these homes, the interventions are much more limited. This is why we searched for neighbourhoods with homes built before 2000.

Selection of Purmerend from the testing grounds for Natural Gas-Free Neighbourhoods

The aim of the government's Natural Gas-Free Neighbourhoods Programme ('Programma Aardgasvrije Wijken') is to learn how to design and scale up a neighbourhood-oriented approach for getting homes off of natural gas. An established knowledge and learning programme (KLP) is part of the approach (Natural Gas-Free Neighbourhoods Programme, 2019). In 2018, 27 neighbourhoods were designated as testing grounds. These neighbourhoods can be regarded as pioneers in the transition to natural gas-free neighbourhoods. In selecting the neighbourhoods, the government has tried to put together a diverse range so that different kinds of lessons can be learned. (Government, 2019).

A relatively large number of housing associations are present in the 27 test neighbourhoods. There are only three neighbourhoods with more than 40% owner-occupied homes (see Table 1). One neighbourhood in Katwijk consists mainly of multi-family houses and therefore fell by the wayside. One neighbourhood in Wageningen is relatively new, with 23% of homes built after 2000. Of all the testing grounds, the Purmerend Overwhere-Zuid neighbourhood meets the selection criteria best.

Table 1 Properties of test neighbourhoods with more than 38% owner-occupied homes (CBS, 2017)

Municipality	Neighbourhood	Share of owner-occupied homes [%]	Share of single-family homes [%]	Average income per income recipient [x1000 euro]	Share of construction year before 2000 [%]
Wageningen	Benedenbuurt	44	79	?	77
Purmerend	Overwhere-Zuid	49	50	26.5	99
Katwijk	Hoornes-West	42	7	20.4	94

Selection of Zwijndrecht as a comparable neighbourhood

Following the selection of Overwhere-Zuid in Purmerend, we selected a similar neighbourhood that resembles Purmerend Overwhere-Zuid in terms of properties but which is at a less advanced stage in making the homes natural gas-free.

Using the key figures on neighbourhoods of Statistics Netherlands (CBS) (CBS, 2017), we compared the characteristics of all neighbourhoods in the Netherlands with Purmerend Overwhere-Zuid. Again, we looked in particular at the selection criteria mentioned earlier. Table 2 lists the five neighbourhoods which are close to Purmerend Overwhere-Zuid on the basis of the selection criteria.

Table 2 Five non-test neighbourhoods with similar characteristics to Purmerend Overwhere-Zuid (CBS, 2017)

Municipality	Neighbourhood	Share of owner-homes [%]	Share of single-family homes [%]	Share of construction year before 2000 [%]	Average income per income recipient [x1000 euro]
Purmerend	Overwhere-Zuid	49.0	50.0	99.0	26.5
Nijmegen	Heseveld	47.0	54.0	96.0	27.0
Ridderkerk	Oost	49.0	48.0	89.0	28.5
Vlissingen	Scheldestraat e.o.	47.0	51.0	98.0	NB
Weert	Wijk 21 Keent	49.0	54.0	89.0	26.2
Zwijndrecht	Wijk 03 Noord	53.0	52.0	90.0	28.1

The differences within the five neighbourhoods are limited. For practical reasons, Wijk 03 Noord in Zwijndrecht has been chosen.

Table3 shows the most important characteristics of Purmerend Overwhere-Zuid and Zwijndrecht Wijk 03-Noord. The shaded cells are the selection criteria.

Table3 Population, housing, energy and income characteristics of Overwhere-Zuid and Wijk 03 Noord (CBS, 2017)

Category	Characteristic	Purmerend Overwhere-Zuid	Zwijndrecht Wijk 03 Noord
Population	Number of inhabitants	6210	6490
	Men	3005	3280
	Women	3205	3210
	0 to 15 years	1000	1195
	15 to 25 years	655	805
	25 to 45 years	1680	1965
	45 to 65 years	1565	1535
	65 years or older	1325	1000
	Total Western	600	470
	Total non-Western	1140	1740
	Total households	3100	2915
	Single-person households	1335	1045
	Households without children	775	820
	Households with children	1000	1055
Average household size	2.0	2.2	
Housing	Housing stock	3192	3038
	Average home value	150,000	143,000
	Percentage of single-family homes	50%	52%
	Percentage of multi-family homes	50%	48%
	Percentage inhabited	96%	93%
	Percentage uninhabited	4%	7%
	Owner-occupied homes	49%	53%
	Total rented homes	51%	47%
	In possession of a housing association	44%	40%
	In possession of other landlords	8%	7%
	Built before 2000	99%	90%
Built from 2000 onwards	1%	10%	
Energy	Total average electricity consumption	2270 kWh	2460 kWh
	Rented home	1910 kWh	1950 kWh
	Owner-occupied home	2640 kWh	2900 kWh
	Total average natural gas consumption	900 m ³ *)	1170 m ³
	Rented home	480 m ³ *)	1000 m ³
	Owner-occupied home	1320 m ³	1330 m ³
	Percentage of homes with district heating	34.5%	.
Income	Average income per income recipient	€ 26,500	€ 28,100
	Average income per inhabitant	€ 21,600	€ 21,600
	40% persons with the lowest income	€ 40,300	€ 42,500
	20% persons with the highest income	€ 11,100	€ 15,500
	40% households with lowest income	€ 48,800	€ 43,200
	20% households with highest income	€ 9,200	€ 13,500
	Low-income households	€ 9,500	€ 10,600
	Household under or around the social minimum	€ 8,500	€ 9,200

*) The average gas consumption per home in Purmerend is lower than in Zwijndrecht. This is because 34.5% of the homes in Purmerend are connected to district heating. These homes do not have any gas consumption, which depresses the average.

1.3.2 *Approach in Purmerend*

Various methods were used to gain insights into the drivers and barriers that residents experience in the transition to natural gas-free.

Conversations with the Aardgasvrij Purmerend team

In order to gain insights into the approach applied in the pilot and testing ground in Purmerend, a number of interviews were conducted.

Talks were held with Jaspert Verplanke (Energy Transition programme manager, Aardgasvrij Purmerend team), Joke Dijkstra (communication advisor, Aardgasvrij Purmerend team) and Paul van Meekeren (alderman for sustainability and the energy transition) (1 May 2019). There were also two working sessions with Joke Dijkstra to identify the Purmerend approach (12 and 24 July).

The draft results were discussed with Jaspert Verplanke and Joke Dijkstra (26 November 2019).

Street interviews with Babelboom¹

The Babelboom ('Chatter Tree') is a tree (a pole with leaves attached) which residents can talk to. Attached to the pole is a sign saying "I'm curious about you. Have you warmed up to NATURAL GAS-FREE?" Next to the tree is an employee who asks residents to have a conversation with the Babelboom. Stood at a distance, not visible to the participant, there is a second employee who is conducting the conversation. The Babelboom has been used to enable residents to speak easily and anonymously about the drivers and barriers they experience in the transition to natural gas-free. Each resident was able to speak to the Babelboom. During the conversation, it sometimes turned out that the resident was a tenant and not an owner. If a driver or barrier only applied to tenants and not to owners, it was not included in this report. The Babelboom was placed in Wormerplein shopping centre (12 July and 13 July). A total of 39 people were spoken to. The total duration of the street interviews was 4.5 hours.

Interviews with residents

One researcher conducted interviews with five residents (three men and two women, including one couple). Of these five residents, three took part in the pilot and two in the testing ground. The interviews lasted about 2 to 2.5 hours and took place at the residents' homes. An employee of the Aardgasvrij Purmerend team planned the interviews. This employee was also present during the first pilot interview. During the interviews relating to the testing ground, the researcher joined home visits by employees of the Aardgasvrij Purmerend team. She asked the interview questions during the last part of the home visit.

¹ The Babelboom was developed by students of Utrecht University of the Arts. The Babelboom is based on the Biechtboom, part of the 'Anders Kijken' ('Looking Differently') project by Achmea. See <http://anderskijken.achmea.nl>

1.3.3 *Approach in Zwijndrecht*

Conversations with employees of the municipality

The following conversations have taken place:

- Arnold van Die: project leader of the 'Samen de buurt verbeteren' ('Improving the neighbourhood together') neighbourhood approach, Zwijndrecht-Noord Area Employee (telephone interview)
- Jacqueline van Dongen: Alderman for Public Spaces, Nature and Recreation, Housing Policy, Public Housing, Sustainability and Environment, Energy, Animal Welfare, Member of the council of Drechtsteden (interview on location in the municipality of Zwijndrecht)
- Janneke Petter: Energy and Environment Policy Officer, Spatial Development Department (interview on location in the municipality of Zwijndrecht)

The draft results have been discussed with/submitted to Dominique Kornel and Janneke Petter (26 November 2019).

Street interviews with Babelboom

The Babelboom was placed in the Zwijndrecht-Noord shopping centre (5 and 6 July) and was spoken to by 40 people. The total duration of the street interviews was almost four hours. These interviews were completely anonymous. It was therefore not always clear whether the interviewees lived in an owner-occupied home or rented home.

Interviews with residents

One researcher conducted interviews with seven homeowners (three men and four women). These homeowners were recruited in different ways: through their own network, through a recruitment agency and through a call from the municipality on Facebook.

Observations

Observations of the neighbourhood and community life were made at different times in Zwijndrecht-Noord: a visit around the neighbourhood, at places with resident interaction (shopping centre) and in a volunteer-run shop and a community centre.

1.4 **Reading guide**

Chapter 2 describes the steps which a resident takes towards a natural gas-free home and the various factors that play a role during these steps. Chapter 3 provides an overview of the drivers and barriers that emerged in talks with residents from Purmerend. It also discusses the approach applied by the Aardgasvrij Purmerend team in the pilot and testing ground in Purmerend. Chapter 4 provides an overview of the drivers and barriers that emerged in discussions with residents from Zwijndrecht. This chapter also contains a description of the perception of the neighbourhood by residents and wishes for the neighbourhood.

Chapter 5 contains the analysis of the results. Chapter 6 contains the conclusions and recommendations.

2 Customer journey to a natural gas-free home

This chapter gives a description of the steps which a resident takes towards a natural gas-free home (see Section 2.1). Section 2.2 describes the factors that play a role during the customer journey.

2.1 Steps on the customer journey to a natural gas-free home

Residents go through different steps on the way to a natural gas-free home. We call this the customer journey. The customer journey consists of the following steps (Figure 3):

1. Becoming aware of natural gas-free as an issue
2. Tam-tam phase
3. Awareness of personal situation
4. Choice of orientation, waiting or active resistance
5. Orientation
6. Choosing a solution
7. Living in a home with ongoing work
8. Living in a (partially) natural gas-free home
9. Becoming an ambassador

The steps of the customer journey are explained below (Tigchelaar, et al., 2019).

Residents can get stuck at each step if there is not enough of a reason to move on to the next one. This is most likely to happen from Step 4 onward, when real action is needed. The customer journey offers starting points to stimulate residents to go to the next step.

Customer journey to a natural gas-free home

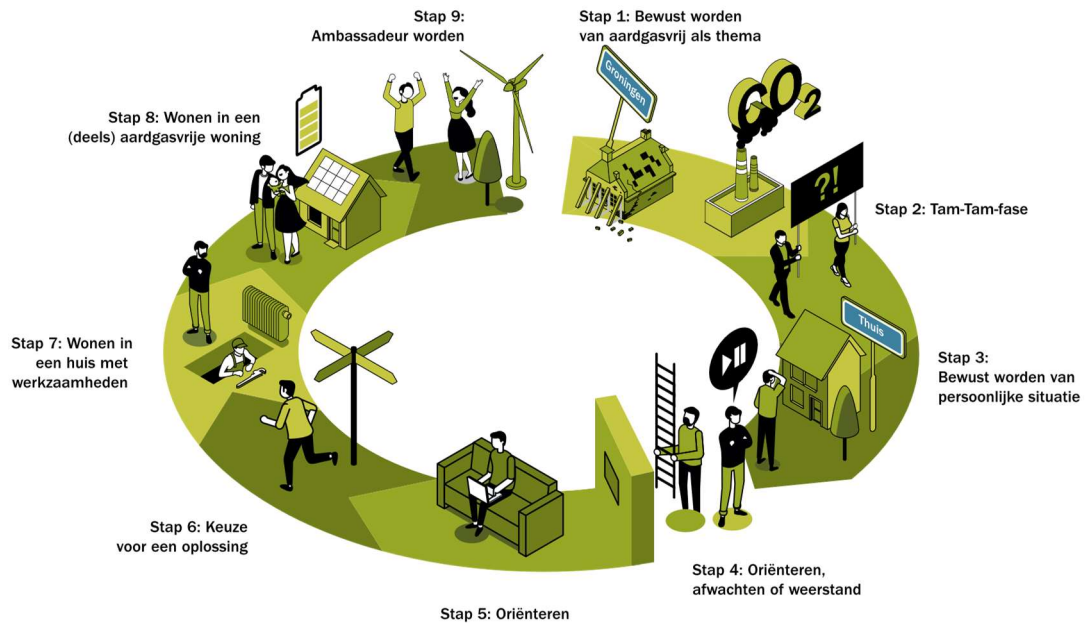


Figure 3: Customer journey to a natural gas-free home

Step 1: Becoming aware of natural gas-free as an issue

Before people actually take action, there will be a period in which they become acquainted with the concept of a natural gas-free home. Through various media, people become aware of what a natural gas-free home means (or an alternative concept, depending on the framing). People will move on to the next step if they indeed become aware of natural gas-free homes and see this as something relevant to them.

Step 2: Tam-tam phase

Between the moment that people become aware of the concept of natural gas-free homes and the moment that there is information about everyone's personal situations (see next phase), there will be a shorter or longer period of time. During this period, people form their opinions on the basis of the information available to them. This is called the 'Tam-tam phase' because these opinions may be based on incorrect or incomplete information that people have heard through the 'tam-tam': their social network, social media and/or regular media. People will go to the next step when they become convinced of the necessity for themselves.

Step 3: Awareness of personal situation

At some point, the options for natural gas-free homes will be known for each municipality and neighbourhood. For example, is there a heat network available in the neighbourhood? At that point, it will become clearer to people what natural gas-free homes will mean for their personal situation. At this stage, residents should be given a rough idea of what a natural gas-free home will look like for them. The search for more detailed information will only come in the next phase. People will move on to the next phase when they feel that they can assess whether the alternatives are urgently needed, feasible and attractive enough or not.

Step 4: Choice of orientation, waiting or active resistance

When the personal situation is known, people will consciously or unconsciously make the choice to orientate themselves towards solutions for their home, to wait (do nothing) or to actively resist natural gas-free. In the latter case, for example, people will set up an action group. The most desirable thing is for people to orientate themselves and find out which option would be suitable for them. People will move on to the next phase if they feel that the alternatives are urgent, feasible and attractive enough for them to take action.

Step 5: Orientation

People who have chosen to orientate themselves will obtain information through channels that are logical for them. They will move on to the next phase if they feel that they are sufficiently informed or that there is a suitable decision aid to base their choice on.

Step 6: Choosing a solution

People choose the solution that they find most attractive. To enter this phase, people need to feel that they are either sufficiently informed or that they have found a good heuristic (what is the neighbour doing? how will the municipality advise me?). In addition, a reason is needed for people to actually make a purchase. A reason could be, for example, that they are called by a provider or advisor.

Step 7: Living in a home with ongoing work

People live in a home while the work takes place. This can be a nuisance.

Step 8: Living in a (partially) natural gas-free home

In this phase, the work has been (provisionally) completed and people are living in a natural gas-free home. If a solution has been chosen whereby the house has not been converted into a completely natural gas-free home all at once, this will be a partially natural gas-free home. In this phase, people experience natural gas-free living.

Step 9: Becoming an ambassador

In this phase, people speak out about how the process went and share very positive or very negative experiences in particular. This is important information for these people's social network of those who have not yet completed the entire customer journey.

2.2 Factors that play a role during the customer journey

2.2.1 The COConsumer DEcisions Comprehended (CODEC) model

The CODEC (COConsumer DEcisions Comprehended) model is a computational model developed by TNO. (Brunsting, S., et al., 2018). CODEC can calculate the adoption rate of a specific sustainable innovation. The model does this by identifying the factors that play a role in consumers' considerations of whether or not to embrace this sustainable innovation. This model can be used, for example, to predict the purchasing behaviour of electric cars or solar panels but can also provide insights into the transition to a natural gas-free built environment. In this case, however, we only use the theoretical framework of this model, which is built up on various psychological theories (Brunsting, S., et al., 2018).

The CODEC model consists of three phases with a total of 14 questions (factors). By going through these phases and answering the questions, a picture is created of the adoption rate of a certain innovation. The figure below shows the phases and questions of the original CODEC model.

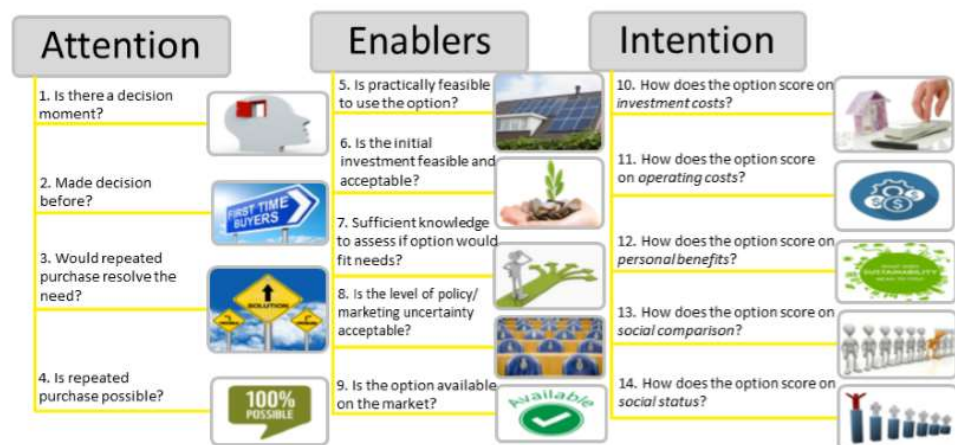


Figure 4: CODEC model: three phases ('Attention', 'Enablers' and 'Intention') and 14 factors

The questions in the 'attention' category are intended to assess how many people will make a well-considered decision in favour of a new innovation. The questions include whether someone is ready to replace their boiler or car, for example, and whether this is a routine decision (choosing the same thing without thinking) or a conscious decision for one or the other. The total number of people who are able to make a conscious choice go through the next phase.

The questions in the 'enablers' category are intended to get a picture of the number of people who have the opportunity to make a choice for sustainable innovation. These questions concern, for example, whether people can pay for the innovation and have enough knowledge about it. The total number of people who are able to make a conscious choice and who are able to make this choice go on to the final phase.

The questions in the 'intention' category are about how many people actually want to purchase the innovation. The questions in this phase are about someone's

personal preferences, for example, but also about how much it would cost to use the innovation in everyday life and how people weigh considerations on these different factors. The number of people who also 'successfully' go through this phase gives a picture of the degree of adoption of the innovation: how many people are going to buy an electric car (for example).

2.2.2 The CODEC model and natural gas-free homes

In a previous TNO study (Tigchelaar, et al., 2019), the three components of the CODEC model were elaborated in regard to making a home natural gas-free. The original model focuses more on concrete products such as cars and solar panels. The questions per phase have therefore been grouped and reformulated so that they can be used to assess whether or not people will decide to move to a natural gas-free home (Figure 5).

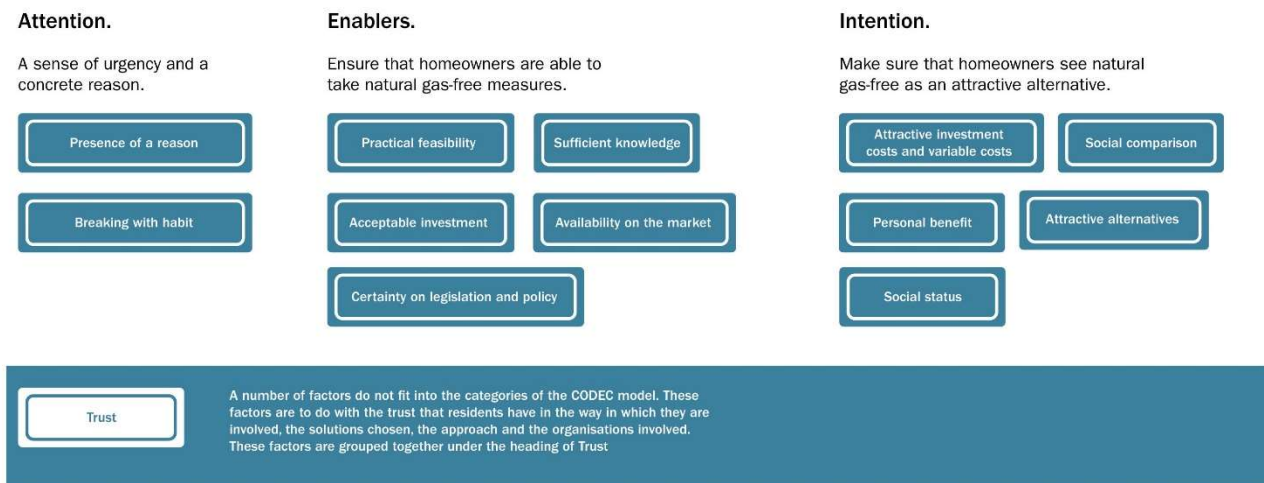


Figure 5: The different factors of importance for natural gas-free homes (based on the CODEC model).

In the current report, we build on the insights from the previous study (Tigchelaar, et al., 2019) with field research in the municipalities of Purmerend and Zwijndrecht. As previously discussed, the results of the interviews and the Babelboom provide insights into which drivers and barriers play a role in which steps of the customer journey.

By also linking these results to the CODEC model, a picture is created of which phase(s) and factor(s) play an important role in the decision whether or not to switch to a natural gas-free home. The CODEC model contains the following factors:

Attention: a sense of urgency and a concrete reason

This section focuses on whether residents are considering natural gas-free alternatives at all. A reason is needed to make a new purchase. When that time comes, it is important that people start considering natural gas-free alternatives, rather than buying the same as they are used to (e.g. buying a new gas-fired boiler).

The following factors play a role in the Attention category:

- The presence of a reason: currently, there are few natural moments at which people will consider a natural gas-free alternative, unless they are intrinsically motivated to do so or if there is a particular reason. Examples include a broken boiler, renovations or a progressive neighbour. Only a small percentage of people experience such a reason.
- Breaking with habit: if residents have to make a choice, there is a good chance that habitual behaviour will occur if residents have already made this choice before. For example, if the high-efficiency boiler breaks down (moment of choice) and the resident has previously bought a new one to their satisfaction, they will probably buy another high-efficiency boiler.

Enablers: ensure that homeowners are able to take natural gas-free measures.

Even if people are open to natural gas-free alternatives, they must be practically capable of taking these measures. This section therefore discusses people's basic needs in order to be able to realise a natural gas-free home. This is independent of people's preferences, which are dealt with under 'Intention'.

- Practical feasibility: to make a home natural gas-free, there are three possibilities: a gas network with green gas, an all-electric solution or a connection to a heat network.
- Acceptable investment: a natural gas-free renovation must be affordable. What is affordable for people can differ per resident and the type of home they live in and also depends on the type of natural gas-free alternative which is implemented. Residents often do not have enough money to invest in a natural gas-free home, are reluctant to borrow or are not creditworthy.
- Sufficient knowledge: homeowners need clarity on the transition to natural gas-free. What are the alternatives? When will the home be disconnected from the gas? What does this mean for the energy bill and comfort? As long as this is unclear, the action perspective for consumers will be limited to trying to pre-empt the ambitions of natural gas-free.
- Certainty on legislation and policy: homeowners need certainty on legislation and policy in order to be able to take sustainable measures. Uncertainty about the possibilities and rules surrounding heat pumps, for example, can put the brakes on implementation.
- Availability on the market: more than 1,000 homes per workday will have to be tackled if we want all homes to be gas-free by 2050. This will require not only affordable and well-functioning alternatives but also sufficiently trained personnel to install these measures.

Intention: ensure that homeowners see natural gas-free as an attractive alternative

In the previous phases, it was all about whether people are going to make a choice (Attention) and whether they can do so (Enablers). In the Intention phase, it's about homeowners seeing natural gas-free homes as an attractive alternative so that they want to purchase products and services.

- **Attractive investment costs and variable costs:** homeowners still face relatively high investment costs when it comes to realising a natural gas-free home. Although in many cases the energy bill will go down following the installation of the necessary measures, the large initial investment costs are a major obstacle for many owner-occupiers. One mechanism that plays a role in determining whether costs are acceptable is 'mental accounting' (Thaler, 2008): the way people think about their financial spending in terms of different 'pots'.
- **Personal benefit:** even though more and more people think sustainability is important, this does not often lead to real, concrete steps. Residents have other priorities. They are busy with issues such as family, work and health. However, people do take action for initiatives that contribute to what occupies them in their daily lives (intrinsic motivation) and their values.
- **Attractive natural gas-free alternatives without 'hassle':** adjustments differ per home (customisation). Measures are therefore not always easy or quick to select. All of the research and regulations can create a barrier and cause people to drop out. There is also the stress of finding a good company that will do the work for a reasonable price. People can also withdraw due to the hassle surrounding a renovation. (Vries, Kooger, & Hermans, 2019).
- **Social comparison:** the consideration of natural gas-free measures can also be influenced by the (immediate) environment of the resident. The more people that purchase products and services related to natural gas-free homes, the greater the chance that others will do the same - especially when it comes to people who are similar to them. It is important that purchasing behaviour is visible. This is the case with solar panels, for example, but not with cavity wall insulation.
- **Social status:** certain residents will be motivated to purchase natural gas-free products when this enhances their social status. According to the innovation theory of (Rogers, 2003), these are mainly the so-called 'early adopters': the people who adopt (purchase) the innovation (natural gas-free products) earlier. These people are often more highly educated and often have more to spend than later adopters. Expensive and innovative products confer status and can therefore be attractive.

3 Results from Purmerend

This chapter begins with a description of the pilot and the testing ground in Purmerend (see Section 3.1). Section 3.2 contains a description of the Purmerend approach. Section 3.3 the drivers that residents of the pilot and the testing ground experience during the various steps of the customer journey to natural gas-free homes. Section 3.4 an overview of the barriers that residents of the pilot and testing ground experience during the steps of the customer journey to natural gas-free homes.

3.1 Natural gas-free Purmerend Overwhere: a pilot and a testing ground

In Purmerend Overwhere, there is a pilot and a testing ground. For this study, we spoke to residents from both the pilot and the testing ground neighbourhoods. The following streets fall within the pilot (Gasvrij Purmerend, 2019) (see Figure 6:): Gasinjetstraat, Hoofd Hasselaarstraat (odd 1-19), Tutein Noltheniusplein (even 2-36), Van Goor Hinloopenstraat (odd 39-73/even 50-60), Van IJsendijkstraat (odd 61-91).



Figure 6: An aerial photo of the pilot neighbourhood

The following streets fall within the testing ground (FAQ Gasvrij Purmerend, 2019): Amstellaan, Cavaljeplein, De Vriesplein, Eemstraat, Flevostraat (even 2 - 6), Hoofd Hasselaarstraat (even 32-168), IJsselstraat, Jhr. Van Citerplein, Klaas Schoorplein, Lekstraat, Maasstraat, Merwedestraat, Rijnstraat, Scheldestraat, Tutein Noltheniusplein (odd 1-27), Van Balenstraat, Van Goor Hinloopenstraat (odd 1-47/even 2-48), Van IJsendijkstraat (1-55 odd), Vechtstraat, Waalstraat, Wormerplein.

The aim of the pilot and the testing ground is the same: to become natural gas-free. However, there are a number of differences between the pilot and the testing ground. Below, we describe the most important differences between the pilot and the testing ground.

- Location: the pilot neighbourhood is located within the testing ground neighbourhood.
- Type of homes: only owner-occupied houses are located in the pilot neighbourhood. In the testing ground, there is a mix of owner-occupied houses, (social) rented housing and other buildings (such as shops and a school).
- Status of the project: the pilot started earlier (October 2017) than the testing ground (kick-off: March 2019). Residents of the pilot neighbourhood are at the beginning of the project. Residents of the pilot neighbourhood have gone through a process and have chosen a solution. The vast majority of the residents in the pilot district will make their home natural gas-free. Most residents have opted for a connection to the heat network. Only a few will go for an all-electric home.
- Funding: residents participating in the pilot will be fully reimbursed for the costs of the energy transition if they opt for a connection to district heating. If they choose another option to get off of gas, such as all-electric, they will receive the maximum amount of subsidy if necessary. Any additional costs must be borne by the residents themselves. For residents at the testing ground, it is not yet known whether they will be reimbursed for all costs (FAQ Aardgasvrij Purmerend).
- Interview set-up: the interviewer does the interviews with residents of the pilot alone. For the residents of the testing ground, the interviewer goes along with a technical expert and sometimes with a communication expert from the Gasvrij Purmerend team.

3.2 The Purmerend approach

The Gasvrij Purmerend team has developed a communication and participation approach to motivate residents regarding a connection to the heat network. (Dijkstra, 2019). This approach is based on two principles:

1. Bottom-up participation: in the heat transition, the municipality can only focus on an excellent relationship with residents in order to be able to advise and facilitate on the basis of this relationship. We call this bottom-up participation. Bottom-up participation requires a people-centred approach in which the focus is not on the desired transition but on the residents themselves.
2. Reconsider in order to arrive at an informed decision: the resident - like the officials working on the transition to natural gas-free neighbourhoods - must have time to consider and reconsider. For the resident, these considerations are at the micro-level: the level of their own home.

On the basis of these two principles, the Gasvrij Purmerend team has developed starting points:

1. **The neighbourly relationship:** Municipalities have restricted their accessibility. At the same time, residents like to ask questions quickly and easily in person. This requires an approachable and accessible organisation. Residents want to be able to ask questions to someone they trust, not an omniscient civil servant but someone they see as an equal. Building a neighbourly relationship takes time and effort. It pays for itself through the relationship of trust, which leads to residents not only coming to ask questions but also to report essential input for the transition from a perspective that the municipality itself is not familiar with.
2. **The resident as project leader:** The owner-occupier has an essential role in the energy transition and yet does not appear within the project's organisation. After all, there is no residents' collective with a delegation that can make decisions on behalf of all residents that will have an effect behind the various front doors. Each resident wants to decide for themselves what adjustments will be made to their own home. Municipalities find themselves maintaining a fragile balance in order both to bring the major parties in the project organisation into the same line of thinking and to facilitate and relieve the residents during the energy transition.
3. **Don't devote energy to resistance:** Every municipality has residents who offer resistance. For municipalities, it sometimes seems as if everyone is against it as you hardly hear the others. Include these residents in the communication, pay no more attention to them than to others and focus on people who are prepared to take step one in the transition. The silent majority is stronger than the smaller section that shouts. People who ask for more information, a home visit, a calculation, a conversation, these are the residents who can be brought to step two. This is how a movement gets started. The residents who offer resistance will later automatically end up in step one and they will then be ready to be taken along as well.
4. **Everyone at the same time in the same way:** If there really is something that concerns every resident in the transition, it is essential that they all hear or read the same thing in the same way on the same day. This means that if everyone wants the news by email, everyone gets it. But if that doesn't apply to everyone (and this is usually the case), everyone will get it in writing, delivered by us as much as possible. In this way, we remain visible, guarantee the delivery and become more and more part of the neighbourhood. A website is there for the big story, but not for the direct provision of information.
5. **Not why but how:** Residents who 'have to' get rid of the gas have thoughts on this and want to talk about the necessity. This is understandable, but not very relevant. The 'point of no return' has already passed and municipalities are working on this. If we enter into the discussion about why, we focus on convincing residents. However, convincing people is not a pleasant way of building a relationship and does not lead to equality. Instead, we focus on the questions that will really help residents to make a choice. It's also better to give the impression that participation is not an obligation. Every resident who makes a well-considered choice for gas is also a committed resident. He or she may be obliged to switch later on, but will make a different choice for now.

6. Involve residents directly, especially if you have questions of your own: The kind of movement needed for the transition requires equality – between parties, between residents and between residents and parties. For the time being, no one knows better and no one is right. Public authorities have information from a broad perspective and oversee a big picture. It therefore seems that they have an overall view. But residents have information at the address level, down to the smallest details. This means that they also have an overview of the big picture, albeit at the address level. Both streams of information are the real big story that the movement needs to get going. So, start on time, especially if you don't know everything.

In addition to these principles, operational tools have also been defined:

1. Introduce yourself

With every new contact, we offer residents our hand and introduce ourselves because we're glad that the resident is here and has made time for us. This is how you set the standard of decency: we are happy with every visitor, we are approachable on a first-name basis, we are there for you, we make contact, we behave respectfully.

2. Live in the neighbourhood

Living in the neighbourhood works in several ways. For residents, you are as accessible and approachable as possible. There is a door they can walk through to drink coffee, ask questions and tell their story. A home in the neighbourhood confronts you with the living situation of residents on a daily basis.

3. Help out

It is difficult to tell from the outside whether residents can do much themselves or not. Open up and help if necessary.

4. Listen carefully

A resident who comes in to report wrongdoing or a potential risk doesn't come to you to point out your mistakes. They come to help you. They are your extra eyes and ears in the neighbourhood. Listen carefully, keep asking questions and solve it.

5. Know your scope but don't put a fence around it

The energy transition could also hit a resident's garden, literally. On top of the millions invested in the construction of a heat network, a decent restoration of the garden is simply a tip. Don't be a miser – pay that tip if necessary.

6. It's not our planning, it's their planning

Within a neighbourhood-oriented approach, you work street by street from number 1 to the highest house number. This is our government's logic, which does not necessarily fit in with the planning of residents. Immerse yourself in the daily practice of residents and take into account exams, pregnancies, holidays, etc.

7. Really put the resident centre stage

Is a dignitary coming by? Put yourself and your colleagues aside. Be strict with your internal group and bring in the residents. You are working in their homes and they matter – after all, isn't this the key element of your success? Let them say what's good (and bad?) about your approach.

8. Stay close

Residents and town halls are not a logical combination, so organise all meetings in the neighbourhood in the immediate vicinity of where you are working. This means baby monitor and rollator distance. You can then help the elderly back home through the dark and pick them up if necessary. At least offer this. Take an extra step.

9. Keep it at workable numbers

Numbers also determine the probability of a unpleasant atmosphere, so keep it small. 50 people in a room is nice, 75 is also possible. Is your neighbourhood bigger; do you expect more? Then do a presentation every hour, split the group apart and let everyone choose the time that suits them best in private. Ensure that conversations take place afterwards: not a plenary discussion but in a parallel walk-in session.

10. Keep track of everything

The GDPR makes things technically complicated but still, process what you can. Which residents have you met and who hasn't accepted any invitations yet? Who has already expressed their intention or even signed something? Who is involved in something special?

11. Be part of the conversation

If residents have received a letter, there will be all kinds of questions, reactions and possibly concerns. It is fine for residents to talk about the contents of the letter, but the municipality must make sure that it is part of the conversation. For example, if a resident thinks something is a bad idea, has questions or concerns, it will not help if he/she talks about it with others at a birthday party.

12. Working with a multidisciplinary team

A transition to a natural gas-free neighbourhood requires knowledge and experience from various disciplines, such as communication, technology, policymaking, legal, financial and project management. Regardless of the discipline, the resident is the starting point for each team member. Points of attention are the right combination of characters in the team and the interactions between the team members. The structure of characters within the team is an important success factor.

13. Connecting with other work activities

The municipality has linked the transition to natural gas-free with the replacement of the sewage system. For both the municipality and the residents, this offers the practical advantage that a street only has to be opened up once. The municipality is not looking for connection opportunities with (non-energy) wishes, such as creating more greenery in a neighbourhood.

14. Capacity to schedule all appointments

An employee is hired to schedule home visits. Scheduling the home visits is quite a task. The agendas of the residents and the employees of the team have to be taken into account. There should also not be too many appointments on one day and the appointments should take place in the evening.

15. Offer information in an accessible manner

A diary has been made in which all the work activities that are carried out in the house is explained. The diary also states what these activities mean in concrete terms for residents. If there is no electricity because of the work, then there is also no Wi-Fi and maybe the clocks will run late. This diary has not yet been used in practice.

16. Keep residents informed

Not all developments taking place are visible to residents. It may then be important for them to hear about these developments. And even if nothing has really happened, this fact (and the reasons why) may be good for residents to know.

17. Create a data checklist

We are working on a form and a checklist on which all of the necessary items (technical data about the home, information about residents, etc.) that need to be asked of residents are listed. In the pilot, residents were called regularly because some additional information was needed.

18. Offer a transition service

We are also working on a transition service to district heating. There is currently no transition service from gas to district heating.

These principles, starting points and operational tools have been applied in a process in which there has been a lot of personal contact between the Gasvrij Purmerend team and the residents in order to win their hearts and minds. For example, the team is present in the neighbourhood in a home that has been converted into an office. The team visited each resident of the pilot in their homes. And the first residents meetings are now also taking place in the testing ground. The team has organised several residents meetings with room for questions and input from residents.

Together with those involved in the Aardgasvrij Purmerend team, we have undergone a retrospective of the activities that have taken place in recent years. Figure 5 shows an overview of the activities. The activities under the timeline concern interactions with residents.

An overview of the activities is given in Table 4. Behind most activities, there is a code (Px for principles, Ux for basic principles and Ox is for operational tools). These correspond to (one of) the principles, starting points or operational tools. This provides insights into the underlying approach that provides a basis for the various actions.

A description of all activities can be found in Appendix A 'The Purmerend approach'. For each activity, it is indicated which principles, starting points or operational tools have been applied.

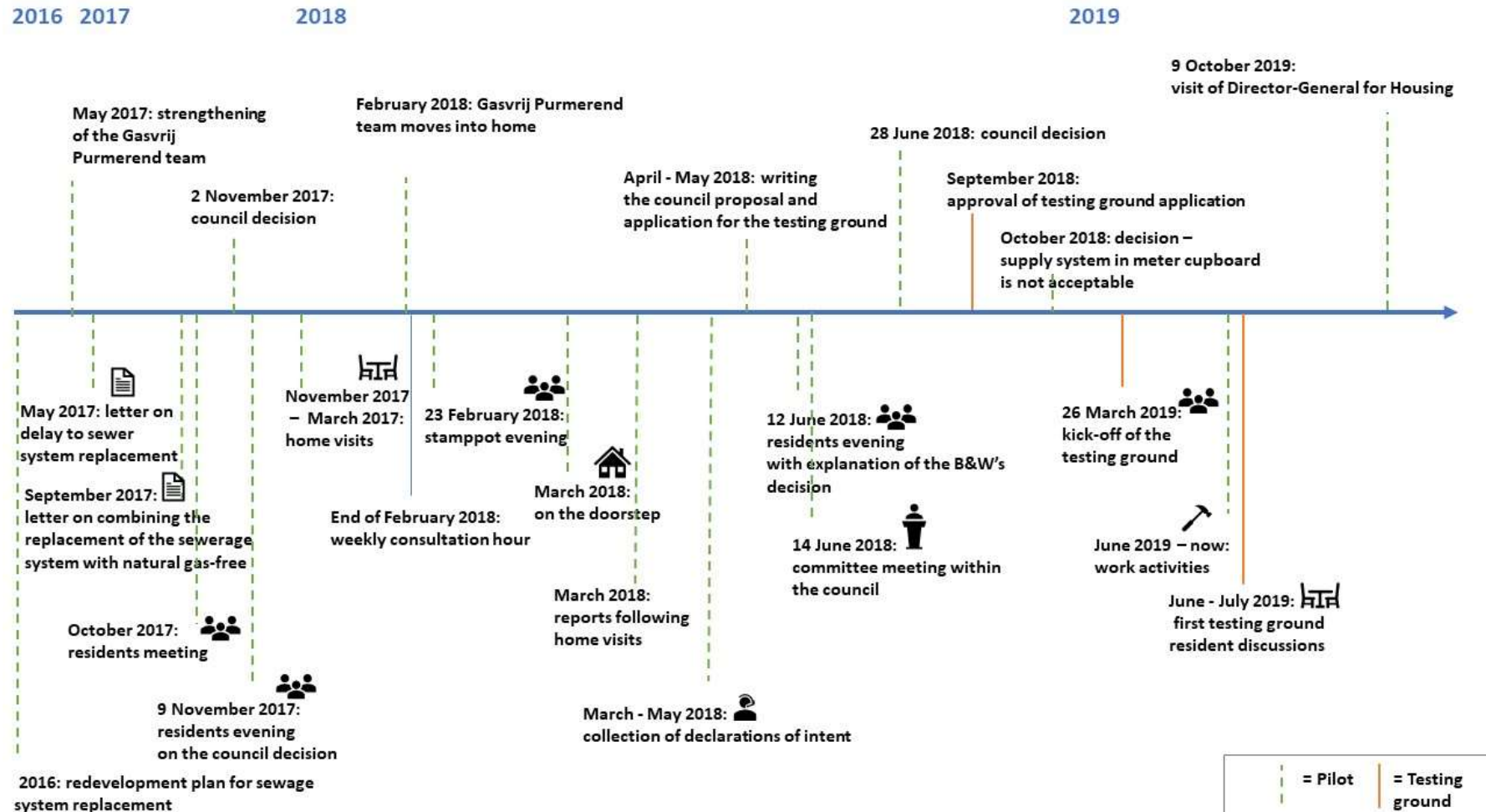


Table4: Overview of the activities in the pilot and testing ground.

Step on customer journey	Actions
Step 1: Becoming aware of natural gas-free as an issue	<ul style="list-style-type: none"> – Letter to residents on delay to sewage system replacement (O13) – Letter to residents on combining the sewage system replacement with natural gas-free <ul style="list-style-type: none"> ▪ Letter to residents of parts of the neighbourhood on the combination of sewage system and natural gas-free ▪ Letter to pilot residents: invitation to residents meeting (O14, U4, O11, P2, U1) – Residents meeting: municipality plans explained (U5, O4, O8, O1, O10) – Residents evening on council decision, possibility for home visits (U6, O9).
Step 2: Tam-tam phase	<ul style="list-style-type: none"> – Stammpot evening: residents write questions and concerns on tablecloths. These are presented to the municipality (U6).
Step 3: Awareness of personal situation	<ul style="list-style-type: none"> – Home visits are made by the Aardgasvrij Purmerend team (O14). – Weekly consultation hour with Stadsverwarming Purmerend: insights into their energy costs when residents switch to district heating (-). – The team plans discussions with other residents in pilot (-). – Reports from home visits (U1). – Residents evening with explanation of B&W decision and follow-up steps (O16). – Investigation into where the supply system should be placed: in the attic (-). – Kick-off of testing ground: end of the possibility for a home visit (O9). – First testing ground residents discussions (O17, O18).
Step 4: Choice of orientation, waiting or active resistance	<ul style="list-style-type: none"> – Collect declarations of intent in pilot (-).
Step 5: Orientation	
Step 6: Choosing a solution	
Step 7: Living in a home with ongoing work	<ul style="list-style-type: none"> – Work activities begin both outside and inside of the homes (pilot) (O6, O3, O15, O11).
Step 8: Living in a (partially) natural gas-free home	<ul style="list-style-type: none"> – First home in the pilot is off of the gas (9 Oct. 2019). Around the same time, the rest of the first block also gets off of the gas (O7).

3.3 Results: drivers

In this section, we link the drivers mentioned to the different steps of the customer journey.

3.3.1 *Step 1: Becoming aware of natural gas-free as an issue* *Ultimately, we will have to get rid of the gas*

Residents indicate that their homes will have to become natural gas-free sooner or later. This awareness helps these residents to make a decision: when is a good time to switch to a natural gas-free home, given the fact that it has to be done sometime? Residents indicate that they would be better off doing it now because there is currently funding and support from the municipality. Maybe the situation will be less favourable later on. One of the residents said: "I have two choices, I can put up a banner and protest against something which is going to happen anyway or I can help, share thoughts and participate. I choose the latter." "Look, if nobody starts, nothing ever happens, right?" said another resident.

The Aardgasvrij Purmerend team emphasises the fact that residents are not obliged to get rid of natural gas. Instead, they tell the residents what the benefits are of switching at this moment (financial reimbursement and relief from the municipality). They also point out that natural gas-free could become an obligation in the future. Residents may not be able to later benefit from the advantages that currently apply. All interviewees are convinced that natural gas-free homes will become compulsory sooner or later. "You'd be crazy not to switch now," said one of the interviewees.

Solidarity with Groningen

A number of residents indicate that the situation of the residents in Groningen has contributed to their decision to opt for a natural gas-free home. They indicate that they empathise with the people who have cracks in their homes and suffer from earthquakes. "People are losing their homes there," noted one of the interviewees. "Imagine living there. I have really, really deep sympathy for the people who have to live there in a ruin and are not paid for it in a reasonable way. They're being fobbed off with a tip," said another resident.

Natural gas-free is safer

Some residents indicate that they find natural gas scary: "You could have a fire or, even worse, an explosion in your house." For this reason, they think it's fine for the gas to disappear. "If you don't have a flame in your house, the chance of a fire is very small."

Rectifying bad decisions from the past

Some older residents indicate that it is important to switch to natural gas-free in order to rectify past mistakes. "Our generation has already ruined so much. We were overjoyed with our plastic but that same plastic is now a disaster in the seas and things like that, but when we got it we didn't know the result in the end."

Higher gas price (in the future)

Many residents believe that the price of gas will eventually rise and that gas will become more expensive than alternatives. This is an important condition for some residents to switch to natural gas-free. One resident said: "If the price of gas ends up dropping, I'll regret my decision to switch to natural gas-free!"

Environmental considerations

A few residents indicate the environment as their motivation. One resident said: "Yes, I want everything to be better for the environment, of course. For animals, for us. Anything for our health."

3.3.2 *Step 2: Tam-tam phase**Openness to renewal*

Some residents indicate that they are open to renewal in general. According to them, a natural gas-free home can be classified as 'renewal'.

Experience of a like-minded individual

One young person interviewed indicated that his friends liked that he took stock of what natural gas-free would mean. The interviewee was able to share his experiences.

3.3.3 *Step 3: Awareness of personal situation**Honest communication*

One resident says: "And don't stitch up the citizens by pretending to be so open and make a big party of it: guys, hip hip hurray, natural gas-free, we'll do coffee and cake. And hip hip hurray, we're all happy. Because it's not like that at all." This also applies to subsidies: "Be open and honest about subsidies too. It was said that a lot of subsidies had been received from the state. And now there's a rumour everywhere, I don't know if it's true, that the subsidy has run out already. And I think, 'they just started'."

Personal approach

Another frequently mentioned driver is the personal approach of the Aardgasvrij Purmerend team. The team has visited almost every resident to discuss with them how the home in question could be made natural gas-free. "Every home is different, you can't avoid coming to people's homes," said one of the residents. On residents evenings as well, several residents found that there was time for a personal conversation. What residents also like is that they can get a calculation of what they would pay for heating based on their gas bill."

Trust in the natural gas-free team/approach

Although there was dissatisfaction among the residents at the start of the process regarding the approach of the Aardgasvrij Purmerend team (see Section 3.2), residents now indicate that they have trust in the approach and the people behind this approach. Team members are recognised on the street and problems are also shared informally. This is partly because residents indicate that the team does what it promises. When residents show up with a problem, real action is taken.

A member of the Aardgasvrij team says: “There was a situation in which a contractor had blocked the driveway of a couple when the woman was about to give birth. This was raised by the couple’s husband and the team then quickly took action to clear the driveway.” What is also important for residents is that the team is easy to approach. One resident said that after the home visit, he was given a specific contact person with whom he was very satisfied. As a result, he did not have to look for whom to call. Furthermore, residents say that the team is also very visible in the neighbourhood and that it is easy to address the members.

Knowing what's ahead

Several residents indicate that they are happy with the communication about the different steps in the process towards natural gas-free. One resident said: “They say, ‘first we do a, then b and then c’ and then that happens.” The model home on Gasinjetstraat also functions as a test home. Residents can see how the heat enters the home via a riser pipe. One resident said: “You may find the riser pipe ugly, but at least you know where you stand.”

3.3.4 *Step 4: Choice of orientation, waiting or active resistance*

Finding somebody to listen

Residents find the contact with the team very accessible. Residents can turn to the model home on Gasinjetstraat if they have any questions or concerns. The team used to sit in the town hall, but that can create a high threshold for visits by residents. One team member described it as follows: “Residents have to go there, pick a number, wait, climb three flights of stairs to a meeting room, by which point people will already have become completely discouraged. Here, you meet people on their own turf.”

Nice and informative residents evenings

Residents indicate that they are happy with the very personal approach of the municipality of Purmerend. There are informative but at the same time pleasant residents evenings. One resident describes it as “an evening out”. At one of the residents evenings, for example, various types of stamppot and mulled wine were served. After a chat with the team, people could write on the tablecloths what their biggest concerns were about natural gas-free. These tablecloths were presented to members of the municipal council.

Able to free up enough time

For some residents, it is easy to join in and remain a part of the transition to natural gas-free because they have the opportunity to make time for this. Young families have fewer opportunities to go to residents evenings or simply don't have the energy to keep track of all of the information about natural gas-free in addition to a job and family. One of the young interviewees had just changed jobs, which meant that he could work from home once in a while and therefore plan this interview. Retired interviewees could more easily make time for discussions and get up to speed. Some older residents were also overrepresented at the residents evenings. A younger participant said to the Babelboom: "I was by far the youngest on the residents evening. I'm 26, but I think the average age was 60+."

District heating is the only option (for poorly insulated homes)

A resident indicated that as a resident, one has few choices of natural gas-free alternatives. "If you live in a well-insulated house, you can still choose 'an alternative', but there is actually little choice for us. And there is no talk of subsidies for insulation. Of course, it's wonderful that you're taking measures like this, but then go and make sure that all homes are well-insulated, as is currently being done in Merwedestraat, for example. Everything was first insulated together there, making it more sustainable. And by the way, there was already district heating, but they're still doing good work there."

Can absorb financial setbacks

One interviewee indicated that if the personal costs became too high for him, his parents could help in the worst-case scenario.

3.3.5 *Step 5: Orientation**Involving reliable professionals in the process*

Several residents indicate that they have gained more trust in the Aardgasvrij Purmerend approach once reliable technicians were involved in the process. Before that, they did not always feel that they were being taken seriously. Several residents are well aware of how their house is constructed and what is (not) possible. It was nice to be able to discuss these matters with professionals and come up with a solution together.

No concerns about broken central heating

In the current situation, each homeowner is responsible for the maintenance and timely replacement of the boiler system. When homes are connected to the Purmerend heat network, this will change. Stadsverwarming Purmerend ('District Heating Purmerend') will remain the owner of the heating units in homes. In the event of a defect, they will solve it. The resident leases the heating unit. This is a consistent amount. Several residents like this idea. Some have previously had problems with their central heating or were confronted with unexpected costs. One resident actually had to replace his central heating. He will now save those costs because he's connected to a heat network.

Good examples of induction cooking

Some residents report positive experiences with induction. "Ultimately, I'm very happy with my induction. I had always had gas in the home, but now induction. It goes super-fast and is also very easy to keep clean."

Refurbishing homes and making them more future-proof

Some residents say they'd also like to use this route to refurbish their home and make it more future-proof.

Increasing the value of a home

A number of homeowners indicate that making homes natural gas-free can increase their value. This was particularly interesting for a younger homeowner who was interviewed. He indicated that he does not intend to continue living in his current home in the long term and sees the natural gas-free modifications as an investment in his home.

*Step 6: Choosing a solution**All costs are reimbursed by the municipality (pilot neighbourhood) or probably covered to a large extent by the municipality (testing ground)*

For several residents, the only or the most important reason to consider a natural gas-free home is reimbursement (to a large extent). Several residents indicate that they do not feel enthusiastic about a natural gas-free home but are still open to it because all or a large part of the costs are reimbursed. One resident says: "How can the municipality make the transition to a natural gas-free home nicer? Well, if they covered more of the costs, it would be nicer."

3.3.6 *Step 7: Living in a home with ongoing work**The street is only opened up once*

Because the replacement of the sewage system has been combined with making the neighbourhood natural gas-free, the street only has to be opened up once. Residents can count on the fact that if the street is closed up again, it won't be open again just like that in a year's time. One resident told us that the street used to be opened up so often that the wedding photos of her and her two sisters all showed work in the background. She likes the fact that the street is only opened up once now.

3.3.7 *Step 8: Living in a (partially) natural gas-free home*

No drivers have emerged for this step in this study.

3.3.8 *Step 9: Becoming an ambassador*

No drivers have emerged for this step in this study.

3.4 Results: barriers

In this section, we link the barriers mentioned to the different steps of the customer journey.

3.4.1 *Step 1: Becoming aware of natural gas-free as an issue**CO₂ is good for nature*

A few residents said that "the story doesn't add up." According to them, the world is only getting greener.

“It’s just not true. Over the last 30 years, the world has only gotten greener. Yeah, the Amazon rainforest is being cut down. Of course, we have to stay away from that. But it’s not true that we as humans are solely responsible for CO₂ emissions.”

No intrinsic motivation or scepticism about natural gas-free plans

None of the residents spoken to are really interested in the subject of natural gas-free or sustainability in general. When asked what they thought was important, one resident replied: “The campsite.” Others are sceptical about the effects of a natural gas-free home: “We’re going to get rid of the gas, but aren’t they going to get on it in Germany?” “We’re going to get rid of the gas, but at the same time they’re going to expand Schiphol – a bit nonsensical.” “The Netherlands is just such a small country; if only we do this, it won’t make any difference.”

The elite are imposing it on us

One resident said it’s all imposed by the elite but that it won’t pay off. “And I just think it’s insane what our government wants and what the EU wants, what the elite wants. We’ll have to drive electric soon, we’ll have to do all kinds of things, it’s just being imposed on us and it’s not paying off.”

Natural gas is a clean fuel

Some residents are convinced that natural gas is a clean fuel for heating homes. “There are really a lot of misunderstandings about natural gas. Nowadays, it’s treated like some kind of toxic product that causes immense damage to the world and in the environment. But people forget a little bit that natural gas is actually very clean and very efficient in terms of energy generation, combustion and residues.”

Natural gas-free is not the most important problem

“I’d rather have a clean beach and fish than a natural gas-free home,” said one interviewee.

Natural gas-free alternatives are also polluting

Not all residents are convinced that the natural gas-free alternatives are clean. They indicate, for example, that biomass plants require a lot of logging. They wonder where all this has to come from. Some residents also have doubts about solar panels. “Solar panels are made in China. This is done under conditions that also release a lot of CO₂.”

Natural gas is imbued with (geopolitical) interests

Some residents are convinced that with the transition to natural gas-free, we are being fooled and that there are all kinds of interests at play from above that are not shared with ‘ordinary people’. This transition would not make the world a cleaner place. One resident said: “We are dancing to the tune of the Americans and NATO and the EU and now we have to get rid of Russian gas. That’s the reason why we have to get rid of natural gas. Because the Americans have already said: ‘Well, that’s fine, you go off the Russian gas and then we’ll bring LNG in oil tankers across the Atlantic’. LNG is liquefied natural gas, so it’s a big lie. In the Netherlands, we’re being a bit silly by spending two hundred billion euros just to get everyone off the gas, which doesn’t really get you anywhere.”

3.4.2 Step 2: Tam-tam phase

Feeling fooled

A single interviewee indicated: "But I'm kind of like, I feel so screwed over and actually taken for a fool that I think: you can't do that to your citizens."

No confidence that heating networks can become profitable

There are several interviewees who are sceptical about the future of the heat network. They think that it will always be very expensive and that it will not be a good, stable and affordable alternative to natural gas.

Clumsy approach by Aardgasvrij (at the start of the project)

The interviewees from the pilot indicated that they were not impressed at the start of the process by the approach of Aardgasvrij Purmerend. They indicated that they had little confidence in the team because they were initially somewhat clumsy and inexperienced. Only later, when more technical experts were involved in the process, did residents gain more trust in the plans. These experts paid more attention to the vision of the residents. On the other hand, many residents indicated that they understood the course of events as the team also had to deal with many new and sometimes unexpected scenarios and had to learn by doing.

District heating is a monopoly

There are a few interviewees who have difficulty with the fact that Stadsverwarming Purmerend has no competition. They will soon be dependent on one supplier of heat. "I think that district heating has a monopoly, so they should first take a good look at who manages it and how it works."

Negative experiences with heat networks in the past

Several interviewees indicated that they themselves had had negative experiences with heat networks in the past. People could not get their home warm in the winter and were therefore left in the cold or had to supplement it with a heater. One of the interviewees had moved from a natural gas-free neighbourhood in Purmerend to a neighbourhood where houses were still connected to gas because of a bad experience with a heat network. (Meanwhile, this neighbourhood now has to get rid of the gas as well). Another interviewee indicated that he was in favour of natural gas-free homes but against a connection to the heat network.

Heat pumps make a lot of noise in the home

One resident commented on the heat pump. "It's not going to happen that everyone in this town will get a heat pump. But if that were to happen, it would take 20 years for every household to have one, 20 years. And then the first one would already have been written off. It's also a big noisemaker, so they have to be cooped up and then they offer less of a return. So, no. Our country is not yet ready to take all these measures in such a relatively short period of time. It just can't."

Leads to polarisation

A resident indicated that natural gas-free leads to polarisation. "You can now also see various camps being created [by natural gas-free]. The atmosphere isn't getting any better. Yeah, yeah. Although you do actually meet a lot of neighbours precisely because of those information evenings, so you could say that it also gives you more of a bond, that you get to know more people in your neighbourhood. That's the

positive side of it, but if you come to the conclusion that what we're being offered is actually very negative, yeah. Then you're not happy after all. It's nice to get to know some new neighbours, but the plans that are there are less nice."

No trust in suppliers

A resident indicated: "When you're in front of the TV or looking at email or whatever, you see all kinds of clips with very happy people who have bought a heat pump or who have underfloor heating, all electric, blah blah blah. And I think: 'Yes, you were paid to do that'. It's too slick."

District heating is not sustainable

Several residents indicated that they are not in favour of district heating as long as fuels are used that they consider unsustainable. These are both natural gas and the woodchips that are used. "As the district heating here is working with organic materials, no. Something's not right in this heat network. As long as the district heating still uses a lot of natural gas, it's a bit of a sham solution." Another resident said: "As far as I know, district heating is not natural gas-free."

Limit natural gas-free to new construction

"Existing buildings are mainly inhabited by older people who are never going to earn this back," said one of the interviewees. "It sounds silly, I'm for the environment, but make new buildings natural gas-free, there are young people there, their lives have yet to begin. They make back the costs easily, they get discounts, subsidies, etc. You should just replace old houses with new ones and not modify them."

3.4.3 Step 3: Awareness of personal situation

Does not fit into phase of life (too little time/money)

According to several residents, younger residents in particular have little savings or financial resources to switch to natural gas-free. Even older residents think that young people (with children) have less time to study the subject. They work a lot and have activities in the evenings, interviewees think. "Young people in particular have no interest in natural gas-free. They only just have a new home, new central heating, often both working. I'm retired, get AOW and pension and I've just converted my mortgage to a more favourable rate," said one resident.

Electric cooking is sub-optimal

Some residents associate electric cooking with cooking on ceramic plates. It takes a long time for these plates to heat up and cool down. This also gives people a negative feeling about induction cooking, although induction plates work differently from ceramic plates. In addition, some interviewees are fond of cooking on gas. "I love fire and gas. I've been saving for a long time for my dream oven, I'm not going to give it up." "Safety doesn't play a role for me, I'm a cook, I love fire. When the time comes, I'll just buy a gas bottle to cook on."

Uncertainty and concerns about costs

This barrier mainly affects the residents of the testing ground. In the pilot neighbourhood, everything is paid on behalf of the residents. Residents of the testing ground indicate that how much they will eventually have to pay will be an important reason to decide whether or not to make the transition. Residents find it difficult that there is still no clarity on this and that the Aardgasvrij Purmerend team

is also unable to indicate when they will be able to indicate what the costs will be. “I don’t want to get rid of the gas because it costs money twice. To get rid of it costs a lot of money and so does buying that equipment for the district heating,” said one resident. Another said: “It costs a lot of money and it doesn’t pay off. It plunges people into poverty.”

Misunderstandings and limited knowledge about the chosen alternative

There are several alternatives to natural gas. For some interviewees, the choice for a heat network is not clear or logical. Some have had bad experiences with heat networks in the past or think that hydrogen, for example, would be a more logical option. “There are already gas pipelines, why don’t we use them for hydrogen?” asked one resident.

Dependency on a housing association

Residents who have to deal with a housing association wonder what happens when they personally want to transition to a natural gas-free home but the housing association as a collective does not like this. Or what if the resident on the ground floor does not want to participate, but people have to walk through their home to get to other homes? Residents have the idea that they are at least partly dependent on what the housing association decides. There can be a lot of variation among the members of a housing association. Some, for example, are wealthier than others. “People with a non-Dutch background are sometimes more difficult to involve because they are less concerned with the subject or do not always understand it well,” according to one resident. Furthermore, some residents are more involved than others. One resident indicated that there is also much less contact with those in his block of flats than before due to the faster turnover. A resident indicated that there is less social cohesion in the building, which can also make a mutual decision more difficult.

Uncertainty about what it means for the home (especially in flats)

A number of residents spoken to who are part of an apartment complex indicated that they still had little clarity on what a natural gas-free home would look like for them. The model home on Gasinjetstraat is a terraced house and is not really a good example of what it would look like in a flat.

3.4.4 *Step 4: Choice of orientation, waiting or active resistance*

Municipality must first clean up the neighbourhood

One resident thinks that the municipality should first clean up the neighbourhood before he’ll invest in his house. He would then be able to sell his house sooner. “If the council first carries out maintenance and makes the neighbourhood a bit tidier, we can talk further, but right now it’s not happening. I think that these things fit together. I think I’d rather sell my house than do any major maintenance on it because I think it’s simply impoverished here. I have a lot of thoughts on this.”

Feeling of not having a choice

There are some residents who are resisting the process besides the discussion of “do I want to move over to a natural gas-free home?” They feel that they have no choice. Regarding the question of whether they would prefer not to live in a natural gas-free home, one resident answered: “That’s not the point. The point is that I don’t have a choice.”

As a condition in order to be allowed to start the natural gas-free pilot, the municipality of Purmerend established that at least 50% of the residents should be open to it. By means of a declaration of intent, residents could indicate their positive or negative attitude towards this initiative. According to one resident, the Aardgasvrij Purmerend team then “lobbied a lot” in the neighbourhood. For some of them, this approach went down the wrong way. One resident said that it looked like the team was on a “mission” to convince everyone. They felt pressured to sign the declaration of intent. It all had to be done “very quickly.”

The decision has already been taken

Some residents feel that they no longer have a say in the decision on whether or not to switch to a natural gas-free alternative. “Yes, you are invited to information evenings, but yeah, I do feel that these are all things that have more or less been decided. You do get beautiful designs in front of you, but in principle it’s true that the decisions have already been made,” stated one resident.

Facing it alone (as an elderly individual)

An interviewee who lives alone indicated that she experiences stress because she sometimes does not know what is happening in the transition to natural gas-free. “Suddenly, there are people on my driveway, pointing and frowning at my house and I have no idea what they’re doing there.” Another interviewee thinks it’s harder for people who live alone because they don’t have anyone to share the uncertainty and stress with or to laugh it off with. “I think it’s also harder for older people.”

One’s own input on technical (im)possibilities is not heard

Several residents indicated that Stadsverwarming Purmerend had initially decided to place the inverters in the meter cupboards of residents. According to the residents, this was not a suitable place because the meter cupboards were too small for this. Several interviewees indicated that little attention was paid to the knowledge of the residents themselves during this process: they quickly indicated that such a construction would not fit. It was only at a later stage that technicians were involved in the discussions and another place was found for the inverter.

Don’t want to take out a loan

One resident indicated that they do not have a sufficient budget and do not want to take out a loan. “Well, no. I’m open to it but the budget doesn’t allow it. There are subsidies but they don’t cover the costs and I’m not going to take out a loan, so that’s a bit of a dead end. I understand that Purmerend really wants to be the first city which is natural gas-free, so let the municipality cough up.”

No room to explore solutions other than the heat network

Residents feel like only heat networks are being discussed. “There are plenty of alternatives, such as solar panels and heat pumps, but there is relatively little talk of them, even during the information evenings. Well, it sounds a bit like a district heating mafia because it’s hardly mentioned. And if you have any questions, you get: ‘then you should look for a heat supplier that specialises in that.’ I don’t call that a natural gas-free route.”

3.4.5 *Step 5: Orientation*

No barriers have emerged for this step.

3.4.6 *Step 6: Choosing a solution*

No barriers have emerged for this step.

3.4.7 *Step 7: Living in a house with ongoing work*

The renovation was noisy

A resident who has already experienced the renovation of his house indicated that it was “terribly noisy.”

Lots of people passing through

A resident who has already experienced the renovation of his house indicated that “a lot of people were passing through.” He experienced this as “just very inconvenient. You lost your privacy.”

3.4.8 *Step 8: Living in a (partially) natural gas-free home*

No barriers have emerged for this step in this study.

3.4.9 *Step 9: Becoming an ambassador*

No barriers have emerged for this step in this study.

4 Results from Zwijndrecht

This chapter begins with a description of the perception of Zwijndrecht-Noord by residents (see Section 4.1). Section 4.2 describes residents' wishes for the neighbourhood. Section 4.3 contains a description of the drivers that residents experience during the different steps of the customer journey to natural gas-free homes. Section 4.4 an overview of the barriers that residents experience during the steps of the customer journey towards natural gas-free homes. Section 4.5 describes how residents want to be approached about natural gas-free homes.

4.1 Perception of Zwijndrecht-Noord by residents

The Zwijndrecht-Noord neighbourhood is a mixed neighbourhood in terms of home ownership (owner-occupied homes and social housing), ethnicity and facilities. The residents' experiences of the neighbourhood depend on the specific location in the neighbourhood (e.g. which side of the Koninginneweg). The boundary of the neighbourhood is not entirely clear to a number of residents. The perception is that the more expensive houses are not part of the neighbourhood.

Residents mention a number of practical issues as the reason why they have settled in Zwijndrecht-Noord. One of the reasons is the location of the neighbourhood. The neighbourhood is close to Zwijndrecht train station, the motorway and the hospital. Residents also mention facilities such as several schools, a church, two shopping centres, a community centre and some facilities for play (two playgrounds and a football cage). Other practical matters include family and friends who live nearby. Residents also mention that Zwijndrecht is a nice, quiet neighbourhood while the city (and other cities) are nearby. In addition, a number of residents indicate that it was also easier to get a home in this neighbourhood than in other places in the area. The neighbourhood is also fairly green. A number of residents do identify waste as an area for improvement. Residents indicate that there are too few public waste bins or that people do not throw their waste in the trash.

Residents describe the neighbourhood as quiet, cosy and nice, although there are also busy places. Some residents are annoyed by this. They suffer from noise nuisance, waste on the street and increasing traffic and are annoyed by loitering youngsters. Some residents would like a bit more liveliness in the neighbourhood. Others feel alienated and intend to leave. Some see the existence of loitering youths as an opportunity. According to these residents, they are social capital in the neighbourhood. "There is a lot of lost talent. Standing at the shopping centre now, I see a lot of boys just not doing anything and we think that's a pity." This resident would like to use the neighbourhood centre ('Xiejezo') as a location to teach young people something that suits their living environment, such as Thai boxing. There are no activities organised for young people in the community centre.

Residents maintain contact with (a limited circle of) neighbours or are more self-contained, besides a few. It is possible to borrow a cup of sugar from neighbours, but "the door will not get stuck." In previous years, there were neighbourhood parties, but not anymore. Residents do not name an aspect that is 'typical of

Zwijndrecht'. A familiar face in the neighbourhood is 'the Knight of Zwijndrecht', a local resident who always dresses up as a knight.

4.2 Wishes for the neighbourhood

Neighbourhood perceptions are personal. So is what it takes to improve the neighbourhood. Nevertheless, a number of wishes emerged from the (street) interviews. For stakeholders in the neighbourhood, wishes for the neighbourhood can serve as starting points for initiatives regarding natural gas-free homes ('linking opportunities'). An overview of the wishes is given in the table below.

Table5: Overview of wishes for the neighbourhood

Wish	Quote	Need
Playgrounds	"[The neighbourhood should] be a little more child-centred, I think. There aren't that many playgrounds around here."	Entertainment for children
Places to hang out	"Activities for young people would be nice."	Entertainment for young people
Less waste	"There's a lot of junk outside: prams, fridges and other stuff, not even recognisable what it is. It's also on certain streets and on the corner."	Cleaner living environment
More greenery	"I'd really like to see more solar panels, but especially more greenery because greenery gives us oxygen and makes us happy. So, I would like to make a plea for a lot more trees here."	Natural surroundings
Shopping centre refurbished	"I would fix this shopping centre up a little bit more. And nicer stores."	More attractive facilities
Hospitality / nightlife venues	"I'd like more shops, more hospitality, more nightlife. And for it to be a little busier and cosier and have more people."	Liveliness
Refurbishing houses	"There's a lot of quick-build construction here from the fifties. The new social housing and all that post-war stuff that was quickly built should disappear. It could be more stylish."	Attractive surroundings
Information from the municipality	"Traffic is jammed because a street has been closed following complaints from residents. As a resident, you are not taken into account at all or informed that it will be closed. That's a pity - missed opportunities. The municipality currently listens to ten people who complain about the street and now it's closed and runs through another street."	Relationship of trust
30-kilometre zone	"People need to drive a little slower for safety in the neighbourhood."	Traffic safety
Fewer loitering youths	"There's a lot of youth hanging around and so on. That's another reason why I don't like to come here at night."	Security
Meeting place	"A place where we can sit and have coffee and chat and listen to music. Not a bar or anything. A place for adults."	Social cohesion

There are also residents who have a positive perception of some of the above themes. These residents name the greenery in the neighbourhood, the many playgrounds and selection of shops and the activities in the community centre as attractive when living in Zwijndrecht-Noord.

4.3 Results: drivers

In this section, we link the drivers mentioned to the different steps of the customer journey.

4.3.1 Step 1: *Becoming aware of natural gas-free as an issue*

Ultimately, we will have to get rid of the gas

Some residents indicated that they would make the step to natural gas-free homes when they have to. For example, it was noted: "Yes, I have, that's how I am. I'll let it come to me. I can go with the flow with anything. If something has to be done, then it has to be done." It was also said that, "when you're really obligated to make the change, that's the moment for me to believe in it."

Solidarity with Groningen

A number of residents cited Groningen as a reason to take steps in the field of natural gas-free homes. "Yes, I think the gas tap should be closed. The people of Groningen need to be listened to."

Environmental considerations

Several residents indicated that they want to do things for the environment. One resident said: "I do think that how we're dealing with energy now is not good for the planet. So I think it makes sense to do it eventually, know what I mean?" Another said: "It all has to be electric, right? It's better for the environment."

A faith-based assignment

A single resident indicated that taking good care of the earth is a matter of faith. This resident said: "As Christians, we have been given an assignment to take good care of the earth. We've received the earth from God because God wants that. Every Christian interprets this in his or her own way. That's why it's the Christians who have many solar panels here."

Health

A single resident named continuing to live a healthy life as a motivation to move away from natural gas: "If that's better for our planet, then we should definitely do it. If we can all continue to do everything together and keep the world a cleaner place and if natural gas is already there. We all want to keep living a healthy life here, so we'll have to do better."

4.3.2 Step 2: *Tam-tam phase*

Alternative must be at least as good

A single resident indicated that he wants to make the move to a natural gas-free home as long as he does not experience any adverse effects compared to the current situation. This resident stated: "If it's sustainable, we'll see if it doesn't have any negative consequences for us at home. For example, if there are no sudden

power outages or that sort of thing. I think that would be too far. But if, for example, it's modified with solar panels or something, you can have power the natural way."

4.3.3 *Step 3: Awareness of personal situation*

Going along with initiatives

Some residents said they'll go along if a step is taken. One resident said, "I mean, any way is fine with me because as soon as a step is taken, I'll go along with it."

4.3.4 *Step 4: Choice of orientation, waiting or active resistance*

Attractive investment

Making things more sustainable can also be an attractive way of investing money you have left over. One resident put this as follows: "What do you do with the pennies you have left over? Put them in the bank or try to get a return on them in another way? We've done the latter and have purchased solar panels, and that's how we get a return on energy."

Opportunity to improve the neighbourhood

A single resident indicated that natural gas-free homes can be combined with other tasks in the neighbourhood. This resident said: "Make the neighbourhood friendlier and safer."

Wanting to become climate-neutral

One resident has taken many steps to make their home climate-neutral. This resident has a lot of technical knowledge and regulates the heat in the home itself, including solar panels and heat pumps.

Step 5: Orientation

Taking steps collectively

A single resident wondered if it is also possible to do things together so that it costs less energy. "Is it possible to do something collectively? It costs a lot of energy for the people themselves. Make sure that houses are insulated and can be removed from the gas in a more collective manner." Another resident said: "Together, it's often a bit cheaper. Some things you can't do alone."

Cost savings through energy saving

By investing in energy saving, you can save money. In regard to this, one resident said: "It suddenly occurs to me that we've done double-glazing front and back and put insulation beads between the cavity walls. We made that investment. That way, you use less heat."

Increasing the value of a home

A few residents indicated that they see taking sustainable measures as a means of increasing the value of their home. "I want to market my house properly when the time comes, which is why I take sustainable measures. Then when I sell it, it's already been improved. That has to be the case in this market."

4.3.5 *Step 6: Choosing a solution*

Net metering

Lower energy bills due to the yield of solar panels was called a “win-win situation” by one resident. Net metering (whereby the supplied energy generated by solar panels is deducted from the energy bill) made it highly attractive for a resident to take up solar panels.

4.3.6 *Step 7: Living in a house with ongoing work*

No drivers for this step have emerged in this study.

4.3.7 *Step 8: Living in a (partially) natural gas-free home*

No drivers for this step have emerged in this study.

4.3.8 *Step 9: Becoming an ambassador*

No drivers for this step have emerged in this study.

4.4 **Results: barriers**

In this section, we link the barriers mentioned to the different steps of the customer journey.

4.4.1 *Step 1: Becoming aware of natural gas-free as an issue*

Uncertainty about why we're getting rid of the gas

A resident said that she doesn't really know why we're getting rid of the gas. “Yeah, why are we getting rid of the gas anyway? (...) Maybe a stupid question.”

The real story isn't being told

One resident said: “They [the government] have to tell us what's really going on. No propaganda.” Playing along nicely with the (national) government and saying that “the energy transition” is fantastic while the energy transition also has disadvantages (such as high costs and technological flaws) is something which is not appreciated by this resident. Examples named include the heat pump, which turned out to be much more expensive than expected, and the zero-on-the-meter concept, which does not seem to be feasible in practice. The result of this is that the resident will wait until the energy transition brings with it an improvement.

Natural gas is a clean fuel

One resident thinks that natural gas is not a dirty fuel. This resident said: “Of course, natural gas is a fossil fuel but it's still not a dirty fuel. At least, not as dirty as petrol or oil.”

Bigger countries hardly do anything, so why must a small country like the Netherlands?

Several residents indicated that other, much larger countries than the Netherlands have to do more. They wondered what the small Netherlands can contribute.

Residents said, among other things: “We ‘must’ do this and that with natural gas-free, but what are you forcing people to do? Let the larger countries, richer ones or industry do more. I sometimes think, what are we doing in the Netherlands? It’s a drop in the ocean. What can we offer? There are so many larger countries that hardly do anything.”

4.4.2 Step 2: Tam-tam phase

People choose the wrong solutions

A few residents wondered whether the right alternative has been chosen. One resident indicated the following: “Yes, I want to do it. I’d like to do something, only then I’d rather choose hydrogen. But not with boilers and all that nonsense, because that doesn’t work. Sorry to say it, but that’s how I see it. In itself good, but then we have to come up with good alternatives. Well, the simplest thing is that our natural gas network is already here and it’s suitable for hydrogen. My boiler can be modified because I have a new one. And I’ve looked into that, that it can be adapted to hydrogen. And that’s the solution for me.” Another resident sees the river as a source of energy.

Fitter indicates that it will take a long time

One resident indicated that the fitter has suggested that it will take a long time. The boiler must be replaced after 18 years. The resident indicated that he will therefore simply replace the boiler.

Insufficient financial resources

A number of residents indicated that it must actually be possible to make things more sustainable. One resident expressed this as follows: “If I have to rebuild in order to get rid of the natural gas, I’ll just end up losing in tens of thousands of euros. I might lose at least 30,000 euros. I can’t afford it like that.” Another resident said: “I think that a lot of people say: if it won’t cost me anything more for 5-10 years, people will be willing to change. But it has to be financially feasible.”

One resident wondered how older residents could recoup the investment: “Look, if you’re someone of 25 or 30 and buy such a thing [heat pump], okay, then in the long run it will pay for itself. But someone who is at an advanced age will never recoup that, never.”

A few residents mentioned the high cost of a heat pump. One resident said: “So far, I’ve heard more disadvantages than advantages from users. Or you get the very expensive heat pumps that go metres deep into the ground. Then you’re talking about investments of €40,000 – I’m not going to do that.” The question was also asked as to whether heat pump technology is expensive now because the technology is still in its infancy: “At the moment, of course, it’s simply a lot of money for heat pumps and so on. I have the impression that it’s all pretty much in its infancy and that that’s why it’s really expensive. Things that are in their infancy shouldn’t be pushed through.” Several residents indicated that they think funding should be arranged. One resident said: “You have to come to an agreement financially. More than 50% of Dutch people don’t have a savings account. How are you going to coerce all these people?” One resident also mentioned a current scheme: “There are subsidies, such as the sustainability loan from SVn. If you work on your house, you get a loan from the state. A good loan, you have to pay it back.”

A resident also indicated that if the municipality co-funds, citizens will eventually notice an increase in costs. “You have to invest around 7,000 euros. The municipality is not going to pay that. Where does the municipality’s money come from? Again, from us. And what does the municipality do then? It’s just going to raise taxes.”

A solution would have to be found for less well-to-do residents: “I would like them to have a pot or something for the people who can’t afford it but who find themselves in a situation with gas. But that could be neighbourhood-oriented, couldn’t it? Because it’s also a neighbourhood...this is also a neighbourhood where quite a lot of people are on lower income or have to live on benefits.”

A number of residents indicated that the costs should not be borne by the citizen at all. One resident said: “And the bill shouldn’t lie with the citizen, which is actually the case.” Another resident said: “It must be clear that there are no extra costs for the citizen. The fact that the Netherlands wants this is fine. But each municipality, sub-municipality and province decides what is done. Those costs should not lie with the citizen. If the government imposes choices, that should not fall to the citizen but to the network administrator. TenneT must do this in a public manner.”

Questions about the feasibility in types of homes

One resident indicated that it is difficult to get the specific homes in the neighbourhood off of the natural gas: “Sixties houses in this area, Noord, that’s going to be a problem actually.” Another resident said: “I don’t think that’s possible yet. I don’t think it’s possible because there are just too many adjustments to be made to get it all done, especially in those old neighbourhoods. It’s a bit the same as with asbestos-free and that sort of thing. Someone comes up with an idea and then they put a date on it but in reality, that usually turns out not to be feasible.”

The heat pump is not mature

A few residents indicated that heat pumps are not yet working properly. One resident said of the heat pump: “And if we have to switch to such a heat pump, I wouldn’t be the first to choose it. I think all the teething troubles need to be resolved first and experience needs to be gained that will allow such a product to be further improved and become more affordable. I really wouldn’t be a frontrunner.” Another resident said: “All those houses (zero-on-the-meter) will get wet with such a water pump.”

4.4.3 *Step 3: Awareness of personal situation*

No real participation is possible

A number of residents indicated that the municipality pretends that there is a say to be had even though the plans are already ready. One resident formulated it as follows: “The municipality pretends to listen a lot to residents but they have their own vision ready. That’s because it’s very complex. It happens far too often that the municipality pretends to listen and then fails to do so.”

Electric cooking is sub-optimal

Several residents mentioned the advantages of gas cooking and indicated that electric cooking has disadvantages. One resident said: “With gas, you can easily make it strong or weak. You can’t really set that with an electric hob, or it’s either

strong or completely weak.” Another resident said: “My brother has induction but I can’t cook on it. Terrible, those plates. Different pans are needed. I thought, I’m going to enjoy my gas for another ten years, then I don’t have to get used to it. Just setting it high or low. I’ve got a really big one, 90 centimetres with a huge wok burner. I always had a very small gas stove and it wouldn’t fit with Indonesian rijsttafels (‘rice tables’), but now I’m going all out. I could also choose 75 cm but, no, I chose 90 cm.”

New way of heating is less comfortable

A number of residents felt that this new way of heating is less comfortable. One resident indicated: “I think that it’s less comfortable to cook electrically. I know from experience that it’s not comparable. Less efficiency and less comfort. Electric is not feasible, not this way.” Another resident said that he doesn’t want to give up his current way of heating with a fireplace: “There’s a fireplace in the living room. You can throw in anything – wood. It gets nice and warm. Lovely fire. Certainly very bad for the environment, but nice and warm.”

No/insufficient information from the municipality

A number of residents indicated that no/insufficient information is given by the municipality. One resident said: “Shouldn’t a municipality such as this have to come up with much more information and entice people to an information evening in order to make people enthusiastic about it and think that they can all go for it? Yes!”

A resident said that he wants to know more about the planning: “Let them [the municipality] come up with a plan [instead of a letter/conversation]. [I would like to know] how they want to proceed, how long it will take, things like that. [It’s nicer if] I myself don’t have encounter any disadvantages.”

Insufficient knowledge

Several residents indicated that they have insufficient knowledge. “I think it’s also complicated. I haven’t looked into it either. I’m not into it. I read about it and saw an electric water pump and hybrid and then I felt a bit stupid because I don’t know exactly how it works.” Another resident said: “If I knew exactly how to do it, I might do it [steps towards natural gas-free homes], but I wouldn’t know where to start right now.”

A resident said: “The hustle and bustle of the regular week stops me. If I have some time to myself, I would rather read a book or go out for dinner or watch a series than occupy myself with it using the entire internet. I have no room in my head for something like that. I don’t like spending my free time like that. Because where do you start?”

Being confronted with the amount of work and inconvenience

A couple of residents indicated that the transition to natural gas-free is causing them inconvenience: “For young families at the moment, they’re thinking about their homes being turned upside down.” Another resident said: “Look, of course I also want a cleaner planet. But when I look at my personal situation, I have a house from 1965 with wooden floors, so you have to rebuild everything, really rebuild everything before you can install it.”

Uncertainty about net metering

A resident indicated that uncertainty over net metering prevents him from taking steps.

Step 4: Choice of orientation, waiting or active resistance

No barriers to this step have been identified in this study.

4.4.4 *Step 5: Orientation up to and including 8 Living in a (partially) natural gas-free home*

No barriers to this step have been identified in this study.

4.4.5 *Step 9: Becoming an ambassador**Negative experience with heat pump*

A resident indicated that he has learned from experience that heat pumps are not sufficient. Comfort is too low compared to heating with natural gas. Hydrogen gas would be interesting for his next home.

4.5 Approach

Residents of Zwijndrecht indicated how they would like to be approached in relation to natural gas-free homes. This implicitly revealed a number of needs, such as clarity on the process, timely information and personalised information. These needs were distilled by the researchers.

Needs

- Clarity
- Timely information about the municipality's plans
- Being able to read back information afterwards
- Not too many contact moments on the doorstep
- Concrete tips for the (type of) home
- Good information
- Being able to respond to plans and timelines from the municipality
- Knowing that everyone is affected and that everyone should participate (countering the 'sucker effect')
- Low-threshold approach that suits the neighbourhood

Communication tools

- Letters
- (Collective) home visits
- Discussions
- Leaflets
- Messages in the newspaper
- Emails
- Messages in government app
- Social media
- Natural gas-free party
- News
- Adverts on TV

- Reports from knowledge institutions
- Rap from a famous Dutch rapper
- Series of interviews with experts with practical information
- Reminder (nudge) on the street to remind people on a daily basis

5 Analysis

This chapter contains an analysis of the drivers and barriers that emerged in the discussions with residents in Purmerend and Zwijndrecht. Section 5.1 contains an analysis of the entire customer journey. Sections 5.2, 5.3 and 5.4 take a closer look at the drivers and barriers during the first steps, the middle steps and the last steps of the customer journey, respectively. Section 5.5 contains an overview of things that stand out when we compare the actions of the municipalities and the opinions of residents. This section is not an evaluation of the approach in Purmerend but rather a description of possible relationships between the actions of the municipality and the drivers and barriers that play a role among residents.

5.1 The entire customer journey: attention, enablers and intention

Residents go on a nine-step customer journey to a natural gas-free home (see Chapter 2 'Customer journey to a natural gas-free home'). During these steps, various drivers and barriers play a role. Table 6 shows an overview of the number of drivers and barriers per step of the customer journey that emerged in the study in Zwijndrecht and Purmerend.

Most of the drivers and barriers emerged in Steps 1 'Becoming aware of natural gas-free as an issue' to 4 'Choice of orientation, waiting or active resistance'. This may be related to the fact that most of the residents we spoke to are still in these steps of the customer journey.

More barriers have been found than drivers. Most barriers are linked to Step 2 'Tam-tam phase'.

Table 6: Overview of the number of drivers and barriers per step of the customer journey

	Drivers	Barriers	Total
Step 1 Becoming aware of natural gas-free as an issue	8	10	18
Step 2 Tam-tam phase	3	15	18
Step 3 Awareness of personal situation	5	12	17
Step 4 Choice of orientation, waiting or active resistance	8	7	15
Step 5 Orientation	7		7
Step 6 Choosing a solution	2		2
Step 7 Living in a home with ongoing work	1	2	3
Step 8 Living in a (partly) natural gas-free home			
Step 9 Becoming an ambassador		1	1
Total	34	47	81

The following drivers and barriers have been mentioned by residents of both Purmerend and Zwijndrecht:

- Solidarity with Groningen (Step 1 Becoming aware of natural gas-free as an issue, driver)
- Ultimately, we will have to get rid of the gas (Step 1 Awareness of natural gas-free as an issue, driver).
- Natural gas is clean fuel (Step 1 Awareness of natural gas-free as an issue, barrier)
- Environmental considerations (Step 1 Awareness of natural gas-free as an issue, driver)
- Electric cooking is sub-optimal (Step 3 Awareness of personal situation, barrier)
- Increasing the value of a home (Step 5 Orientation, driver).

In Table7, the drivers and barriers have been broken down for Purmerend and Zwijndrecht. Fewer barriers and drivers were identified for Zwijndrecht than for Purmerend in the study.

Table7: Overview of the number of drivers and barriers per step of the customer journey, broken down for Zwijndrecht and Purmerend

	Barriers		Drivers	
	Purmerend	Zwijndrecht	Purmerend	Zwijndrecht
Step 1: Becoming aware of natural gas-free as an issue	7	4	6	5
Step 2: Tam-tam phase	10	5	2	1
Step 3: Awareness of personal situation	6	7	4	1
Step 4: Choice of orientation, waiting or active resistance	7		5	3
Step 5: Orientation			5	3
Step 6: Choosing a solution			1	1
Step 7: Living in a home with ongoing work	2		1	
Step 8: Living in a (partially) natural gas-free home				
Step 9: Becoming an ambassador		1		
Total	32	17	24	14

In the first step of the customer journey, drivers and barriers play a role in the 'Attention' category of the CODEC model in particular (see Section 2.2). Drivers and barriers related to the 'Enablers' category play a role in the first five steps. Drivers and barriers related to 'Intention' play a role during all steps.

A number of factors do not fit into one of 'Attention', 'Enablers' and 'Intention' categories well. These factors have to do with the trust that residents have in the way they are involved, the solutions chosen, the approach and the organisations involved. For these factors, we have defined a new category of 'Trust'. Examples of factors that fall into this category are: 'The real story is not being told', 'Feeling fooled', 'Choosing the wrong solutions' and 'No real participation is possible'. This category plays a role in Step 2 'Tam-tam phase' in particular.

The table below shows an overview of the total factors (drivers and barriers) per category.

Table8: Overview of total drivers and barriers per category (Attention, Enablers and Intention)

	Attention	Enablers	Intention	Trust	Total
Barriers	13	14	12	10	49
-Drivers	10	6	17	5	38
Total	23	20	29	15	87

The table below shows how many drivers and barriers were identified in the study for each factor in the CODEC model.

Table9: The number of drivers and barriers in this study is indicated for each factor in the CODEC model.

	Drivers	Barriers
Attention		
Presence of a reason	9	12
Breaking with habit	1	1
Enablers		
Practical feasibility	1	4
Acceptable investment	1	2
Sufficient knowledge	2	6
Certainty on legislation and policy		1
Availability on the market	2	1
Intention		
Attractive investment costs and variable costs	4	
Personal benefits	8	3
Attractive, hassle-free natural gas-free alternatives	4	8
Social comparison	1	1
Social status		
Trust*		
Trust	5	10

* Trust is not part of the CODEC model, but is included in the table for completeness.

5.2 The first steps of the customer journey (Step 1 to Step 3)

In the first step of the customer journey, 'Becoming aware of natural gas-free as an issue', there are a number of drivers (such as 'Solidarity with Groningen') and barriers ('Natural gas is a clean fuel') that play a role in both Purmerend and Zwijndrecht. Residents experience the same starting position, as it were, regardless of their place of residence.



In Step 1 'Becoming aware of natural gas-free as an issue', 'Natural gas-free is good for the environment' is one of the drivers mentioned. The environment plays a role in raising awareness among some residents. This driver no longer emerges in the next steps of the customer journey.

In opposition to this driver are barriers such as 'Natural gas is a clean fuel' and 'Natural gas-free alternatives are also polluting'. Research by the Netherlands Institute for Social Research (Steenbekkers & Scholte, september 2019) also shows that residents do not always agree with the chosen measures. The manner in which natural gas is removed still appears to be a choice for a number of residents; it is not yet evident that this will actually be the case.

In Step 1 'Awareness of natural gas-free as an issue', Step 2 'Tam-tam phase' and Step 3 'Awareness of personal situation', various barriers emerge. Residents mention more barriers than drivers. From some of these barriers, an image emerges of something which is imposed (from above) (i.e. 'The elite are imposing it on us' and 'No real participation is possible') whereas a number of residents do not have trust in the necessity of this (i.e. 'CO₂ is good for nature' and 'Natural gas is a clean fuel') nor that the right solution has been chosen (i.e. 'People choose the wrong solutions').

In the further steps of the customer journey, fewer and fewer barriers play a role. A possible explanation for this is that residents who experience barriers in Step 1 'Becoming aware of natural gas-free as an issue' through to Step 3 'Awareness of personal situation' of the customer journey do not make any progress in the customer journey. Many residents will now still be in Step 2 'Tam-tam phase'. In Zwijndrecht, for example, there are fewer initiatives aimed at residents in relation to natural gas-free neighbourhoods than there are in Purmerend-Overwhere, one of the testing ground neighbourhoods for natural gas-free. Perhaps this is also an explanation for the fact that fewer drivers and barriers emerged in Zwijndrecht than in Purmerend.

From conversations with residents in the Purmerend-Overwhere neighbourhood, improvements in the neighbourhood (e.g. in terms of quality of life or safety) are hardly ever mentioned as a consideration related to making the home natural gas-free. Nor does the municipality look for connection opportunities with (non-energy) wishes, such as the creation of more greenery in a neighbourhood. The environment is hardly mentioned as a driver either. One possible explanation is that the municipality of Purmerend, as one of the natural gas-free testing grounds, is already undergoing concrete work in the Purmerend-Overwhere neighbourhood. Other considerations (such as 'Ultimately, we will have to get rid of the gas') can therefore become a (more) important driver.

In Purmerend-Overwhere, there is talk of a specific solution: a connection to a heat network. The municipality's plans, activities and communication are responsible for the forming of opinions among residents on the transition to natural gas-free, including on the specific heat network solution. Various barriers in Step 2 'Tam-tam phase' are related to this solution, such as 'District heating is a monopoly' and 'Negative experiences with heat networks in the past'.

In Step 2 'Tam-tam phase', more barriers than drivers emerged. In addition to barriers related to the heat network solution, barriers related to other technical solutions play a role in Step 2 (such as 'People choose the wrong solutions' and 'The heat pump is not mature').

Residents do not always have an idea of what natural gas-free homes mean. The fact that it means that it is no longer possible to cook on gas is clear to many residents. In Step 3 'Awareness of personal situation', the barrier 'Electric cooking is sub-optimal' is regularly mentioned. Residents associate natural gas-free homes with no longer being able to cook on gas. They have positive experiences with cooking on gas and/or negative associations with electric cooking. For (willing) residents, it is not easy to take steps without the municipality. Barriers that play a role here are 'Having insufficient knowledge' and 'No/insufficient information from the municipality'.

5.3 Underway on the customer journey (Step 4 to Step 6)

In Step 4 'Choice of orientation, waiting or active resistance' of the customer journey, the personal situation is known and residents will consciously or unconsciously make the choice to orientate themselves towards solutions for their home, to wait (do nothing) or to actively resist natural gas-free. Some residents in Purmerend-Overwhere feel that their autonomy is under threat. They have the feeling that they cannot talk about solutions other than the heat network. Residents attach great importance to maintaining their autonomy. This also emerges in the research of (Steenbekkers & Scholte, September 2019).

In Step 4 'Choice of orientation, waiting or active resistance', a number of drivers (i.e. 'Finding somebody to listen' and 'Nice and informative residents evenings') and barriers (i.e. 'Facing it alone') emerge that usually receive less attention in policy and can possibly be seen as 'secondary issues'. However, these issues can be 'main issues' for residents.



In Step 5 'Orientation', drivers such as improvements to the home/making the home more pleasant emerge (to a limited degree). A number of residents indicate that the transition to natural gas-free can be used to refurbish the house and make it more future-proof.

The subject of 'cost'/investment' comes up at various points in the customer journey. In the first steps, this concerns issues of affordability in general. In the further steps of the customer journey (Step 4 'Choice of orientation, waiting or active resistance' and Step 5 'Orientation'), this concerns drivers and barriers around the financing of the specific solution in one's own home. Examples include the barrier 'Don't want to take out a loan' (Step 4 'Choice of orientation, waiting or active resistance') and the driver 'Cost savings through energy saving' (Step 5 'Orientation').

5.4 The final steps of the customer journey (Step 7 to Step 9)

In both neighbourhoods, there are still few experiences related to Step 7 'Living in a home with ongoing work'. It is important to avoid inconvenience at this step. For example, the following barriers are mentioned: 'Lots of people passing through' and 'Renovation was noisy'. More practical experience will lead to insights into the drivers and barriers at this step of the customer journey. The proper organisation of this step and positive word of mouth from residents can be a driver for residents who are still at earlier steps of the customer journey. Residents who have already experienced Step 7 'Living in a home with ongoing work' and Step 8 'Living in a (partially) natural gas-free home' can act as ambassadors (Step 9) for residents who are at earlier steps of the customer journey.



5.5 Analysis of the Purmerend approach per step of the customer journey

Table 10 contains an overview of the actions of the municipality of Purmerend per step of the customer journey and the different drivers and barriers indicated by the residents. In this section, we discuss issues that stand out when we compare the actions of the municipality and the opinions of residents. This section is not an evaluation of the approach in Purmerend but rather a description of the possible relationships between the actions of the municipality and the drivers and barriers that play a role among residents. We look at both possible relationships per step and things that stand out in general.

Step 1: Becoming aware of natural gas-free as an issue

The drivers and barriers experienced by residents at the first step of the customer journey both have to do with natural gas-free in a broad sense. Many of the barriers have to do with the conviction that natural gas is a clean fuel or that natural gas-free alternatives are polluting or will not deliver anything. People also wonder why we should get rid of natural gas. Incorrect or incomplete information on natural gas-free alternatives plays a role here. Drivers also include the perceived environmental friendliness of natural gas-free alternatives and solidarity with Groningen. The municipality's actions are aimed at providing information but focus on a smaller and more specific scale: natural gas-free in Purmerend Overwhere. Moreover, the municipality does not discuss whether natural gas-free alternatives would be good or useful – they discuss the how and not the why. It seems that before residents are 'ready' to think about how natural gas-free fits into their neighbourhood, they need good information and clarity on natural gas-free in general (such as why we are getting rid of natural gas in the first place and how environmentally friendly the alternatives are).

Step 2: Tam-tam phase

One clear municipal action can be discerned in this step: a residents evening during which people could eat stamppot and share their questions and concerns about natural gas-free. The aim of this action was to inform members of the municipal council of residents' feelings on natural gas-free in their neighbourhood. This action seems to fit in well with the sentiments of residents at this phase. People experience a lot of confusion and frustration. Moreover, there is not yet much trust in the approach of the Aardgasvrij Purmerend team. Residents have indicated the most barriers at this step. There are also few drivers at this step. The municipality could be more aware of the uncertainties involved in this step and develop more focused actions on this.

Step 3: Awareness of personal situation

At this step, the municipality makes personal contact with residents by means of home visits, a weekly consultation hour and an additional residents evening. What is striking is that the drivers in this phase connect with the intentions of the municipality. Residents indicate that they have trust in the team, appreciate honest communication and have insights into what awaits them. The barriers experienced by residents are more specific than in the first phases of the customer journey. People are worried about whether their home is suitable for natural gas-free and how much it will cost and are against electric cooking. This may have to do with the fact that some residents have not yet had a personal conversation. In addition, people need good information on possibilities and costs.

Step 4: Choice of orientation, waiting or active resistance

The municipality will collect declarations of intent. Residents will indicate in this declaration whether or not they are open to a natural gas-free home. Important barriers have to do with the feeling of having little choice or not being involved in the process. Personal considerations, such as being on their own, also play a role. Drivers concern a positive experience of the process, such as finding somebody to listen or the nice residents evenings. Ultimately, the vast majority of the residents filled in a positive declaration of intent in the pilot. In this phase, it is important to pay sufficient attention to what the moment of decision-making means to residents so that they can make a well-considered decision.

Step 5: Orientation

In Step 5 of the customer journey, we did not find any concrete actions from the municipality.

Step 6: Choosing a solution

In Step 6 of the customer journey, we did not find any concrete actions from the municipality.

Step 7: Living in a home with ongoing work

The municipality is starting natural gas-free work activities. There are only a few residents who already have to deal with renovations to their homes. The work activities start outside of the home on the street. People like the fact that the street is only opened up once. A tenant (probably not living in the pilot neighbourhood) who already has a natural gas-free home indicated that the renovation was noisy and that many people passed through. However, it is difficult to say anything about the municipality's approach because of the limited data.

Step 8: Living in a (partially) natural gas-free home and Step 9: Becoming an ambassador

In October, the first natural gas-free home was unveiled. However, this event fell after the study's final point of data collection.

Table10: The actions of the municipality of Purmerend and the different drivers and barriers indicated by residents per step of the customer journey

Step in customer journey	Actions	Barrier	Driver
Step 1: Becoming aware of natural gas-free as an issue	<ul style="list-style-type: none"> – Letter to residents on delay to sewage system replacement (O13) – Letter to residents on combining sewage system replacement with natural gas-free 3. Letter to residents of parts of the neighbourhood on the combination of sewage system and natural gas-free 4. Letter to pilot residents: invitation to residents meeting (O14, U4, O11, P2, U1) – Residents meeting: plans of the municipality explained (U5, O4, O8, O1, O10) – Letter to pilot residents: invitation to residents meeting (O14, U4, O11, P2, U1) 	<ul style="list-style-type: none"> – CO₂ is good for nature – No intrinsic motivation or scepticism about natural gas-free plans – The elite are imposing it on us – Natural gas is a clean fuel – Natural gas-free is not the most important problem – Natural gas-free alternatives are also polluting – Natural gas is imbued with (geopolitical) interests 	<ul style="list-style-type: none"> – Ultimately, we have to get rid of the gas – Solidarity with Groningen – Environmental considerations – Rectify bad decisions in the past – Higher gas price (in the future) – Natural gas-free is safer
Step 2: Tam-tam phase	<ul style="list-style-type: none"> – Stampot evening: residents write questions and concerns on tablecloths. These are presented to the municipality (U6). 	<ul style="list-style-type: none"> – Feeling fooled – No confidence that heat networks can become profitable – Clumsy approach of Aardgasvrij (at the start of the project) – District heating is a monopoly – No trust in suppliers – District heating is not sustainable – Negative experiences with heat networks in the past – Heat pump makes a lot of noise in the home – Leads to polarisation – Limit natural gas-free to new construction 	<ul style="list-style-type: none"> – Openness to renewal – Experience of a like-minded individual
Step 3: Awareness of personal situation	<ul style="list-style-type: none"> – Home visits are made by the Aardgasvrij Purmerend team (O14). – Weekly consultation hour on district heating in 	<ul style="list-style-type: none"> – Does not fit in with phase of life (too little time/money) – Electric cooking is sub-optimal 	<ul style="list-style-type: none"> – Honest communication – Personal approach – Trust in team/approach of Aardgasvrij

Step in customer journey	Actions	Barrier	Driver
	<p>Purmerend: insights into their energy costs when residents switch to district heating (-).</p> <ul style="list-style-type: none"> - The team plans discussions with other residents in pilot (-). - Reports from home visits (U1). - Residents evening with explanation of B&W decision and follow-up steps (O16). - Investigation into where the supply system should be placed: in the attic (-). - Kick-off of testing ground: end of the possibility for a home visit (O9). - First testing ground residents discussions (O17, O18). 	<ul style="list-style-type: none"> - Uncertainty about costs - Misunderstandings and limited knowledge about the chosen alternative - Uncertainty about what it means for the home (especially in flats) - Dependency on a housing association 	<ul style="list-style-type: none"> - Knowing what's ahead
Step 4: Choice of orientation, waiting or active resistance	<ul style="list-style-type: none"> - Collect declarations of intent in pilot (-). 	<ul style="list-style-type: none"> - No room to explore solutions other than the heat network - The decision has already been taken - Municipality must first clean up the neighbourhood - Feeling of not having a choice - Don't want to take out a loan - Facing it alone (as an elderly individual) - One's own input on technical (im)possibilities are not heard 	<ul style="list-style-type: none"> - Finding somebody to listen - Nice and informative residents evenings - Can absorb financial setbacks - Able to free up enough time - District heating is the only option for poorly insulated homes
Step 5: Orientation			<ul style="list-style-type: none"> - Involving reliable professionals in the process - No concerns about broken central heating - Refurbishing and making homes more future-proof - Increase in the value of a home - Good examples of induction cooking
Step 6: Choosing a solution			<ul style="list-style-type: none"> - All costs reimbursed by the municipality (pilot neighbourhood) or probably covered to a large extent by the municipality (testing ground)

Step in customer journey	Actions	Barrier	Driver
Step 7: Living in a house with ongoing work	<ul style="list-style-type: none"> – Work activities begin both outside and inside of the homes (pilot) (O6, O3, O15, O11). 	<ul style="list-style-type: none"> – Renovations were noisy – Lots of people passing through 	<ul style="list-style-type: none"> – Street is only opened up once
Step 8: Living in a (partially) natural gas-free home and Step 9: Becoming an ambassador	<ul style="list-style-type: none"> – First home in the pilot is off of the gas (9 Oct. 2019). Around the same time, the rest of the first block also gets off of the gas (O7). 		

6 Conclusions and recommendations

6.1 Conclusions

6.1.1 *Drivers and barriers at the different steps of the customer journey*

Making a neighbourhood natural gas-free is a process in which residents go through different steps individually. This process begins with 'Becoming aware of natural gas-free as an issue' (Step 1) and ends with 'Becoming an ambassador' (Step 9). Residents find themselves at different steps of the customer journey. They can get stuck at each step if there is not enough of a reason to move on to the next one. The distribution of drivers and barriers across the different steps of the customer journey provides starting points on the type of information and support that residents need.

Attention to the earthquakes in Groningen, the decision to discontinue gas production in Groningen and climate change have all contributed to residents becoming aware of the natural gas-free issue. Residents in this study consider it necessary to make the neighbourhood natural gas-free. This can be a driver if this 'must' stems from a felt responsibility for the environment and sympathy with residents in Groningen. It can also be a barrier if it is felt by residents to be an obligation imposed by the government while they themselves are not convinced of the necessity. For example, residents may regard natural gas as a clean fuel, comment on alternatives to natural gas-free or wonder why the Netherlands (as a small country) should take steps while Germany, for instance, is opting for natural gas. There is still a lack of clarity for residents on the chosen solution direction. This ambiguity plays a role in Step 1 'Becoming aware of natural gas-free as an issue' and Step 2 'Tam-tam phase'. Residents have all kinds of ideas and opinions on natural gas and the chosen solutions. From the interviews, it emerges that it is mostly negative images that circulate in these steps.

A pilot was started in Purmerend a number of years ago and a 'Natural Gas-Free Neighbourhoods' testing ground is now taking place in Purmerend. In Zwijndrecht, fewer initiatives have taken place in this area. The residents in Purmerend and Zwijndrecht are at different stages of the customer journey. In the first step in particular, a number of the same drivers and barriers emerge.

In Purmerend, an intensive process has been started to involve residents. This may explain why residents in Purmerend have slightly more ideas about the consequences for their personal situation and are orientating themselves towards the options while this is less the case in Zwijndrecht.

Possibilities to improve the neighbourhood or the home through the transition to natural gas-free are hardly mentioned by residents. In Zwijndrecht, the possibility of improving the neighbourhood is occasionally mentioned. This hardly ever happens in Purmerend. In general, the decision on whether or not to switch to a natural gas-free home is a decision made by the residents based on their personal situation and their home.

Behaviour comes about from Attention, Enablers and Intention. The CODEC model helps to identify which categories drivers and barriers are related to. Through this, it

becomes clear which drivers need to be addressed and which barriers need to be removed so that residents will pay attention to natural gas-free homes, are able to make their homes natural gas-free and are willing to do so. In this way, a neighbourhood approach to natural gas-free homes can ensure that Attention, Enablers and Intention all receive sufficient attention.

6.1.2 *The role of information and trust*

Interviews in the neighbourhoods studied show that trust plays an important role in the opinions and choices of residents. In the 'Tam-tam phase', a lack of trust is an important barrier for residents to participate in the neighbourhood approach. This can be a concrete lack of trust in the heat supplier or the approach chosen by the municipality, but also more general such as 'feeling fooled'.

Although the sample is too small to draw definitive conclusions, it seems that a more intensive, personal approach in the next steps of the customer journey leads to more trust. In contrast to Zwijndrecht, trust is also mentioned as a driver for participation in the neighbourhood approach in Purmerend. For example, interviewees mention 'honest communication', 'personal approach' and 'trust in the Aardgasvrij team' as positive aspects of the neighbourhood approach. This applies to residents who are already further along in the customer journey and who have had conversations with the team about their personal situation. In the street interviews in Purmerend and Zwijndrecht, where interviewees were probably less informed, trust is not mentioned as a positive point.

6.1.3 *Costs and hassles*

Alongside other studies, such as those of the Netherlands Institute for Social Research (Steenbekkers & Scholte, september 2019), this research shows that costs play an important role for residents. Costs come up in all kinds of forms in the answers given by residents: as a barrier because people are worried about costs and are uncertain about them or because they think that costs will never be recouped. But costs (and benefits) can also be a driver. In Purmerend, (part of) the costs will be reimbursed in the pilot neighbourhood. For residents in that neighbourhood, there is a 'now or never' feeling. Not participating in the pilot now probably means that the costs will not be reimbursed later on. Residents also cite an increase in the value of the home and savings on energy bills as important drivers for becoming natural gas-free.

For residents who have not yet received a concrete offer, the uncertainty regarding the costs also leads to concerns. Is it not going to cost much and can I pay for it? Will I ever recoup the investment?

In addition to costs, the organisation and all of the hassles involved are important concerns for residents. The mess – "all those people passing through" - is something that scares people away.

6.1.4 *Secondary issues are often the main issues*

During the discussions with residents, various subjects that receive little attention in government texts, such as the Climate Agreement, came to the fore. However, these 'secondary issues' are often 'main issues' for residents. One resident liked to go to residents evenings because it was fun. Another resident is just too busy with other things to put time and effort into making the home natural gas-free. Yet another is reluctant because she feels that she's out on her own after the death of her husband. All of these are not subjects for which policy instruments have been devised. It is also very difficult to set up a policy for this because these aspects are very specific to each resident.

It is also often not (only) about the content of the offer but also about the way in which it is presented. While most residents like to receive a concrete offer, there are also those who have already studied their options themselves. One resident did not feel that he was taken seriously when his own technical input was not heard by the neighbourhood team.

6.2 Recommendations

Develop a neighbourhood approach that responds to the different steps of the customer journey towards natural gas-free homes.

Residents find themselves at different steps of the customer journey. The barriers and drivers that residents experience are also different at each step of the customer journey. By addressing this, residents can be assisted throughout the customer journey.

Ensure that residents pay attention to natural gas-free, have the opportunity to live natural gas-free and want to live natural gas-free.

How homeowners make choices about making their homes natural gas-free depends on many factors. To visualise these factors, we have used the COConsumer DECisions Comprehended (CODEC) model as a framework. We linked the drivers and barriers that emerged from the research to this model. In order for residents to move towards natural gas-free, a neighbourhood approach is needed that ensures that residents pay attention to natural gas-free, have the opportunity to live natural gas-free and want to live natural gas-free.

Based on the answers in this study, there should be a consideration of extending the CODEC model to include trust as an element in the analysis of consumer decisions.

Trust is not part of the CODEC model used in this study to analyse decision-making behaviour. Further research is needed to determine whether and how trust can be placed in the CODEC model.

Clarify the costs (and benefits) of natural gas-free and what it will mean for residents as soon as possible.

Uncertainty regarding costs leads to resistance. It is not yet possible to determine what the costs will be for every home in the Netherlands. However, agreements can be made in principle about the extent to which residents will have to incur costs themselves. The precondition that it must be possible to carry out natural gas-free in a 'costs of living-neutral' manner (Government, 2019) must be put in concrete terms. Does this mean that no household will be disadvantaged or does this principle apply to the average resident? Which subsidy measures and other financial arrangements will be put in place and under what conditions?

Support the development of relief products to reduce 'hassle'.

Various market parties are developing one-stop-shops and other relief concepts. This is important because such products can reduce an important barrier. Government support should therefore not only focus on information and cost limitation but also on practical support.

Take individual wishes and objections into account in neighbourhood approaches.

What often seems to be a secondary issue for municipalities and market parties may turn out to be a key issue for residents. If this is not taken into account, it can lead to resistance.

References

- Brunsting, S., Matton, R., Tigchelaar, C., Dreijerink, L., Paradies, G., Jansen, J., & Usmani, O. (2018). *Modelling consumer decisions towards sustainable energy technology*. TNO 2018 P11304.
- CBS. (2017, Juli 31). *Kerncijfers Wijken en Buurten 2017*. Opgehaald van CBS: <https://www.cbs.nl/nl-nl/dossier/nederland-regionaal/wijk-en-buurtstatistieken>
- Dijkstra, J. (2019). *Lessons learned*. Purmerend.
- Gasvrij Purmerend. (2019). *FAQ Gasvrij Purmerend*. Opgehaald van <https://www.purmerendgasvrij.nl/nl/faq/>
- Kanne, P., Hofweegen, T. v., Kooiman, K., & Engeland, W. v. (2019). *Duurzaam denken is nog niet duurzaam doen*. I&O research.
- Programma Aardgasvrije Wijken. (2019, september 20). *Proeftuinen*. Opgehaald van Programma Aardgasvrije Wijken: www.aardgasvrijewijken.nl
- Rijksoverheid. (2019, september 25). *Maatregelen Klimaatakkoord per sector*. Opgehaald van Rijksoverheid: <https://www.rijksoverheid.nl/onderwerpen/klimaatakkoord/maatregelen-klimaatakkoord-per-sector>
- Rijksoverheid. (2019, maart 20). *Rijksoverheid.nl*. Opgehaald van Deelnemende gemeenten aardgasvrije wijken: <https://www.rijksoverheid.nl/onderwerpen/aardgasvrije-wijken/deelnemende-gemeenten-aardgasvrij-maken>
- Rogers, E. (2003). *Diffusion of Innovations (5th edition)*. New York: The Free Press.
- Steenbekkers, A., & Scholte, S. (september 2019). *Onder de pannen zonder gas? Woningeigenaren en hun afwegingen voor aardgasvrije alternatieven*. Sociaal en Cultureel Planbureau.
- Thaler, R. (2008). Mental Accounting and Consumer Choice. *Marketing Science Journal*, 27 (1), pp. 15-25.
- Tigchelaar, C., Kooger, R., Lidth de Jeude, M., Niessink, R., Koning, N. d., & Paradies, G. (2019). *Alle bestaande woningen aardgasvrij in 2050. Wie moet wat, wanneer en hoe doen?* Amsterdam: TNO 2019 P10909.
- Vries, G. d., Kooger, R., & Hermans, L. (2019). *Factsheet Groen en Gemak*. TNO en partners.
- VVD, CDA, D66 en ChristenUnie. (2017, oktober 10). *Vertrouwen in de toekomst, regeerakkoord 2017-2021*. Den Haag: Rijksoverheid.

A The Purmerend approach

The sections below contain a description of the activities that took place in the pilot and testing ground in Purmerend from 2016 to the present (November 2019). The principles, starting points or operational tools which were applied are indicated per activity.

2016

2016: redevelopment plan for sewage system replacement

As part of a participatory process, residents create a redevelopment plan for the replacement of the sewerage system.

2017

May 2017: strengthening of the Gasvrij Purmerend team

Jaspart Verplanke and Joke Dijkstra join the Gasvrij Purmerend team to help the council to roll out the heat network. A project leader (sustainability policy officer) is already at work. The management asks Jaspart to steer her. Joke gets to work on communication and participation.

Operational 12 - Working with a multidisciplinary team: A transition to a natural gas-free neighbourhood requires knowledge and experience from various disciplines, such as communication, technology, policymaking, legal, financial and project management. Regardless of the discipline, the resident is the starting point for each team member. Points of attention are the right combination of characters in the team and the interactions between the team members. The structure of characters within the team is an important success factor.

May 2017: letter on delay to sewage system replacement

A letter is sent to all residents in the neighbourhood (testing ground and pilot). This letter indicates that the replacement of the sewerage system will be delayed because the municipality will first examine whether the sewerage system replacement can be combined with making the neighbourhood natural gas-free.

Operational 13 - Connecting with other work activities: The municipality connects the transition to natural gas-free with the replacement of the sewerage system. For both the municipality and residents, this offers the practical advantage that a street only needs to be opened up once.

The municipality does not look for connection opportunities with (non-energy) wishes, such as creating more greenery in a neighbourhood. In the neighbourhood in question in Purmerend, many residents do not consider more greenery important either. On the contrary, they feel the need for more parking spaces.

September 2017: letter on combining the replacement sewerage system with natural gas-free

All residents receive a letter. The message of this letter is that the sewerage system replacement will indeed be combined with making the neighbourhood natural gas-

free. A start will be made with the houses around Prisma primary school because the sewage system will have to be replaced there first.

Two different letters are sent to the following two groups of residents:

- Letter to the residents of parts of the neighbourhood indicating that the sewage system replacement will be combined with making the neighbourhood natural-gas free.
- Letter to the residents in the area around Prisma primary school (pilot letter) indicating that the sewage replacement will be combined with making the neighbourhood natural gas-free and that this will begin with the homes of these residents. The letter also contains an invitation to a meeting in Tabor Church in October, during which the plan will be explained.

Starting point 4 - Everyone at the same time in the same way: If there is something which concerns every resident, it is essential that they all hear or read the same thing in the same way on the same day. After the letter has been sent to all residents, a meeting will be organised for the residents for the near future (about ten days after the letter). In this way, we can ensure that all questions that residents have will actually reach the municipality (see next point).

Operational 11 - Be part of the conversation: If residents have received a letter, all sorts of questions, reactions and perhaps concerns will be raised. It's fine for the residents to talk about the contents of the letter but the municipality should make sure that it is part of the conversation. If a resident thinks that something is a bad idea or has questions or concerns, for example, it will not help if he/she talks about it with others at a birthday party. These ideas, worries and questions from residents should be brought to the municipality so that it can do something with them. Personal communication, such as in small groups during meetings, is therefore very important.

Principle 2 - Reconsider in order to arrive at an informed decision: Officials go through several steps when making policy. During these steps, questions – such as 'how should this be done?', 'how do we get this through the council?', 'who is going to pay for it?', etc. – all play a role. A certain direction is considered and then reconsidered. Policy creation consists of thinking, doing, making mistakes and fixing them.

The questions that arise during the steps are often discussed by the team during the 'croquette meeting'. (During this lunch meeting, a croquette is eaten). These meetings are still taking place. However, the content is being straightened out more and more as things have already become clear or steps have already been taken.

The resident – like the officials working on the transition to natural gas-free neighbourhoods – must have time to consider and reconsider. These considerations play a role for the resident at the micro-level: the level of their own home. It is therefore important to involve residents early so that they too have sufficient time to discuss issues with family, friends and neighbours and are able to consider and reconsider choices.

Starting point 1 - The neighbourly relationship. By approaching residents early, this period can also be used to build up the relationship between the municipality and the residents. By becoming embedded within the neighbourhood and getting boots on the ground, work is done to win the hearts and minds of residents.

October 2017: residents meeting

95 residents are invited to a meeting in Tabor Church. Approximately 60 residents attend. During this meeting, programme manager Jaspert Verplanke explains what the municipality of Purmerend is planning. A number of residents wonder why this concerns them as it takes them by surprise. There are also local residents, especially younger ones, who see the inevitability of the coming energy transition.²

A record is kept of who took part in the meeting. This way, the municipality knows who they have never spoken to and therefore whom they should contact personally.

Starting point 5 - Not why but how: The municipality does not take part in the 'usefulness and necessity' discussion. The consideration which causes a resident to participate is of no importance to the municipality. If you start a discussion about the 'why', you can fall into a discussion with residents. The municipality refers to the government's decision in its contact moments with residents. It also indicates that it supports this decision. The municipality does not put forward arguments such as it being better for the environment. This can raise counter-arguments or questions, such as "and is your own house already natural gas-free?"

In the 'croquette meetings', the (potential) counter-arguments of residents are discussed on a regular basis. If a resident indicates that he or she does not believe in melting ice caps, for example, how do you answer that?

The municipality listens to what the residents indicate without putting forward any counter-arguments. People can struggle with change because they have to say goodbye to a future they had in mind. Such a future could be, for example, "in ten years' time, I'll still be cooking on gas." Or "in ten years, I'll replace my central heating." If a municipality then says, "in 10 years' time, you'll be using induction cooking", the municipality will be changing the expected future for that resident.

Operational 4 - Listen carefully: Any ideas, concerns, (negative) expectations or experiences of residents can help you to develop and implement effective policies.

Operational 8 - Stay close: Remove barriers for residents that would make it impossible for them to come to a meeting. Help the elderly home through the dark. Offer to pick them up.

Operational 1 - Introduce yourself: Municipalities ask a lot from residents when they invite them to a meeting. For example, the resident has to arrange a babysitter, go out in the dark or travel down a somewhat difficult street with the rollator. (See the previous point 'Operational - Stay close'). For municipal officials, this is part of their job; their (overtime) hours are paid. Residents who invest their own time must

² <https://www.binnenlandsbestuur.nl/ruimte-en-milieu/achtergrond/achtergrond/vertrouwen-winnen-in-de-gasinjetstraat.9591157.lynx>

be treated with respect. All residents receive a personal handshake from the team upon arrival. Team members introduce themselves to the residents and are addressable by their first name. Team members carefully note down questions to which they do not immediately have an answer and come back to this later.

Operational 10 - Keep track of everything: Make sure you accurately record the contact moments which have taken place with a resident.

November 2, 2017: council decision

The council states that it is prepared to provide a budget for the pilot if 50% of the residents want to participate.

9 November 2017: residents evening on council decision

On 9 November, a second residents evening takes place in the neighbourhood school of Purmerend Overwhere. There are 80 participants.

During this meeting, it is explained that the council has indicated that it wants to free up a budget for a natural gas-free pilot if 50% of the residents want to participate. Residents will have to indicate their willingness to participate by means of a declaration of intent. This declaration of intent is not discussed during this residents evening.

The team says no one is required to participate. For the people who want gas, the network operator will build new gas pipelines.³

The municipality does not yet know what needs to be done in all homes. The residents evening begins with a presentation. There is then a walk-in section in which as much information as possible will be given about the various natural gas-free options. Stadsverwarming Purmerend and Duurzaam Bouwloket ('Sustainable Construction Office') will take care of this part. The municipality asks them to show what is possible. They explain exactly what all-electric and the heat network mean and how homes can be made more sustainable. The costs of the heat network are not yet clear. Residents ask many questions about the monthly costs of district heating.

The municipality of Purmerend indicates that it understands if residents first want to know more before they say yes to natural gas-free. The municipality therefore wants to make home visits to all residents. During the home visits, they identify what it would mean if the house in question were to switch to a heat network or a heat pump (the two available natural gas-free alternatives). Residents who wish to make an appointment for a home visit can hand in a note during the residents evening.

These residents would like to know where they stand.

Starting point 6 - Involve residents directly, even if you still have questions of your own: The municipality does not yet know what the solutions will look like in the home. The municipality also communicates honestly with residents about this.

³ <https://www.binnenlandsbestuur.nl/ruimte-en-milieu/achtergrond/achtergrond/vertrouwen-winnen-in-de-gasinjetstraat.9591157.lynkx>

Sometimes, the municipality is unaware of the fact that it already knows a lot. Residents also know a lot, such as regarding the situation in their home. It is therefore important to talk to one another and share this information. One point of attention is to do this in workable numbers. Avoid all kinds of plenary discussions. See the next operational point.

Operational 9 - Keep it at workable numbers: At a plenary meeting, there is a good chance that a few dominant people ('shouters') will determine the atmosphere or that time will be spent on plenary discussions in which all participants are by no means interested. A plenary meeting is therefore followed by a walk-in session.

November 2017 - March 2018: home visits

Home visits are made by a technical employee of Duurzaam Bouwloket and an employee of the Gasvrij Purmerend team. The home visits last approximately one hour. They are scheduled in the evenings in order to minimise the burden on residents.

The home visits are all at the request of residents. The atmosphere during the home visits is neutral to fairly positive. During the home visits, the employees look not only at the living room but also at other rooms. Residents have no problem with this.

Operational 14 - Capacity to schedule all appointments: An employee is hired to schedule home visits. Scheduling home visits is quite a job. The agendas of the residents and the employees of the team have to be taken into account. Also, there should not be too many appointments on one day and the appointments should take place in the evening.

2018

February 2018: Gasvrij Purmerend team moves into home

The team moves into a home on Gasinjetstraat and is thus embedded in the neighbourhood. Previously, the team worked at the town hall. The home on Gasinjetstraat offers the following advantages:

- Better visibility to residents
- Being able to try out structural modifications in an actual home. This also gives a better sense of what interventions in a home mean, such as the size of certain equipment in relation to the dimensions of the home. The home on Gasinjetstraat is comparable to many homes that will become natural gas-free
- Getting away from the cycle of meetings at the town hall

Operational 2 - Living in the neighbourhood: Make sure that you live in the neighbourhood where it's all happening, preferably in a home so that techniques can be tried out and you can get a sense of what certain interventions could mean in this type of home.

End of February 2018: weekly consultation hour

A weekly consultation hour with Stadsverwarming Purmerend begins. Residents can take their annual bills with them and gain insights into their energy costs when they switch to district heating. Approximately 50 to 60 residents have done this.

23 Feb 2018: stampot evening

A stampot evening takes place at Prisma primary school. Residents of the pilot are invited. There is mulled wine, hot chocolate, three kinds of stampot and dessert. Residents sit at long tables with tablecloths in the house style of Aardgasvrij Purmerend. The programme manager gives a presentation on the progress. Residents can then write down on the tablecloths what bothers them, what they like and what else they would like to know about natural gas-free. These tablecloths were later presented to the members of the municipal council.

Starting point 6 - Involve residents directly, even if you still have questions of your own: Not everything is clear at this point regarding the pilot. This isn't a problem. The Gasvrij Purmerend team communicates openly on this.

March 2018: on the doorstep

In the evening, the Gasvrij Purmerend team visits residents who have not yet had a home visit in order to make appointments. After the first voluntary home visits, the secretary has scheduled the other home visits. Ultimately, home visits will take place in about 80 of the 95 homes. Approximately 15 residents will not participate in a home visit. The reasons for this are diverse. For example, residents have no need for it, are not interested because the home is for sale or have social problems.

March 2018: reports following home visits

A report has been made of every home visit. The team checks carefully whether these reports are correct. In order to create trust among residents, it is very important that the report is correct down to the smallest detail. If, for example, a mistake has been made in the address or the spelling of a name, residents will soon no longer trust the content of the report either.

The report contains data on the residents, the person who made the home visit, data on the home (including the degree of insulation), possible solutions for the home (district heating versus heat pump), the costs of the different solutions and the preference of the resident. It also indicates that residents who opt for a heat pump will only be reimbursed the basic amount available for connection to the heat network.

These reports are delivered to the residents together with a letter. The letter also contains information about the consultation hour on Gasinjetstraat and the request to submit the declaration of intent within two weeks.

Starting point 1 - The neighbourly relationship: It is important that residents have trust in the municipality when they are going through a process towards natural gas-free homes alongside them. In order to build and maintain this trust, it is important, among other things, that all information that you share – even seemingly trivial details – is correct. This is why the team checks the reports very carefully.

March - May 2018: collection of declarations of intent

The secretariat calls all residents to remind them to hand in the declarations of intent on time. The team also goes door to door. On the declaration of intent, residents indicate whether or not they intend to participate in the testing ground. They do not have to provide a motivation if they do not want to participate.

Approximately 60 to 70% of the residents sign a positive declaration of intent.

April - May 2018: writing the council proposal and applying for the testing ground

In April and May, the team writes the council proposal so that the Municipal Executive (B&W) can take a decision on it in the first half of June. For this council proposal, it is necessary to have the completed declarations of intent. After all, the council has given a condition that 50% of the residents of the intended pilot must want to participate in this pilot. After the B&W has formed an agreement, the municipal council must make a decision at the end of June (before the summer recess).

12 June 2018: residents evening with explanation of the B&W's decision

The team informs residents of the B&W's decision and explains the next steps. One of these follow-up steps is a committee meeting within the council.

Operational 16 - Keeping residents informed: Not all developments taking place are visible to residents. It may be important for them to hear these developments. Even if nothing has really happened, this fact (and the reasons why) may be good for residents to know.

14 June 2018: committee meeting within the council

Residents can speak at the committee meeting within the council. One resident does so. This resident is natural gas-free. There are about 20 residents in the room.

28 June 2018: council decision

The council takes a positive decision on the implementation of the pilot. The team receives many compliments on the approach taken. Residents have expressed a positive opinion of the course of events and the council has heard this.

September 2018: approval of testing ground application

The testing ground application is approved in September 2018. This will be officially communicated at the beginning of October. The municipality has received a subsidy of seven million for the testing ground.

October 2018: Decision - supply system in meter cupboard is not acceptable

Finding a suitable technical solution is complex. In newly built houses, the supply system is usually placed in the meter cupboard. Stadsverwarming Purmerend also assumes that the supply system will be installed in the meter cupboard in the pilot. In existing homes, however, the meter cupboard is too small for the supply system. A conversion of the meter cupboard is then necessary. Enlarging the meter cupboard is difficult or not possible for some residents. For example, a rollator can no longer pass through the door.

Residents and the Gasvrij Purmerend team wonder whether the supply system can be placed in the attic. However, this is too dangerous according to Stadsverwarming Purmerend.

We are looking for a system in which the work activities indoors can be done quickly. If this is not possible then residents will have to spend a week elsewhere, such as in a holiday park.

There will be a long-lasting investigation into whether the supply system can still be placed in the meter cupboard. The heat will enter the home through a jacket pipe. This must have a certain bend in order to enter the home under the meter cupboard. This would mean that a hole of about five metres wide and three metres deep would have to be dug in all of the front gardens.

There appears to be asbestos in the crawl spaces of homes. The steering group⁴ decides that the solution with the supply system in the meter cupboard is not acceptable. If no other solution is found, the project will be terminated. Stadsverwarming searches for another solution and finds one in which the supply system can be placed in the attic. A riser pipe will be used. This goes up between two front doors and enters the home in the attic. As a result, the supply system can be placed on the spot where the old boiler was.

2019

March 26, 2019: kick-off of the testing ground

Half a year after the approval of the testing ground, the kick-off takes place in Tabor Church.⁵ At the meeting, residents are informed about district heating, the heat network and other options. The municipality gives a presentation on what will happen in the near future and the possibilities open to residents. In addition, the municipality indicates that it does not yet know what this will cost.

Following the presentations, participants can ask questions on the sewage system, district heating and redevelopment to a number of experts from Duurzaam Bouwloket and the Gasvrij Purmerend team. Residents who want to know how much it will cost to make their home gas-free can sign up for a home visit.

The plan is to bring the whole testing ground together twice a year and to meet in smaller groups in between. Two important topics are:

- How much residents have to pay: this depends, among other things, on the business case, which is partly determined by the participation of the housing association.
- Neighbourhood planning: who's turn is it and when?

⁴ The steering group meets once every six weeks. The steering group consists of the management of Stadsverwarming and of the housing association, the aldermen of Purmerend and Beemster, the spatial domain management, the programme manager and a few members of the Gasvrij Purmerend team.

⁵ See also the 'Kick-off proeftuin' film at <https://www.purmerendgasvrij.nl/>.

Operational 9 - Stick to workable numbers: As an organisation, you yourself are an important factor in the creation of the desired atmosphere and the standards of decency during meetings. It is important to be able to look residents in the eye. You should therefore make sure that you keep the plenary part of meetings short and create sufficient space for discussion in small groups. This way, shouters will have less space. The way in which you yourself approach residents is also very important. Introduce yourself. Hold out your hand. Indicate that you are happy that the people have come to the meeting. Indicate that you have time for everybody later in the programme and make sure that there are several colleagues present who can talk to the residents. During the kick-off of the testing ground, there will be more than enough colleagues present. Clearly indicate that there is no room for this in the plenary part, however.

June 2019 - now: work activities

The work activities begin both outside and inside of the homes. When planning the work activities, the personal situation of the residents will be taken into account as much as possible.

Operational 6 - It is not our planning but their planning: Connect as much as possible to the plans of residents. For example, make sure that the work activities can be brought forward for a resident who is pregnant and would like the work to be carried out before the delivery.

Operational 3 – Help out: Some people have an attic full of belongings. Not all of these people are able to clear the attic themselves. The team then helps with this.

Operational 15 - Offer information in an accessible way: A diary has been created explaining all of the work activities carried out in the home. The diary also states what these activities mean in concrete terms for residents. If there is no electricity because of the work, then there will also be no Wi-Fi for a while and clocks may be running late. This diary has not yet been used in practice.

Operational 11 - Be part of the conversation: A resident has already signed all of the papers but has started to have doubts. This resident feels under pressure. The resident joins the team on Gasinjetstraat and talks to them for an hour. The team emphasises that participation is the resident's own choice. In this way, the team takes the pressure off of the resident and removes the doubts. The resident decides to participate again.

June - July 2019: first testing ground interviews with residents

A number of conversations take place with residents who signed up for this during the kick-off of the testing ground.

Operational 17 - Create a data checklist: We are working on a form and a checklist on which all of the necessary items (technical data about the home, information about residents, etc.) that need to be asked of residents are listed. In the pilot, residents were called regularly because some additional information was needed.

Operational 18 - Offer a transition service: A transition service to district heating is also being developed. There is currently no transition service from gas to district heating.

9 October 2019: visit of the Director-General for Housing

The Director-General of Housing visits Purmerend. A terraced house on Van Goor Hinloopenstraat is the first to be officially declared 'gas-free'. The boiler has been permanently shut down and the district heating has been connected. Together with the responsible alderman, Director-General for Housing Paul van Meekeren sticks a sign with the text 'gas-free' on the window of this terraced house.

Around 9 October, the first connections to district heating also take place. This is the first block to get rid of gas within the testing ground.

Operational 7 - Really put the resident centre stage: Let residents play an important role in the programme if a dignitary passes by. It's always about the work in their home. Let them have their say