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Sun, Citizens and Sustainable Businesses

An ex-ante analysis of the willingness of citizens to participate in
Waternet's solar panel project



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Abstract

Moving from grey energy to green energy presents citizens the opportunity to participate in the energy production process. They can do so by investing in green energy production installations. Although citizens can decide to individually invest in these installations, organisations may invite citizens to collaborate in a local green energy project. If an organisation starts a green energy project and invites citizens this project contains citizen participation. The success of these projects is highly dependent on the 'willingness to participate' of citizens.

Although scientific research into willingness to participate has been conducted, a knowledge gap exists. The aspects that increase (drivers) and decrease (barriers) citizens' willingness to participate have never been researched in one project. Instead, in all studies a small number of drivers and barriers were researched in different projects, which makes it difficult to compare their impact. This research aims to help fill this gap, by researching the drivers and barriers in one case study. This is the citizen participation solar panel project which Waternet currently develops.

The knowledge gap in scientific research is also a knowledge gap for Waternet, as they do not know how willing citizens will be to participate in their project. Next to filling the scientific knowledge gap, this research therefore also aims to analyse the influence of these drivers and barriers in Waternet's project and present recommendations based on this. It thereby helps Waternet to create a successful project. The central research question of this thesis is the following:

"Under which conditions can citizens be expected to be willing to participate in business initiated local solar panel projects, such as the project of Waternet?"

A total of 28 drivers and 21 barriers which potentially influence citizens' willingness to participate was identified in this research, based on scientific literature, a pilot project of Waternet and reasoning. After testing these drivers and barriers in a survey it was found that only 14 drivers and 5 barriers influence citizens' willingness to participate in local solar panel projects in practice.

It is clear Waternet should not expect a high willingness to participate. Waternet only uses two drivers in practice in the project as it is currently planned, and no barriers in practice are tackled. However, most can (partly) be used or tackled by Waternet in their project. By incorporating the drivers and barriers citizens' willingness to participate will increase, making it more likely this project becomes successful.

Preface

This master's thesis is the 'grand finale' of my master's programme. It is the result of eight months of research as a student of the research master Sustainable Development at Utrecht University and as an intern at Waternet. It focusses on the willingness to participate of citizens in business initiated local solar panel projects. More specifically, it focusses on Waternet's citizen participation solar panel project. I would like to thank everyone who in some way contributed to this thesis.

My special thanks go out to the following people: Dr. Carel Dieperink, for his valuable feedback from an academic standpoint during the course of my thesis. Ir. Jos van der Meer, my supervisor at Waternet, for his valuable feedback, his help with the research into Waternet's solar panel projects and his supervision of my internship. Drs. Ingrid Heemskerk, Ing. Erik Kessler, Ir. Enna Klaversma and Ir. Stefan Mol for taking the time for an interview with me to discuss Waternet's solar panel projects. All respondents who were willing to fill out the questionnaire for this thesis.

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List of abbreviations

AEB	Afval Energie Bedrijf
BTW	Belasting over de Toegevoegde Waarde (VAT in English)
CO ₂	Carbon Dioxide
df	Degrees of freedom
GHG	Green House Gasses
kWh	Kilowatt hour
PV	Photovoltaic
VAT	Value Added Tax
Wp	Watt peak
ZIP code	Zone Improvement Plan code (i.e. postal codes of the United States of America)

1. Introduction

1.1. Citizen participation in local green energy projects

Electricity and heat production create over 40 per cent¹ of all CO₂ emissions associated with fuel combustion worldwide (International Energy Agency, 2013). A movement towards green energy² is therefore an important step towards solving the problem of global warming and can be seen as one of the main factors in discussions concerning sustainable development, as was also noted by Dincer (2000).

The shift from grey energy³ towards green energy may change the role of citizens in the energy production process. From a role of pure consumer citizens may become both consumer and producer. To become a producer, citizens will need to invest in a green energy production installation, such as solar panels or wind turbines (Watson et al., 2006). Citizens can invest in green energy production installations on different locations. Often, citizens decide to invest in green energy production installations on their own property and directly use (part of) the energy produced themselves, thereby replacing the energy they buy from a utility company. Citizens may even sell electricity back to the utility company. However, citizens can also decide to invest in local green energy projects that are located on a property not owned by them. Citizens are sometimes invited to participate in such a local green energy project⁴ by the government or a private company⁵. Because citizens are invited to participate in a project of an organisation (rather than the organisation carrying out the project on its own, or only in combination with other professional organisations) these projects contain '*citizen participation*'. Citizen participation is defined as "a process in which individuals take part in decision making in the institutions, programs and environments that affect them" (Florin & Wandersman, 1990, p. 43).

Citizen participation exists in multiple forms, which Arnstein (1969) ordered in a ladder of eight steps. Higher steps present citizens a greater ability to influence a project. The eight steps are (1) manipulation, (2) therapy, (3) informing, (4) consultation, (5) placation, (6) partnership, (7) delegated power and (8) citizen control. The first two steps on this ladder do not contain participation of citizens, but are instead misused under the notion of citizen participation by some companies (something which also happens in local green energy projects, according to Hoffman and High-Pippert (2010) and Irvin and Stansbury (2004)). Steps three and four allow citizens to listen to plans and have a voice (although no power of influence). Step five is similar to steps three and four, although citizens have the option to 'advise'. Citizens are only able to negotiate and engage in trade-offs with the other stakeholders on levels six, seven and eight (Arnstein, 1969). The steps are of course indicative and most citizen participation projects are situated between two steps. This is also indicated by Arnstein who states that "in the real world of people and programs, there might be 150 rungs with less sharp and 'pure' distinctions among them" (Arnstein, 1969, p. 217).

Irrespective of the level of citizen participation in a project, citizen participation in local green energy projects can be seen as a form of governance, more specifically environmental governance. Environmental governance is defined as "the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes" (Lemos

¹ 13,066.8 million tonnes of CO₂ out of a total of 31,342.3 million tonnes of CO₂ created by fuel combustion (measurements of 2011) (International Energy Agency, 2013).

² Green energy is energy that is produced from renewable resources and does not have a negative impact on the environment.

³ Grey energy refers to energy produced from fossil fuels.

⁴ The word 'project' in this thesis means 'projects in which an organisation (or multiple organisations), the government and/or multiple households are involved'. If only one household is involved, this is not considered a 'project' in this thesis.

⁵ Examples of this in the Netherlands are a swimming pool in Woerden on which solar panels will be placed which citizens can buy (Eneco, 2013) and a similar project on the soccer stadium of FC Groningen (1miljoenwatt, n.d.).

& Agrawal, 2006, p. 298). Depending on the organisation that invites the citizens in the local green energy project, it can be either a form of self-governance or interactive governance, as defined by Driessen et al. (2012). Their definitions of different types of environmental governance are based on the actors who cooperate. If citizens (defined as 'civil society' by Driessen et al. (2012)) cooperate with one or multiple governmental organisations ('the state' as defined by Driessen et al. (2012)) Driessen et al. (2012) define it as interactive governance⁶, while if one or multiple private companies ('the market' as defined by Driessen et al. (2012)) cooperate with civil society they define it as self-governance. Because the distinction between market and state is not always clear it is also possible for citizens to cooperate with a semi-governmental organisation. Because Driessen et al. (2012) do not define a specific type of environmental governance for this, this type of cooperation is situated between interactive and self-governance.

The shift citizens can make from pure energy consumer towards energy consumer and producer can be made in a number of ways⁷. In this thesis one method to make this shift is researched. This is the method in which citizens are invited by a larger organisation to participate in a local green energy project on the terrain of this organisation. In this project green energy is produced via solar panels. This is researched with both a scientific and a societal focus.

In section 1.2 the scientific focus, which concerns citizens' willingness to participate, is discussed. In section 1.3 the societal focus, which concerns a specific situation in which the scientific focus is applicable, is discussed. This situation is the citizen participation solar panel project Waternet (a Dutch public utility organisation situated in Amsterdam which focusses on water⁸) currently develops. This citizen participation project of Waternet is used as a case study for this research. By doing so it is possible to gain insight in the factors that influence citizens' willingness to participate in business initiated local solar panel projects in general, but it is also possible to present more direct insight into Waternet's project and present recommendations for them. The scientific and societal focus are therefore of equal importance, which is also apparent from the aim of this research (defined in section 1.5), in which the scientific and societal focus are combined.

1.2. Citizens' willingness to participate in business initiated local solar panel projects

Although many different methods to produce green energy are used in projects in which citizens participate (such as solar panels and wind turbines (see for example 1miljoenwat (n.d.), Eneco (2013), Hinshelwood and Tawe (2000) and Wij Krijgen Kippen (2013)), this thesis focusses on local solar panel projects because of two reasons.

Firstly, in the Netherlands (where this research is conducted) a new Energy Agreement, published in September 2013 by the Dutch government, has increased the possibilities for citizen participation in local green energy projects via a tax reduction construction (see SER (2013) for the Energy Agreement). Although this agreement officially stimulates citizen participation in all types of local green energy projects, a regulation in the new Energy Agreement limits the stimulating factors for participation of citizens to the citizens who live in the vicinity of the project (SER, 2013). This means that installations for green energy production in which citizens participate other than solar panels (such as shared wind turbines) are much more difficult to realise based on this regulation, simply because not enough citizens live in the vicinity of the locations where these installations can be placed.

⁶ Although 'the market' also plays a role in this type of governance according to Driessen et al. (2012), this type of governance is closest to a state – civil society cooperation project.

⁷ E.g. with different production installations, individually or in a group, on citizens' own property or on the terrain of someone else.

⁸ Waternet is responsible for the purification of waste water, production of drinking water and cleaning and maintaining of the surface water in Amsterdam and surroundings (Municipality of Amsterdam, n.d.).

Secondly, research has shown that actors who participate in local renewable energy programs tend to favour solar panel installations. Although this research has not been conducted in the Netherlands, Seyfang et al. (2013) found that photovoltaic (PV) installations were used much more frequent than other technologies in local green energy projects in the United Kingdom (71 per cent of the respondents of their large survey used PV installations, while the next most used technology (solar thermal technology) was only used by 23 per cent).

Although possibilities for local solar panel projects in which the government or private companies invite citizens to participate (i.e. business initiated) have increased in the Netherlands because of the Energy Agreement, this does not mean that all projects automatically become successful. An important factor in the success (or failure) of citizen participation in local solar panel projects are the citizens. Already in 1977 it was noted by Lovins (1977, p. 58) that “the most important, difficult and neglected questions of energy strategy are not mainly technical or economic but rather social and ethical”. Hoffman and High-Pippert (2013) also state that in most local green energy projects it is challenging to engage citizens and often only a small percentage of a locality’s community is willing to participate. As Hoffman and High-Pippert (2010, p. 7573) state: “the problem is (...) the behaviour of the average, largely unengaged, community member”. Because citizens cannot be forced to participate in this type of projects, the success or failure of a project is dependent on citizens’ *willingness to participate* in local solar panel projects. *Willingness to participate* is the scientific focus of this research. The concept of willingness to participate consists of three pillars⁹: *willingness to invest* in solar panels, *willingness to join* local green energy projects and *willingness to sustain participation* in local green energy projects¹⁰ (see chapter 2 for more details).

1.3. Waternet’s solar panel project

1.3.1. The societal focus of this research

A goal of Waternet is to become CO₂ neutral in 2020 (Van der Meer, 2013a), which means they create “zero net GHG (greenhouse gas) emissions” (Van Odijk, 2012, p. 5). Waternet can use PV installations on their property to partly reach this goal¹¹ (ibid). Solar energy replaces the electricity that would normally be bought. Financial benefits of PV installations are therefore directly dependent upon the price of electrical energy and made on a longer term (at first a financial loss is made, because investments have to be made up front, while financial benefits are divided over the years the PV installation works) (Van der Meer, 2013a).

Waternet has divided its property (which is suitable for solar panels) in five classes, ranging from low to high electricity use. The lowest two classes have a combined surface that is appropriate for PV installations of 180m², the middle class 700m² and the two highest classes have a combined surface of 61,500m² available for solar panels (Van der Meer, 2013a). In the Netherlands higher electricity use leads to a lower relative price¹². This means electricity prices are relatively low for Waternet because most of its terrain has a high electricity use. Because of this, on most of Waternet’s terrain it

⁹ In the scientific focus.

¹⁰ For readability’s sake when referring to willingness to participate, invest, join and/or sustain participation, the reference to citizens (i.e. *citizens’* willingness to invest) and the texts ‘in solar panel projects’ and ‘in local green energy projects’ are sometimes left out in this thesis.

¹¹ If all of Waternet’s available property is used to produce solar energy, this may provide up to 10 per cent of Waternet’s electricity (calculations made in 2013). In the future (due to both increased efficiency of solar panels and energy savings of Waternet) this may become 15 to 25 per cent (Van der Meer, 2013a).

¹² Energy prices in the Netherlands are dependent on the amount of electricity used via a connection. The price of energy consists of four factors: leveringstarief (delivery rate), transporttarief (transport rate), energiebelasting (energy taxes) and BTW (VAT) (21 per cent). The higher the amount of energy used, the lower the energy tax per kWh. For the first 10,000 kWh per year part this is €0.1410 per kWh, for the 10,001-50,000 kWh per year part €0.0513 per kWh, for the 50,001-10,000,000 kWh per year part €0.0137 and for the >10,000,000 kWh per year part €0.000605 (all including VAT) (Essent, 2013; Nuon, 2013). Because Waternet has ‘clustered’ most of its property (which means the electricity bills are combined) they mostly pay the lowest or second lowest tariff (due to their high electricity use) and thus pay a relatively low energy price (Van der Meer, 2013a).

is not yet possible to place solar panels in a financially viable way¹³. Due to decreases in the price of solar panels, combined with increases in the efficiency of solar panels this may change and it will most likely become financially viable in the future for Waternet to place solar panels on their property, most likely starting in 2017 (Van der Meer, 2013e; Waternet, 2013a).

However, instead of financing the solar panels themselves, Waternet has another option. They can invite citizens to participate in the solar panel project. This makes it already financially viable to place solar panels since the start of 2014, because of new regulations in the Dutch energy agreement (SER, 2013). In such a project citizens would buy a solar panel, which is placed on the terrain of Waternet. The citizen receives a financial compensation, in the form of a tax reduction and financial compensation for the produced energy, for his/her investment. Waternet on the other hand may count the reduction in CO₂ for its goal of becoming CO₂ neutral. Waternet takes care of the installation and maintenance of the solar panels. The project would run for about 25 years, the life expectancy of the solar panels. A similar project called Zon op Waternet ('Sun on Waternet'), in which employees instead of citizens were invited to participate, has already been implemented by Waternet. This can be seen as a pilot project for this citizen participation project.

The citizen participation solar panel project is still in its research and planning phase¹⁴. Before Waternet can make a decision whether to implement this project or not, more research is required (Van der Meer, 2013b). One of the aspects which requires more research concerns the willingness of citizens to participate in the project, because if citizens are unwilling to participate the project will not succeed. The citizen participation solar panel project of Waternet therefore perfectly matches the scientific focus and is the societal focus of this research.

In the following sections the characteristics¹⁵ of Waternet's citizen participation solar panel project are discussed in more detail. In section 1.3.2 more details of the project's setup (including the financial costs and benefits) are presented, as well as a discussion of the means Waternet plans to use to invite citizens. In section 1.3.3 the reasons of Waternet to develop this project (which are partly influenced by the setup and the means) are discussed.

1.3.2. Setup of Waternet's citizen participation solar panel project

In the citizen participation solar panel project of Waternet citizens are invited to make an investment in one or multiple solar panels. These solar panels are placed on the terrain of Waternet. The citizens receive a financial compensation for their investment. Waternet currently researches five possible locations for such a project¹⁶. Below, the setup of the project as well as the financial costs and profits are briefly discussed. In the appendix, section 1, more details are provided about the setup of the project, including the financial regulations that influence it.

The project's financial viability is dependent on a regulation introduced in the new Energy Agreement in the Netherlands (SER, 2013). This regulation allows citizens to deduct a part of the taxes from their own energy bill¹⁷ if they produce green energy with an installation that is connected

¹³ The relatively low electricity price means that the financial means saved if Waternet produces its own electricity are also relatively low, increasing the time needed for financial benefits to become greater than financial costs when installing solar panels. Some locations (those with the highest electricity use and therefore the lowest taxes) may even create a financial loss if investments are made in solar panels, because the payback time (the time that is needed to save the amount of financial means that the solar panels cost (including installation, maintenance and insurance)) is longer than the life expectancy of the solar panels (Van der Meer, 2013a).

¹⁴ There is therefore no official name for the project yet.

¹⁵ Defined as the setup of the project, the means Waternet plans to use to invite citizens and the reasons Waternet has to start the project.

¹⁶ Water treatment installation De Ronde Venen, drinking water production location Leiduin, pre-treatment installation Nieuwegein, drinking water production location Weesperkarspel and water treatment installation Westpoort. This is based on the fact that more detailed information was researched by the author of this thesis about the possibilities for solar panels on these five locations on request of Jos van der Meer, project coordinator of the citizen participation solar panel project (Van der Meer, 2013h).

¹⁷ This tax reduction is guaranteed for at least ten years.

to the grid via a connection that is different from their own¹⁸. To produce energy with this installation a citizen has to invest financial means in the installation via a cooperative of citizens of which they are a member. For every kWh a citizen's solar panel produces he/she may deduct €0.09 of taxes of one kWh he/she uses (SER, 2013). A requirement for this is that the citizens live in the same postal code area as where the installation is placed, or an adjacent postal code area¹⁹ (from now on referred to as *postal code circle*²⁰). Generally speaking this means it can be any green electricity production installation in the postal code circle that is not placed on the property of the citizen. The produced energy is sold to a utility company²¹ (for about €0.05 per kWh (Van der Meer, 2013d)) and the return is divided among the citizens that own the installation, proportionally to their investment (SER, 2013). The tax reduction and the sold energy create a combined return of €0.14 per produced kWh for a citizen, which is a price reduction of 61 per cent for citizens per produced kWh.

The following costs and profits for the participating citizens are expected (see section 2 of the appendix for more details about the profit calculations): investments costs are expected to be €400.00 per solar panel (the same as was the case in the pilot project (Intranet, 2013c)). After 25 years (the life expectancy of the solar panels) the total return is around €902 (or €710 when adjusting for inflation). This is a profit of €502 (€310 after adjusting for inflation). After the 13th (the 14th when adjusting for inflation) year the investment costs of €400.00 will have been fully recovered by the citizen. All earning made by the citizen from that moment onwards are profits. The calculations that have been corrected for inflation show that the only method to make this project financially viable is by using the tax reduction regulation. Without it, citizens can expect a total return of about €343 (corrected for inflation) after 25 years (which is the life expectancy of the solar panels), which is €57 lower than the original investment made by the citizen. All calculations are made based on a citizen who buys one solar panel. If a citizen decides to buy more solar panels, costs and benefits can simply be multiplied with the number of solar panels.

Currently, Waternet is unsure what means²² will be used to invite citizens in the citizen participation project and to increase their willingness to participate. Van der Meer (2014b) stated that it is uncertain whether Waternet itself will carry out the project. Waternet may ask an external organisation to carry out the project for them (Van der Meer, 2013c). This also happened in the Zon op Waternet project, although Waternet was involved in the creation of willingness to participate among employees (see section 4.4 for the means Waternet used to increase the willingness to participate of employees). According to Van der Meer (2014b) the citizen participation project requires a level of expertise in this type of projects of which he is uncertain whether Waternet can offer it.

Waternet may decide that the external organisation can use the official channels of Waternet to contact the citizens, although no decision has been made about this yet (Van der Meer, 2014b). As no external organisation has been chosen yet, it is not possible to identify the means to involve citizens this organisation plans to use.

It should be noted that Waternet is unable to invest financial means in this project for two reasons. Firstly, as indicated by Van der Meer (2014a) it has been internally decided by Waternet that they can only spend time on the citizen participation project. Secondly, Waternet is not allowed

¹⁸ Because the new tax regulations were not yet in place when the pilot project was launched, the solar panels in the pilot are placed on a property of Waternet which has a high energy tariff (Van der Meer, 2013a). The produced electricity is directly sold to Waternet for this higher price, thereby giving a financial return to the participating employees.

¹⁹ This adjacency is dependent on the physical location, not on the number of the postal code.

²⁰ Postcoderoos in Dutch.

²¹ Because the produced energy is sold to an energy company this means citizens still have to buy energy from an energy company for their own use.

²² Defined as 'the methods and resources Waternet has used or is going to use to invite citizens into the project'.

to fund parts of the project. The regulations surrounding this project make this impossible for Waternet, as citizens may only deduct €0.09 of taxes per kWh if they fully finance the installation themselves (SER, 2013). If Waternet would invest financial means in the project, the citizens would no longer be able to deduct €0.09 per kWh. The internal decision of Waternet not to invest funds in this project and the regulations that even forbid this may limit the means Waternet can use to invite citizens.

Waternet has had meetings with a number of organisations that may be involved if this project is carried out. These organisations include organisations that may carry out the project (e.g. install the solar panels or take care of the administrative part of the project), but also a possible financier. Although financing is done by the citizens, they may borrow money to do so²³. They can subsequently repay their loan with the money they save via the solar panels²⁴ (Waternet, 2014a). It is important to note that the risk of receiving a smaller financial return from the solar panels (e.g. if the sun shines less than expected) is carried by the citizen. If the risk would not be carried by the citizen the Energy Agreement states that the tax reduction of €0.09 per kWh may not be applied on the electricity the citizen uses (SER, 2013).

1.3.3. Waternet's reasons to create a citizen participation solar panel project

In total, five reasons²⁵ of Waternet to start this project can be identified. A summary of these reasons can be found in table 1.1. More detailed, the reasons are the following²⁶.

Reason
Help Waternet to reach its goal of becoming CO ₂ neutral in 2020
Expansion of the Zon op Waternet project, which was impossible with only employees (on a larger scale)
Use extra room on Waternet locations for solar panels
Reduce tariff costs for citizens
Involve citizens in a Waternet project

Table 1.1: Summary of the reasons of Waternet to start the solar panel project in which citizens are invited to participate.

The first reason to create a solar panel project with citizen participation for Waternet is that it helps Waternet to reach its goal of becoming CO₂ neutral in 2020, as discussed in section 1.3.1. To become CO₂ neutral, there are multiple GHG mitigation measures Waternet can use, possibly combined. Although the production of solar energy on Waternet's terrain alone will not make Waternet fully CO₂ neutral, it may contribute towards becoming so. Van Odijk (2012) is relatively negative about the use of solar energy by Waternet, stating that cost-effectiveness is low and the contribution towards CO₂ mitigation is also low. However, a different conclusion was reached by Van der Meer (2013a). According to him, 10 per cent of Waternet's energy requirements can be created by solar panels (if all available terrain of Waternet is used to create solar energy), and this may rise to 15-25 per cent in the future. Currently, it is unclear whether the guarantees of origin can be bought by Waternet from the citizens²⁷. However, according to Van der Meer (2014b) and Strucker (Waternet, 2014a) the green energy that is produced by the solar panels may be counted towards Waternet's goal of becoming CO₂ neutral, even if the guarantees of origin are property of the citizen. This means that even if the guarantees of origin are

²³ Because the project is still in its planning phase, no decision has been made about this yet. Possibly this option will not be presented to the citizens.

²⁴ The calculations on which the financial costs and profits are based as discussed above are not based on this construction. Details about this financing construction do not exist yet.

²⁵ Defined as 'Waternet's motives to start the project'.

²⁶ It should be noted that although the reasons are presented one-by-one, there is no order in importance.

²⁷ Most experts (Knibbe, 2013; Klimaatverbond, 2013a; Klimaatverbond, 2013b) expect that if the guarantees of origin are sold to Waternet the citizen can no longer deduct taxes of his/her energy bill, because if the guarantees of origin are sold the produced energy is no longer classified as green (which is a requirement for the tax reduction). Van Merksteijn however indicated this is not a certainty (Waternet, 2014a). Other experts agree with the fact that it is currently unclear (Klimaatverbond, 2014).

the property of the citizens and cannot be bought by Waternet, the project helps Waternet to reach its goal of becoming CO₂ neutral.

A second reason for Waternet to develop this project according to Heemskerk (2014) and Klaversma (2014) is that Waternet decided the Zon op Waternet project should be expanded beyond the small group of Waternet employees that participated in the Zon op Waternet project (i.e. the 51 employees that are part of the cooperative that has placed solar panels on the technical building near sewage treatment installation De Ronde Venen). Although the project team first researched whether this expansion could be achieved by inviting more employees and using other roofs of Waternet, they discovered that this was not a viable option because of the following reason. The useable and financially viable roofs that were available to expand the project with employees of Waternet were very small²⁸, but the time that would be needed to expand the project for other employees onto such a small roof was almost equal to the time that would be needed to expand it to a larger group of citizens on a larger roof²⁹ (Van der Meer, 2014d). Because a project with citizen participation would most likely result in a larger CO₂ reduction while the required time would be almost equal, it was decided to develop a project in which citizens participate, using the regulations presented in the Energy Agreement.

The third reason for Waternet to start this project is connected to the second. According to Van der Meer (2014b) the citizen participation project will not only help Waternet to reach its goal of becoming CO₂ neutral in 2020, but can go a step further. Some properties of Waternet have more room available for solar panels than is needed to produce enough green energy to make that location CO₂ neutral. Citizen cooperatives can use this extra terrain to produce more solar power than Waternet would normally do. It can therefore contribute towards a further reduction of CO₂ emissions in the future, beyond the goal of Waternet to become CO₂ neutral.

Fourthly, a reason for Waternet to create this project is that it helps to lower the costs for citizens (Van der Meer, 2014b). Although it does not directly reduce the bill citizens receive from Waternet, they receive a lower energy bill and a compensation for the produced electricity, which is seen as an indirect tariff reduction by Waternet. A downside is that this tariff reduction is only available for the citizens that live in the postal code circle, and more specifically for those that decide to participate in this project.

Finally, the fact that citizens are involved in a project of Waternet is also a reason to start this citizen participation project. Van der Meer (2014b) stated that it is important for Waternet that citizens are involved in and connected to their projects, although Van der Meer (2014b) also indicated that the exact importance of citizen involvement is yet to be determined by those with a higher position in the organisation.

1.4. A knowledge gap

The willingness of citizens to participate in local solar panel projects is influenced by many factors, which can be divided in drivers (a positive influence) and barriers³⁰ (a negative influence). Although multiple studies concerning the willingness of citizens to participate have been conducted, almost all are separate research initiatives which do not build upon each other and often only focus on one or

²⁸ Because the employees not necessarily live in the postal code circle, they cannot use the regulation in which they can deduct a part of their taxes when investing in green energy production installations. Instead, they have to be repaid fully by Waternet via the energy price, which requires a location with a high energy tariff.

²⁹ Because citizens living in the postal code circle can subtract €0.09 of taxes, this means the price of the energy can be relatively low on a location and still create a financially viable project for citizens. This means more (and larger) roofs can be used.

³⁰ It is important to note that although a driver is a positive influence, the stimulant one driver presents is not necessarily strong enough for citizens to participate in a project. Often a combination of drivers is required. The same goes for barriers: often a combination of barriers is required to stop a citizen from participating in a project.

two of the three pillars that together form willingness to participate (see section 1.2 and chapter 2). Most drivers and barriers found during studies are based on one or a few case studies, and only a part of them has been verified by other scientists. Previous research therefore does not present a complete overview of the *drivers* and *barriers* that influence willingness to participate and research them in similar circumstances³¹ (i.e. in one project), but rather consists of a number of separate studies which tackle parts of the theory concerning willingness to participate³². Their exact influence is therefore often unknown. This means that there is a large number of ‘potential drivers and barriers’, but it is unknown which of these drivers and barriers are ‘drivers and barriers in practice’ (i.e. whether they indeed have a large influence on citizens’ willingness to participate in local solar panel projects), because comparing their impact is not possible. This lack of a study into all drivers and barriers that influence citizens’ willingness to participate in one project constitutes a knowledge gap in the scientific literature. It is also a societal problem for Waternet because it means Waternet does not know whether citizens in the vicinity of their terrain are willing to participate in their citizen participation solar panel project (as it is currently planned). Knowing whether citizens in the vicinity are willing to participate is of crucial importance before Waternet continues its project by either conducting further research and/or implementing it, because both bring additional costs. If (certain groups of) citizens are not willing to participate in the proposed solar panel project and Waternet cannot change this, spending financial means on further research and/or implementation (in this group) would be unwisely.

1.5. The research aim and the relevance of this research

1.5.1. The research aim

Because a knowledge gap exists in current research and Waternet therefore does not know how high or low the willingness of citizens to participate is, aim of the research (i.e. the research objective), based on both the scientific and societal focus of this thesis, is *to create an overview of the drivers and barriers that influence citizens’ willingness to participate in business initiated local solar panel projects in practice, investigate their influence in the case of Waternet’s project and present recommendations to increase citizens’ willingness to participate in Waternet’s project based on this*. It helps fill the knowledge gap because all³³ potential³⁴ drivers and barriers are researched in one case study (i.e. Waternet’s citizen participation project). Researching all drivers and barriers in one case study has a benefit. Although it is likely that all drivers and barriers influence the willingness to participate of at least a small portion of citizens, a distinction can now be made between the drivers and barriers that influence a large group and those that only influence a small group. This helps fill the knowledge gap, as it was impossible to compare the impact of most drivers and barriers before, because they were researched in different projects.

Furthermore, by comparing the drivers and barriers that influence citizens’ willingness to participate in practice to the setup of Waternet’s citizen participation solar panel project, as well as their reasons to start this project and their means to invite citizens (as discussed in section 1.3) the

³¹ There are two exceptions to this, but both do not have the focus this research has. Irvin and Stansbury (2004) present a first rough overview but their focus lies not specifically on local green energy projects (or even more specifically solar panel projects), but rather on environmental management in general. Seyfang et al. (2013) test drivers and barriers found in other articles concerning the success or failure of community energy programs, but do not test all drivers and barriers. Rather, they focus on testing a small number of drivers and barriers in multiple projects.

³² See for example Jager (2006) (who focusses mostly on drivers), Palm and Tengvard (2011) (who only test a small number of barriers and drivers) and Hoffman and High-Pippert (2010) (who focus only on two of the three pillars of willingness to participate (see chapter 2 for more details about the three pillars)).

³³ It is of course possible that not *all* drivers and barriers have been researched in this thesis. However, as many as possible have been researched.

³⁴ Potential drivers and barriers refer to drivers and barriers which may be of influence on citizens’ willingness to participate, but have not been analysed based on the survey conducted for this thesis yet.

research presents an ex-ante evaluation of the (to be expected) willingness to participate of citizens in Waternet's project. Recommendations for Waternet on how to influence this are also presented based on this. Waternet can use this information to decide whether they continue their research and possibly implement the project. This means the research object³⁵ is Waternet's citizen participation solar panel project.

1.5.2. The relevance of this research

The aim of this research makes it both relevant in a scientific way (and linked to the research of the Copernicus institute) as well as in a societal way.

Scientific relevance is present in this thesis in the form of theory testing. The theory that is tested concerns the willingness of citizens to participate in local green energy projects (and more specifically (business initiated) local solar panel projects). Many different authors have found drivers and barriers that influence the willingness of citizens to invest in solar panels and join and sustain participation in local green energy projects, but an overview of all these drivers and barriers has never been created and therefore has not been scientifically tested in one case study (see also section 1.4). Because they are all tested under the same conditions in one project rather than different projects with different conditions in this research, this adds to the theoretical scientific basis of sustainable development. This thesis thereby helps to fill the knowledge gap that currently exists.

Furthermore, this thesis is linked to the scientific research of the Copernicus Institute (part of Utrecht University) which focusses on *sustainable development*. More specifically, it is linked to the Copernicus Institute's focus on *environmental governance*. The website of the Copernicus Institute (n.d.) states in the section about environmental governance that "stimulating sustainable development often requires transitions that can't be made by individuals alone" and "sustainable development is a matter of collective action". This thesis is linked to *sustainable development* because it focusses on local green energy projects (more specifically solar panels) in a form of collective action. Furthermore, this thesis is also linked to *environmental governance* for the following reason. Waternet considers creating a solar panel project in which citizens participate, because at this moment Waternet cannot do so in a financially viable way on its own. Because this project requires cooperation between two types of actors and Waternet is a semi-government organisation and citizens are part of civil society, this can be seen as a form of environmental governance which is situated between interactive governance and self-governance as defined by Driessen et al. (2012) (see also section 1.1). This means this thesis includes environmental governance by researching drivers and barriers that influence citizens' willingness to participate in a project with this form of governance.

Societal relevance of this thesis can be found in the fact that it presents recommendations for Waternet to increase citizens' willingness to participate in their project. Furthermore, this thesis can help Waternet to decide whether or not to continue and possibly even implement their solar panel project in a form which includes citizen participation.

However, societal relevance goes beyond purely Waternet. As stated before no research has presented an overview of all drivers and barriers that influence citizens' willingness to participate in local green energy projects (or more specifically (business initiated) local solar panel projects) and tested these in one case study. By presenting and testing them in this thesis not only Waternet, but also other organisations may be better able to decide whether or not to invest in citizen participation projects in a similar situation. These other organisations may include other water related companies,

³⁵ "The research object is the phenomenon in empirical reality that you are going to study" (Verschuren & Doorewaard, 2010, p. 67).

who have similar ambitions as Waternet (Klimaatakkoord, 2010). A number of these organisations have also shown interest in the possibilities created by the Dutch Energy Agreement and considers involving citizens in similar projects as Waternet (Klimaatverbond, 2013b).

1.6. The central research question and the research framework

Based on the research aim and the research object as discussed in section 1.5 the central research question of this thesis is the following:

“Under which conditions can citizens be expected to be willing to participate in business initiated local solar panel projects, such as the project of Waternet?”

The central research question is answered by following a number of steps. These steps together form the research framework, which can be found in figure 1.1.

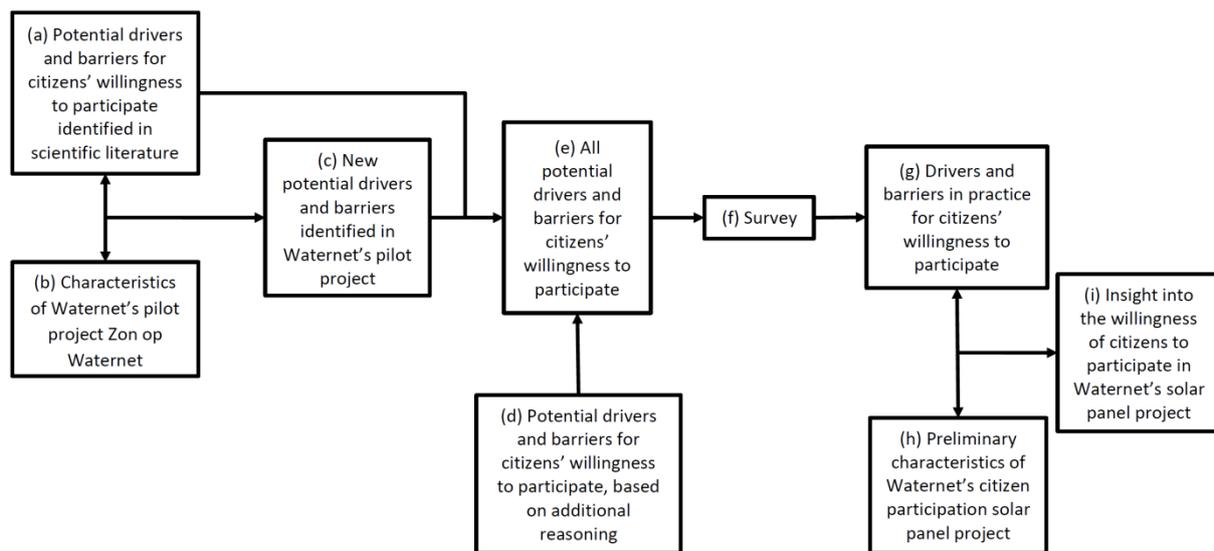


Figure 1.1: The research framework that is followed to conduct this research.

First, three types of scientific literature (see chapter 2 for details about the three types) are used to create a scientific overview of potential drivers and barriers that may influence the willingness of citizens to participate in local solar panel projects. Together these three pillars form the theoretical scientific background of this research. They form a first list of potential drivers and barriers (box a).

Secondly, the pilot project in which employees of Waternet were invited to join a solar panel project is researched (box b). This includes research into the setup of the pilot project and Waternet’s reasons to create it and the means used to invite employees. This pilot project is subsequently compared to the potential drivers and barriers found in the scientific literature (box a). The pilot project partly overlaps with some potential drivers and barriers that have been identified in scientific literature. However, the reasons and means of the pilot project also constitute potential drivers and barriers that have not been identified in the scientific literature research. These are therefore also identified (box c). Although they have not been discovered during scientific research before, they may also be cause of the success of the pilot project. They are added to the list of potential drivers and barriers which is researched in this thesis, as they may also influence the willingness to participate of citizens.

But even after combining the potential drivers and barriers found in the scientific literature with those identified in Waternet’s pilot project, it is likely that there are still potential drivers and barriers

that may influence the willingness of citizens to participate in local solar panel projects that have not been identified. Therefore, the author has created a short overview of other potential drivers and barriers (based on reasoning) which may influence the willingness to participate of citizens (box d). These form the last number of potential drivers and barriers that may influence the willingness to participate of citizens that are researched in this thesis. They are added to the potential drivers and barriers identified in the scientific literature and those identified in the pilot project. Together, the potential drivers and barriers identified in the scientific literature, the new potential drivers and barriers identified based on the reasons and means of the pilot project and those based on reasoning of the author form the complete list of 'potential drivers and barriers' (box e).

After this a survey is conducted among citizens of two districts in which Waternet's project may be implemented (box f). The questionnaire is based on the potential drivers and barriers that may influence willingness to participate (box e). The survey results in a distinction between drivers and barriers that citizens find important (and therefore have the greatest influence on their willingness to participate) and those that are of lesser importance to the citizens. The drivers and barriers that citizens view as important are defined as the *drivers and barriers in practice* (box g).

Finally, the drivers and barriers in practice (box g) are confronted with the citizen participation solar panel project of Waternet, including the setup of the project, the reasons to create it and the means Waternet plans to use to invite citizens³⁶ (as discussed in section 1.3) (box h). The differences between the project of Waternet and the drivers and barriers in practice (based on the survey) provide insight in to what degree Waternet can expect citizens to be willing to participate in their project (as it currently is planned) and to what degree Waternet can possibly influence this (box i). If the setup of the project and Waternet's reasons and means use the drivers in practice and tackle the barriers in practice this may increase the willingness of citizens to participate, but if the drivers and barriers in practice are not used or tackled by the project's setup and Waternet's reasons and means this may have a negative influence on the willingness of citizens to participate in Waternet's project. Based on this insight recommendations can be made for Waternet.

1.7. The sub-questions and research methods

Based on the research framework presented in section 1.6 the central research question is split in the following sub-questions:

1. Which drivers and barriers influence the willingness of citizens to participate in local solar panel projects according to scientific literature?
2. What lessons concerning drivers and barriers that influence citizens' willingness to participate can be learned from the pilot project Zon op Waternet?
3. Which of the potential drivers are drivers in practice which influence the willingness of citizens to participate in Waternet's solar panel project?
4. Which of the potential barriers are barriers in practice which influence the willingness of citizens to participate in Waternet's solar panel project?
5. To what degree does and can Waternet use the drivers in practice and tackle the barriers in practice in their citizen participation solar panel project?
6. What are the limitations of this research and to what degree do they influence the possibilities to generalize the results of the case study?

³⁶ It should be noted these characteristics are preliminary, because the citizen participation project of Waternet is still in development.

Multiple research methods have been used for this thesis. More specifically, a scientific literature research, desk research, talks, meetings, interviews and a survey were used³⁷. In table 1.2 an overview of which research method has been used to answer which sub-question is presented.

Sub-question	Research method(s) used to answer the sub-questions
Sub-question 1	Scientific literature research
Sub-question 2	Desk research, talks, meetings and interviews
Sub-question 3	Survey
Sub-question 4	Survey
Sub-question 5	Based on sub-questions 4 and 5
Sub-question 6	Based on sub-questions 1 through 5 and the research process.

Table 1.2: Research methods used to answer the sub-questions.

Some research methods have also been used in the introduction (chapter 1). For example, desk research, talks, meetings and interviews have been used to research the citizen participation solar panel project of Waternet, which is discussed in section 1.3. In the next sections the methods that have been used are discussed in more detail. The survey is an exception to this and is discussed in chapter 4, as it requires a more detailed description than can be provided in this introduction.

1.7.1. A scientific literature research

First of all, a scientific literature research was conducted to create a scientific basis for this thesis. This scientific literature research was used to answer sub-question 1. The results of this scientific literature research can be found in chapter 2. A number of keywords were used to find articles via the scientific search engines Scopus and Google Scholar. Utrecht University offered the option to download these scientific articles. Keywords used in these search engines are among others (combinations of) 'willingness to participate', 'willingness to invest (in solar panel*)³⁸', 'willingness to join', 'willingness to sustain participation', 'citizen participation' and '(local) green energy project*'. Furthermore, of the articles that were found using these keywords the references and citations (visible in Scopus) were also studied and if applicable used. This was done in an iterative process (i.e. of the articles found via this method the references and citations were also studied, a process which was repeated until no more new and useful articles were found).

The scientific literature used concerning citizens' willingness to participate consists of scientific literature in which 'top-down' initiatives (e.g. business initiated projects like the project of Waternet) are studied and scientific literature in which 'bottom-up' initiatives are researched. Reason to do this is that they show overlaps in drivers and barriers that influence the willingness of citizens to participate, and together offer a more comprehensive overview³⁹.

1.7.2. Desk research

Sub-question 2, which is answered in chapter 3, is answered based on a combination of desk research, talks, meetings and interviews. These same methods were used to research the citizen participation project as discussed in section 1.3. In this section the desk research is discussed, while in section 1.7.3 the talks, meetings and interviews are discussed.

For the desk research documents, calculations, websites et cetera were analysed. Part of the data for the desk research was accessed via the local network of Waternet. Because the author wrote this thesis during an internship at Waternet, he was provided access to this network. The local network of

³⁷ The author of this thesis was an intern at Waternet when writing this thesis, which has influenced parts of the research methods, as gaining access to actors and parts of the information used in the desk research was easier. Parts of the desk research and some talks, meetings and interviews could not have been conducted or visited without this internship.

³⁸ An asterisk is a 'wildcard' in the Scopus search engine. This means it can be replaced by zero, one or multiple characters. For example, 'panel*' shows results for 'panels' but also for 'panel'.

³⁹ See Hoffman and High-Pippert (2013) for a model in which bottom-up and top-down (including their sub-forms) green energy projects are distinguished. They show that overlaps often exist between these projects.

Waternet can be divided in two categories (both inaccessible to those not logged into the computer network of Waternet). The first category is the 'intranet'. This is an internal website⁴⁰ that is used to inform Waternet's employees of news and other information concerning the organisation. The second category concerns the network's hard disks that can be accessed via the local network (from now on referred to as 'internal network'). The internal network contains the results and products that have been produced by Waternet's employees (e.g. reports, detailed calculations and presentations). Generally speaking it can be said that the internal network contains more in-depth information for experts on the subject, while the intranet is used to spread more basic information to a larger group of employees⁴¹.

Available information on the intranet and internal network consisted among others of research from Waternet employees into the viability of solar panels for Waternet (via different constructions, including the involvement of employees and/or citizens). Furthermore, presentations and other means to transfer the ideas of the Zon op Waternet project to the employees of Waternet and invite them in the pilot project were also available and discussed on this network. Information about means to transfer information concerning the project in which citizens may participate (e.g. presentations) was not available on the internal network. Reason for this is that the means mostly have not been created by Waternet yet as the citizen participation project is in its first phase. Instead, talks, meetings and interviews were used to research this (see sections 1.3 and 1.7.3).

Information about the characteristics (i.e. setup of the project, the means to invite citizens and the reasons to start this project) of Waternet's citizen participation solar panel project (as discussed in section 1.3) was not only available via the intranet. For example, the Dutch tax regulations have an impact on Waternet's citizen participation solar panel project. These tax regulations were researched via, among others, information available on websites of the Dutch government, Dutch energy related utility companies and websites dedicated to the creation of local green energy projects, such as Hier Opgewekt⁴². Finally, a number of other water-related companies are also interested in similar solar panel projects and have held meetings concerning this. Although the author was present at some of these meetings (see section 1.7.3), information concerning a number of these meetings was only available via reports written afterwards. These written reports were therefore used as information sources for the desk research.

1.7.3. Talks, meetings and interviews

Next to desk research, talks, meetings and interviews were used to research Waternet's pilot project and the citizen participation project. All three concern conversations with actors.

Talks are defined as small conversations aimed at answering a specific question. A number of experts on among others solar panels and tax regulation (concerning solar panels) is employed by Waternet. From time to time these experts have been asked to provide insight into specific questions concerning these subjects⁴³. Because these talks were often short and aimed at answering one specific question, they have not been typed out and analysed in depth. Instead, the information provided by the experts concerning the questions was directly used in this thesis.

⁴⁰ Because this 'website' is not accessible from outside Waternet there is no exact weblink provided in the list of references, but instead the word 'intranet'.

⁴¹ Of course this does not mean the intranet does not contain in-depth information at all, or that the internal network only contains in-depth information. Both contain both types of information. Furthermore it should be noted that the intranet and internal network are connected. This means that making a distinction between the two is not always possible (e.g. a news item on the intranet may refer to a directory on the internal network for a pdf file, powerpoint presentation or other document).

⁴² www.hieropgewekt.nl

⁴³ In some occasions these questions were (partly) answered by email, instead of a personal talk. If this is the case this is noted in the list of references.

Next to talks, information discussed during a number of meetings with multiple actors was used. These meetings were for example between actors of different water-related companies and companies that supported them in their ideas concerning solar panels projects (e.g. Klimaatverbond, 2013b; Waternet, 2014a). At some of these meetings the author was present (e.g. Klimaatverbond, 2013b; Waternet, 2014a), while at others the information used in this thesis was based on the report that was written after the meeting (e.g. Klimaatverbond, 2013a). These reports were part of the desk research (see section 1.7.2). Because these discussions were not guided by the author (even if he was present) only portions were of interest for this thesis. The parts that were of interest for this thesis were directly used, as was also done with the talks discussed in the previous section, instead of writing down the full text of the discussion and analysing this.

Next to talks and meetings, interviews were used as a third type of conversations with experts. The interviews focussed on the characteristics of both the pilot project and the project involving citizens. Interviews were used to assess those parts that were not clear or available in the desk research, and to verify those that were. In-depth questions were based on the findings of the desk research and previous talks, meetings and interviews. In the appendix, section 3, the topics and questions used to guide the interviews can be found. All interviews were recorded and typed out. Then, using the computer programme NVivo, the written interviews were analysed. The interviews were held in Dutch, as the interviewees preferred this over English⁴⁴. In table 1.3 an overview is presented of the interviewees, as well as their role in the pilot and/or citizen participation project.

Validity and reliability were maximized as much as possible for the interviews by conducting them with all people willing and available who are involved in decisions concerning either the pilot project Zon op Waternet or the citizen participation project (or both)⁴⁵. Furthermore, statements made in an interview and/or found during the desk research were checked in other interviews held afterwards if possible (as advised by Corbin & Strauss (1990)). Additionally, linkages between the setup of the projects, the reasons and the means were also addressed in the interviews, as advised by Corbin & Strauss (1990). Because the author of this thesis was an intern at Waternet, it was possible to re-check findings made after an interview with the interviewee if needed, thereby increasing the level of validity and reliability.

Interviewee	Role	Interview date
Ingrid Heemskerck	Financial and strategic expert of the pilot project team	24 January 2014
Stefan Mol	Participant in the pilot project Zon op Waternet	27 January 2014
Enna Klaversma	Leader of the pilot project team	3 February 2014
Jos van der Meer	Founder of the pilot project, member of the pilot project team and project coordinator of the citizen participation solar panel project	3 February 2014
Erik Kessler	Participant in the pilot project Zon op Waternet	19 February 2014

Table 1.3: Overview of the key project participants that were interviewed for this thesis⁴⁶. They are all employees of Waternet.

1.8. Outline of the thesis

To answer the central research question this thesis follows the following structure. In the following chapter (chapter 2) focus lies on the theoretical scientific background (i.e. sub-questions 1 and box a in figure 1.1). It consists of a scientific literature research in which the drivers and barriers that influence citizens' willingness to participate according to other researchers are identified. In chapter 3 Waternet's pilot project is analysed. This includes a discussion of the key characteristics

⁴⁴ Quotes of the interviews used in this thesis are therefore translations made by the author of this thesis.

⁴⁵ An exception are the participants of the Zon op Waternet project. Not all participants in the Zon op Waternet project have been interviewed as this group consisted of too many employees (51) to interview during the course of this thesis. Furthermore, the usefulness of interviewing all was expected to be small.

⁴⁶ The fourth project team member of the Zon op Waternet project, Gijs van der Meer, was unavailable due to a sabbatical.

(i.e. the setup of the project, Waternet's reasons to start the project and the means they used to invite employees), a comparison of the pilot project with the scientific literature research and a discussion of how these key characteristics form new drivers and barriers (i.e. sub-question 2 and box b and c). Furthermore in this chapter, the potential drivers and barriers that were not present in either the scientific literature or the pilot project that may also be of influence on citizens' willingness to participate (based on reasoning of the author) are discussed (box d). In chapter 4 the key characteristics of the survey are discussed, including the operationalization of all drivers and barriers and a description of the sample (box f). In chapters 5 and 6 the results of the survey are presented. In these chapters a distinction is made between the potential drivers and barriers which are drivers (chapter 5) and barriers (chapter 6) in practice and those which are not (i.e. sub-questions 3 and 4 and box g). In chapter 7 the drivers and barriers in practice are compared to Waternet's citizen participation solar panel project (box h). This creates insight in to what degree Waternet can expect citizens to be willing to participate and to what degree they can influence the drivers and barriers in practice in their project (i.e. sub-question 5 and box i).

In chapter 8 the discussion of this thesis is presented. In this chapter the limitations that influenced this research are discussed and the findings made are compared to the findings of other researchers. It is also discussed in how far the findings made in this case study can be generalized towards other projects and studies (i.e. sub-question 6). Lastly, in chapter 9 the conclusion of this thesis is presented. This includes the answer to the central research question as well as recommendations for Waternet to increase the willingness to participate of citizens and suggestions for future research.

2. Drivers and barriers that influence willingness to participate, a literature research

2.1. Introduction

The choice to participate in a local green energy project is a decision which most citizens do not easily make. Although there is often widespread support for the local generation of renewable energy, actual participation is often much lower (Rogers et al., 2008). Eventually, citizen participation is based on citizens' 'willingness to participate', which is influenced positively by drivers and negatively by barriers. In this chapter scientific literature is reviewed to identify drivers and barriers that may⁴⁷ influence citizens' willingness to participate⁴⁸. Sub-question 1 is therefore answered in this chapter:

Which drivers and barriers influence the willingness of citizens to participate in local solar panel projects according to scientific literature?

The willingness to participate of citizens is split in three equally important pillars for this scientific literature research, which together form the theoretical and scientific background of the research (see figure 2.1). Distinction between these pillars is made because a solar panel project in which citizens participate that is started by the government or a private company is influenced by citizens at different moments: before the start of the project, at the start of the project and during the project. The second and third pillar are defined based on a distinction made by Hoffman and High-Pippert (2010).

Firstly, before the project starts citizens' *willingness to invest* in solar panels is important (this also contains scientific literature concerning willingness to invest in solar panels on citizens' own terrain), because citizens that are not interested in investing in solar panels will not participate in a project that concerns the

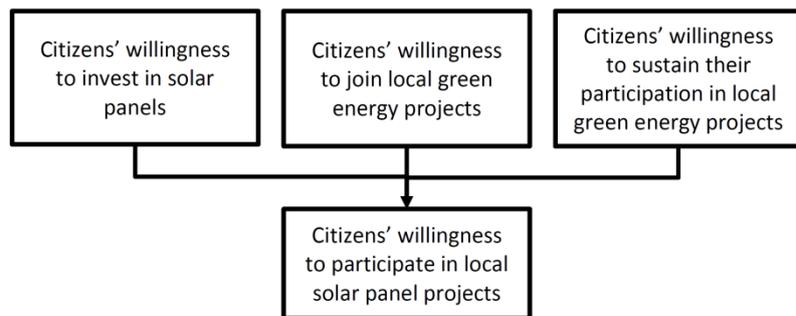


Figure 2.1: Overview of how the three theoretical pillars together form the theoretical and scientific background of the research.

placement of solar panels. Secondly, at the start of the project citizens' *willingness to join* a local green energy project is important, because if people are unwilling to join the project it will not succeed. Finally, during the project citizens' *willingness to sustain participation* in local green energy projects is important⁴⁹, because if citizens quickly leave after joining the project will also fail, due to

⁴⁷ I.e. potential drivers and barriers.

⁴⁸ In chapter 3 more drivers and barriers that may influence citizens' willingness to participate are identified based on the pilot project of Waternet and reasoning of the author.

⁴⁹ Focus lies on willingness to join and sustain participation in local green energy projects rather than local solar panel projects, because scientific literature that specifically focusses on these pillars concerning local solar panel project is very rare, while more information is available for local green energy projects in general. By combining this with citizens' willingness to invest in solar panels the overarching theory still focusses on local solar panel projects.

the long payback time⁵⁰. By combining the three pillars, the scientific theory that forms the basis of this thesis is created.

The three scientific pillars all contain drivers and barriers that respectively increase or decrease citizens' willingness to participate. In this chapter the three pillars are discussed, focussing on drivers and barriers found in previous research⁵¹. In section 2.2 willingness to invest is discussed, in section 2.3 willingness to join and in section 2.4 willingness to sustain participation. These drivers and barriers are combined (if applicable) in section 2.5 and an overview of all drivers and barriers identified in scientific literature is presented in this section. In section 2.6 the conclusion of this chapter is presented and sub-question 1 is answered.

2.2. Drivers and barriers that influence citizens' willingness to invest

In a large survey held in the United Kingdom two-thirds of the respondents indicated that they supported renewable energy, preferably created by solar and wind sources (Energy Saving Trust, 2007). But although a large percentage of the respondents supported the creation of renewable energy, only a small group actually invested in solar panels (ibid). A survey by Caird et al. (2008) also showed that only 8 per cent of the respondents who showed interest in renewable energy actually invested in solar panels⁵². This shows that many citizens decide not to invest in solar panels, even though they support the concept of renewable energy. Reasons not to invest in solar panels are defined as barriers for citizens' willingness to invest in solar panels. But besides barriers, drivers also exist for citizens' willingness to invest in solar panels, as a group of citizens not only supported renewable energy, but also decided to invest in solar panels. Scientific research has shown a number of drivers and barriers which influence the willingness of citizens to invest in solar panels. These can be either solar panels that have been placed on citizens' own roof or solar panels that have been placed on a different location. In this section these drivers and barriers are presented⁵³.

2.2.1. Drivers

Caird et al. (2008) identified a number of drivers that positively influence citizens' willingness to invest in solar panels. The three main drivers for citizens' willingness to invest in solar panels according to them are *saving energy* (i.e. using less grey energy), *reducing bills* and *concerns for the environment*. This last driver (i.e. concerns for the environment) was also found by Palm and Tengvard (2011).

Another (although less important) driver according to Caird et al. (2008), which was also identified by Palm and Tengvard (2011) and Faiers and Neame (2006), is the fact that solar panels are often seen as a '*green status symbol*' by citizens. Solar panel installations are by some citizens seen as "the environmentally conscious consumers' equivalent of a four-wheel drive car" (Caird et al., 2008, p. 159), Mercedes or BMW (Palm & Tengvard, 2011).

⁵⁰ 'Payback time' in this thesis refers to the financial payback time: the time that is needed to save the amount of financial means that the solar panels cost (including installation, maintenance and insurance). It does not refer to the payback time in energy (the time it takes for a solar panel to produce as much energy as it costs to produce and install it).

⁵¹ It is important to note that from the articles that are used as a basis for this chapter not all drivers and barriers are discussed in this thesis. Some drivers and barriers are country or location specific (e.g. political decisions) and are therefore not of influence in the situation of Waternet, because they are irrelevant for the Dutch situation.

⁵² Although these surveys (Caird et al., 2008; Energy Saving Trust, 2007) show that interest in renewable energy of citizens does not automatically lead to investments made by these interested citizens, the exact percentages are only indicative for the current situation because of the research methods and conditions that have changed since then. Firstly, since the research was conducted multiple years have passed. Since then, the price of solar panels has dropped considerably (a price reduction of 66 per cent has taken place between 2006 and 2012 (AllesOverZonnepanelen.nl, 2012)). This may result in a higher percentage of citizens who invest in solar panels now than when these studies were conducted. Secondly, the methods that were used to create respondents favoured environmentally concerned citizens (in the case of Caird et al., 2008), which makes it likely that the real percentage is lower.

⁵³ Drivers and barriers are written in *italics* to improve clarity and readability.

Furthermore, Caird et al. (2008) found that having funds available to invest in solar panels was an important driver for citizens and that this was often related to a higher income. This is a finding that was also made by Kwan (2012). He found that a higher (average) income in a district⁵⁴ was related to a higher number of installed residential solar panels. Jager (2006) also found that citizens with a higher income invest more often in solar panels. A *higher income* can therefore be seen as a driver for citizens' willingness to invest in solar panels.

Kwan (2012) also found that in areas in which relatively more citizens with a high education lived a (relatively) high number of residential solar panels were installed. A similar finding was made by Jager (2006). A *higher educational level* can therefore be seen as a driver that influences citizens' willingness to invest in solar panels. A final driver found by Kwan (2012) was the fact that *age* may be positively related to the number of solar panels installed by citizens. He found that in areas with a high number of citizens of the age of 45 to 54 years a relatively high number of solar panels were installed. On the other hand, Kwan (2012) also found that age may constitute a barrier (see section 2.2.2 for details).

Bollinger and Gillingham (2012) as well as Jager (2006) found that *peer effects* (i.e. citizens stimulate each other to invest in solar panels) are important drivers for citizens to invest in solar panels. It became apparent in their research that greater and more visible installations had a larger peer effect, as did installations that had been placed for a longer time. This shows that the peer effect is positively influenced by both image motivation (seeing the installation, which increases when a larger installation is placed) and information transfer (hearing from others about the installation, which requires time). Examples to stimulate peer effects provided by Bollinger and Gillingham (2012) are the use of signs indicating a PV installation has been placed (image motivation) and the use of demonstration sites (a combination of image motivation and information transfer).

Finally, Jager (2006) found that *information meetings* with citizens may greatly stimulate their willingness to invest. In his research he found that two information meetings made the number of citizens that were willing to invest in solar panels ten times as high as in a region in which citizens had no opportunity to visit such a meeting.

2.2.2. Barriers

Besides drivers, barriers for citizens' willingness to invest also exist of course, as is apparent from the fact that of the interested citizens only a small percentage eventually decides to invest in solar panels (Caird et al., 2008; Energy Saving Trust, 2007).

Firstly, *high up-front costs* (even if payback times are relatively short) and *long payback times*⁵⁵ are a barrier for the willingness of citizens to invest in solar panels (Caird et al., 2008; Faiers & Neame, 2006; Jager, 2006; Palm & Tengvard, 2011; Watson et al., 2006). Furthermore, a *perceived risk of new technologies* was also found to be a barrier for citizens' willingness to invest in solar panels⁵⁶ (Palm & Tengvard, 2011; Seyfang et al., 2013; Watson et al., 2006). This is related to the finding of Watson et al. (2006) and Jager (2006) that a *lack of information concerning the technologies* is a barrier for citizens' willingness to invest. Furthermore, a *lack of access to capital* (Caird et al., 2008; Watson et al., 2006) and a *lack of time* (Watson et al., 2006) are also barriers for citizens' willingness to invest. The final barrier that influences willingness to invest in solar panels

⁵⁴ All areas distinguished by Kwan (2012) were based on ZIP codes.

⁵⁵ Interviews Watson et al. (2006) held with citizens indicated that payback times should be below ten years (preferably five) for many consumers before they would invest. Of great influence on this is the fact that citizens prefer money now over savings on a longer term (see Brook Lyndhurst (2003) and Pearce et al. (2003)). Of course, there is a small group of citizens that will invest in solar panels irrespective of this payback time, as well as a group that will never invest even if payback times are much shorter than five years (Watson et al., 2006).

⁵⁶ Although this may play a role the impact is expected to be relatively small compared to other green energy production technologies because solar panels are by now established technologies that have a good track record.

Watson et al. (2006) discovered concerns a political aspect. According to them, *getting planning permission* was for many citizens a barrier for their willingness to invest in solar panels. This was also found by Jager (2006) to be a barrier.

Caird et al. (2008) also found that *finding a suitable location*, *finding a trustworthy installer* and *(fear of) insufficient output* (because space was lacking) are barriers for citizens' willingness to invest. Finding a trustworthy installer was also found to be a barrier for citizens' willingness to invest by Palm and Tengvard (2011).

Kwan (2012) found, besides a number of drivers for citizens' willingness to invest in solar panels (discussed in section 2.2.1) two barriers for willingness to invest. Firstly, he found that a *lower education level* forms a barrier, as districts with a larger group of lower educated citizens had relatively few solar panels installed. Secondly, he found that *age* may constitute a barrier which influences willingness to invest. In districts with a relatively large number of citizens of an age of 25-34 and 55-64 year a relatively low level of solar panels was installed. Reason for this according to him is that these citizens have relatively little purchasing power available for green products.

2.2.3. An overview of the drivers and barriers

As becomes apparent from the sections above, there is a large number of drivers and barriers that influence citizens' willingness to invest in solar panels. In table 2.1 an overview of all drivers is presented, while table 2.2 presents an overview of all barriers. The order in the tables is random and does not indicate the importance of one driver or barrier over another (the same goes for the other tables in this chapter). The next section goes into detail concerning the drivers and barriers that influence citizens' willingness to join local green energy projects.

Driver	Source(s)
Saving energy	Caird et al. (2008)
Reducing bills	Caird et al. (2008)
Concerns for the environment	Caird et al. (2008); Palm and Tengvard (2011)
Green status symbol	Caird et al. (2008); Faiers and Neame (2006); Palm and Tengvard (2011)
Higher income	Caird et al. (2008); Jager (2006); Kwan (2012)
Higher education level	Jager (2006); Kwan (2012)
Age	Kwan (2012)
Peer effects	Bollinger and Gillingham (2012); Jager (2006)
Information meetings	Jager (2006)

Table 2.1: Overview of all drivers that positively influence citizens' willingness to invest in solar panels according to scientific literature.

Barrier	Source(s)
High up-front costs	Caird et al. (2008); Faiers and Neame (2006); Jager (2006); Palm and Tengvard (2011); Watson et al. (2006)
Long payback times	Caird et al. (2008); Faiers and Neame (2006); Jager (2006); Palm and Tengvard (2011); Watson et al. (2006)
Perceived risk of new technologies	Palm and Tengvard (2011); Seyfang et al. (2013); Watson et al. (2006)
Getting planning permission	Jager (2006); Watson et al. (2006)
Lack of information concerning the technologies	Jager (2006); Watson et al. (2006)
Lack of access to capital	Caird et al. (2008); Watson et al. (2006);
Lack of time	Watson et al. (2006)
Finding a suitable location	Caird et al. (2008)
Finding a trustworthy installer	Caird et al. (2008); Palm and Tengvard (2011)
(Fear of) insufficient output	Caird et al. (2008)
Lower education level	Kwan (2012)
Age	Kwan (2012)

Table 2.2: Overview of all barriers that negatively influence citizens' willingness to invest in solar panels according to scientific literature.

2.3. Drivers and barriers that influence citizens' willingness to join

In the previous section the drivers and barriers that influence citizens' willingness to invest in solar panels have been discussed. As stated in section 2.1, a group of citizens that is willing to invest in solar panels is only part of the requirement for a citizen participation solar panel project to become successful. Citizens must also be willing to join a project which involves other parties. This is also indicated by Hoffman and High-Pippert (2010), who state that citizens must be recruited and thus willing to join local green energy projects. Multiple researchers have identified different (and sometimes overlapping or related) drivers and barriers that influence willingness to join local green energy projects. In this section these are discussed.

2.3.1. Drivers

Drivers for citizens' willingness to join were among others identified by Hoffman and High-Pippert (2010). They found that the willingness of citizens to join a project is positively influenced by an "*act of neighbourliness*" (p. 7569) (being asked by someone you know personally). The results of their study showed that although email, newsletters, letters, websites and word-of-mouth were used to spread a green energy project, the majority of the participants that took part in a survey indicated to have joined based on a personal invitation⁵⁷, preferably on the "most local of levels" (ibid, p. 7573). This was supported by their findings that recruitment into a community energy program depends upon an infrastructure of personal contacts and neighbourly relations and is stimulated by casual interactions between citizens (Hoffman & High-Pippert, 2010), which was also found by Hinshelwood and Tawe (2000) and Seyfang et al. (2013).

Although Hinshelwood and Tawe (2000) focus in their article on wind energy instead of PV, they also found factors that influence the willingness of local citizens to join in local green energy projects, of which one is related to the finding of Hoffman and High-Pippert (2010) discussed above. Willingness to join is not only stimulated by an act of neighbourliness as defined by Hoffman and High-Pippert (2010), but also by *involvement via respected people in the community* (Hinshelwood & Tawe, 2000). Even if a citizen did not know the 'respected person' personally (but only indirectly), the citizens' willingness to join the local green energy project increased.

Furthermore, Hoffman and High-Pippert (2010) found that local green energy projects may also become "*a source of community pride*" (p. 7570). This may constitute a driver for citizens' willingness to join, as people are stimulated to join these types of projects because they are proud of them. This finding is similar to the driver defined as a 'green status symbol' which influences willingness to invest in solar panels as discussed in section 2.2.1.

Contrasting the 'green status symbol' and 'community pride' that is a driver for some citizens to invest in solar panels and/or join a local green energy project, Palm and Tengvard (2011) found that a driver for the willingness to join local green energy projects on a different location for some citizens was the (*fear of*) *negative reactions of neighbours towards a renewable energy installation on citizens' own property*, because it might be seen as 'visual contamination'. This means that citizens that consider placing a green energy production installation on their own property may choose to join a project in which the installation is placed on a terrain that is not part of the property of the citizen, because they fear the reaction of neighbours if they place them on their own property.

Boon (2012) discovered that a driver for many citizens to join a local green energy project would be a *fair distribution of potential benefits*, allocated to improve the local community. This might even decrease local opposition towards the project if it exists. A similar finding was made by Walker (2008). Furthermore, Hinshelwood and Tawe (2000) found that a *democratic decision making process*

⁵⁷ This personal invitation did not necessarily take place via word-of-mouth. It can also be done via email for example.

is a driver for citizens to participate, a process which gives legitimacy to the project. They also found that *debates and consultation* made available with the help of (enough) funding by the organising actor has a positive influence on the willingness of citizens to join a local green energy project and thereby constitutes a driver (Hinshelwood & Tawe, 2000). This is also discussed by Irvin and Stansbury (2004).

Another driver found by Hinshelwood and Tawe (2000) is that of *local people's awareness of broader issues of renewable energy production installations*, i.e. knowing what the positive and negative sides of renewable energy production installations are. According to Hinshelwood and Tawe (2000) clear information is something that is greatly appreciated by citizens, thereby increasing their willingness to join.

Finally, Walker (2008) found that *ethical and environmental commitment* (similar to the 'concerns for the environment' driver discussed in section 2.2.1) as well as *financial incentives* (similar to the 'reducing bills' driver discussed in section 2.2.1) were both drivers for citizens' willingness to join local green energy projects. This financial driver can be an increase of income as well as a decrease of expenditure on energy.

2.3.2. Barriers

Not only drivers for citizens' willingness to join exist, so do barriers. Leaney et al. (2001) found two of these barriers. They found that a *lack of access to information* (specifically trustworthy information, as information from the media is often incorrect, biased and/or specifically negative) and a *lack of access to knowledge* (citizens and communities want to be involved, but lack expertise on how to develop a project) negatively influence the willingness of people to join a local green energy project. The lack of access to knowledge barrier found by Leaney et al. (2001) is related to the 'lack of information concerning the technologies' barrier found by Watson et al. (2006) to influence citizens' willingness to invest in solar panels⁵⁸. Furthermore, it is also related to a barrier that influences willingness to join identified by Walker (2008). According to him a *lack of expert advice and support* may also constitute a barrier. Citizen may be willing to join a local green energy project, but may fear that the required expertise is lacking if experts are not connected to the project from the start. This is connected to the driver 'act of neighbourliness' (see section 2.3.1) as discussed by Hoffman and High-Pippert (2013). They state that chances of success of local green energy projects increase if the project is diffused among the neighbourhood via personal relations, but support from a larger organising actor in the knowledge sector is equally important, because they have more knowledge related to the project⁵⁹.

Boon (2012) also discovered a number of barriers for attracting (additional) citizens into a local green energy project. These barriers are a *low local awareness of the organisation, low interest of citizens in energy issues, unwillingness to be committed to an organisation and discouragement from having to make a financial contribution*.

Furthermore, Hinshelwood and Tawe (2000) as well as Rogers et al. (2008) found that time is of great influence on the willingness of citizens to join. However, although both found that time may be of influence, they found different ways in which it can be a barrier. According to Hinshelwood and Tawe (2000) willingness to join can decrease if citizens are not given enough time to make a decision.

⁵⁸ Leaney et al. (2001) and Watson et al. (2006) use a different definition of 'information'. According to Leaney et al. (2001) information concerns general knowledge about (green energy production in) this project, while 'knowledge' is much more specific (i.e. how to exactly install installations and lead such a project). However, in the definition of Watson et al. (2006) information is already specific, and similar to the 'knowledge' of Leaney et al. (2001). That explains why a 'lack of access to knowledge' and not a 'lack of access to information' found by Leaney et al. (2001) is related to lack of information concerning the technologies found by Watson et al. (2006).

⁵⁹ Although they are related they are not combined in one driver/barrier, because multiple other authors than Hoffman and High-Pippert (2013) do not combine them.

This means that a *lack of time to make a decision* (e.g. if Waternet only gives citizens a small amount of time to reply to their invitation and join the project) may be a barrier for citizens' willingness to join⁶⁰ (people feel pressured). Rogers et al. (2008) found that willingness to join may also decrease if citizens are feeling they will not have the time that is required to be involved (i.e. time spend once the project has started). *Lack of time during involvement* may therefore also constitute a barrier for some citizens.

Finally, Seyfang et al. (2013) found that a *lack of trust in the organisation* (i.e. to organise the project in such a way that it meets the needs of the community) may also constitute a barrier for some citizens to join green energy projects. Similar findings were made by Walker et al. (2010)⁶¹.

2.3.3. An overview of the drivers and barriers

The sections above have shown that a large number of drivers and barriers exists which influence citizens' willingness to join local green energy projects. In table 2.3 an overview of all drivers is presented, while table 2.4 presents an overview of all barriers. The next section goes into detail concerning the barriers and drivers for citizens' willingness to sustain participation in local green energy projects once they have joined them.

Driver	Source(s)
Act of neighbourliness	Hinshelwood and Tawe (2000); Hoffman and High-Pippert (2010); Seyfang et al. (2013)
Involvement via respected people in the community	Hinshelwood and Tawe (2000)
Source of community pride	Hoffman and High-Pippert (2010)
(Fear of) negative reactions of neighbours towards a renewable energy installation on citizens' own property	Palm and Tengvard (2011)
Fair distribution of potential benefits	Boon (2012); Walker (2008)
Democratic decision-making process	Hinshelwood and Tawe (2000)
Debates and consultation	Hinshelwood and Tawe (2000); Irvin and Stansbury (2004)
Local people's awareness of broader issues of renewable energy production installations	Hinshelwood and Tawe (2000)
Ethical and environmental commitment	Walker (2008)
Financial incentives	Walker (2008)

Table 2.3: Overview of all drivers that positively influence citizens' willingness to join local green energy projects according to scientific literature.

Barrier	Source(s)
Lack of access to information	Leaney et al (2001)
Lack of access to knowledge	Leaney et al (2001)
Low local awareness of the organisation	Boon (2012)
Low interest of citizens in energy issues	Boon (2012)
Unwillingness to be committed to an organisation	Boon (2012)
Discouragement from having to make a financial contribution	Boon (2012); Rogers et al. (2008)
Lack of time to make a decision	Hinshelwood and Tawe (2000)
Lack of time during involvement	Rogers et al. (2008)
Lack of expert advice and support	Walker (2008)
Lack of trust in the organisation	Seyfang et al. (2013); Walker et al. (2010)

Table 2.4: Overview of all barriers that negatively influence citizens' willingness to join local green energy projects according to scientific literature.

⁶⁰ Unfortunately, Hinshelwood and Tawe (2000) nor any other scientist give an indication of what is 'enough time' and what is 'too little time'. They simply state that "people need time to think through the pros and cons [and] to open up the debate and allow people's concerns to be aired, discussed and resolved" (p. 303).

⁶¹ Seyfang et al. (2013) and Walker et al. (2010) do not go into further detail why some organisations are untrustworthy in the eyes of citizens, nor what sort of organisations they are. They also do not discuss how trust can be built by an organisation in this type of projects.

2.4. Drivers and barriers that influence citizens' willingness to sustain participation

Sections 2.2 and 2.3 show the drivers and barriers that increase or decrease the willingness of people to respectively invest in solar panels and join local green energy projects. As discussed in section 2.1 citizens' willingness to invest in solar panels and their willingness to join local green energy projects are two important pillars for citizens' willingness to participate (that is an important influence on the success or failure of Waternet's citizen participation solar panel project), but are not sufficient. The third pillar of willingness to participate is that of willingness to sustain participation for a longer period of time. Like the previous two pillars, this pillar is also influenced by drivers and barriers. This section discusses the drivers and barriers that have been found in scientific literature to influence citizens' willingness to sustain participation in local green energy projects.

2.4.1. Drivers

One of the drivers which influences willingness to sustain participation is identified by Arnstein (1969), creator of the 'citizen participation ladder' (see section 1.1). She found that on the highest three steps of the ladder (i.e. step six, seven and eight) chances to create a successful citizen participation project (and thereby increase the willingness of citizens to sustain their participation in the long term) are the highest because citizens have real influence on and are thereby involved in the project. This real influence is in contrast with what happens on the fifth step of the ladder. On this step committees of citizens are formed, but their rights and responsibilities are often unclear, which "is likely to cause considerable conflict at the end of (...) the planning process" (Arnstein, 1969, p. 220). This reduces the chance of success and long term participation. This effect grows on every lower step. This means that *influence of citizens in the planning and decision making process* through structures such as joint policy boards and planning committees positively influences citizens to sustain their participation for a longer period of time. This is related to the fact that a democratic decision making process is a driver for the willingness of citizens to join local green energy projects (Hinshelwood & Tawe, 2000) (see section 2.3.1).

Hoffman and High-Pippert (2010) found that sustaining participation is, next to personal financial incentives, also positively influenced by a commitment to community values (the willingness of people to place societal needs over personal needs). As Hoffman and High-Pippert (2010, p. 7571) state: "neither pure altruism nor calculating self-interest [is enough], but rather a mix of desires to benefit the self and others" is required to positively influence citizens' willingness to sustain participation. In other words: purely a financial compensation often does not positively influence the willingness of citizens to sustain participation in a local green energy project enough (although personal benefits are also required). According to Hoffman and High-Pippert (2010, p. 7571) "failing to acknowledge the important role played by the nonmaterial benefits of social gratification (...) can create significant difficulties" in sustaining citizens' participation. In another article from Hoffman and High-Pippert (2005) similar findings were discussed: citizens want selective benefits (benefits they can only acquire if they participate), but also want civic gratification (contributions to the welfare of the community). Rogers et al. (2008) made a similar finding. They found that local motivators are among the most important drivers, more important than those of global issues. This finding was also made by Walker and Devine-Wright (2008) as well as Seyfang et al. (2013), who found in their survey that over half of the respondents used the financial surplus earned by local green energy projects to invest in the neighbourhood. This means a driver that positively influences citizens' willingness to sustain participation in local green energy projects is a *combination of personal and (immediate) societal benefits* of the project. Personal benefits can be material (e.g. money) as well as non-material (e.g. career opportunities). Societal benefits can for example be the

development of a strong community and enhancing the local employment opportunities (Hoffman and High-Pippert, 2010).

Finally, Ho and Coates (2002) found that although sustaining citizen participation is difficult, many citizens will be willing to do so if they believe that their investment of time and money makes a difference. They found that *officials that demonstrate support to the process and are committed to implementing the results* are important for this and therefore positively influence the willingness of people to sustain their participation on a longer term. It thereby constitutes a driver.

2.4.2. Barriers

A barrier for willingness to sustain participation can be found in the *knowledge and skills gap* citizens have concerning the technologies and regulations that are of influence on the project. Although citizens may be willing to participate, they are often unable to lead the project because they lack expertise. This may be a negative influence on their willingness to sustain participation in the long term (if they discover leadership is lacking they may leave), but can be reduced or even removed by a larger organisation that leads the project (Rogers et al., 2008; Seyfang et al., 2013).

Furthermore, a barrier can be found in the (lack of) financial means to support the project in the long term. Seyfang et al. (2013) discovered that a main barrier for citizens' willingness to sustain participation in local green energy projects was that of funding. Citizens often pay the first expenses with their own financial means, but in time a distinct *lack of strategic financial resilience* may constitute a barrier for their willingness to sustain participation (i.e. if citizens have to keep making financial contributions, rather than earning from the project (either via extra income or a reduction in energy bills) citizens are unlikely to sustain their participation).

2.4.3. An overview of the drivers and barriers

Although the number of drivers and barriers that influence citizens' willingness to sustain participation in local green energy projects is relatively small compared to those that influence their willingness to invest and join according to scientific literature, the drivers and barriers are of equal importance as those of the previous two pillars (see also section 2.1). Table 2.5 presents an overview of all drivers, while table 2.6 presents an overview of all barriers that influence citizens' willingness to sustain participation identified in scientific literature.

Drivers	Source(s)
Influence of citizens in the planning and decision making process	Arnstein (1969)
Combination of personal and (immediate) societal benefits	Hoffman and High-Pippert (2005); Hoffman and High-Pippert (2010); Rogers et al. (2008); Seyfang et al. (2013); Walker and Devine-Wright (2008)
Officials that demonstrate support to the process and are committed to implementing the results	Ho and Coates (2002)

Table 2.5: Overview of all drivers that positively influence citizens' willingness to sustain participation in local green energy projects according to scientific literature.

Barriers	Source(s)
Knowledge and skills gap	Rogers et al. (2008); Seyfang et al. (2013)
Lack of strategic financial resilience	Seyfang et al. (2013)

Table 2.6: Overview of all barriers that negatively influence citizens' willingness to sustain participation in local green energy projects according to scientific literature.

2.5. A synthesis of the drivers and barriers

Sections 2.2, 2.3 and 2.4 show that a large number of drivers and barriers influence the willingness of citizens to participate according to scientific literature. Willingness to join is influenced by the highest number of drivers (10), while willingness to invest is influenced by the highest number of barriers (12). Some of the drivers and barriers overlap between the three pillars⁶². Because the three pillars are of equal importance for a successful solar panel project in which citizens participate (see section 2.1), combining the drivers and barriers that overlap between the pillars is possible. In section 2.5.1 the overlapping drivers are combined. In section 2.5.2 the same is done for the overlapping barriers. After combining the drivers and barriers it is possible to create an overview of all potential drivers and barriers identified in scientific literature. This overview is presented in section 2.5.3.

2.5.1. Combining the drivers that influence citizens' willingness to participate

The following drivers found in the scientific literature contain such great overlaps that they can be combined. Firstly, *reducing bills* and *financial incentives* overlap and are combined, because both result in financial gains for citizens and thereby increase their willingness to participate. Secondly, *concerns for the environment* and *ethical and environmental commitment* are also highly related and overlap, because both concern the same 'relation' citizens feel with the environment. Thirdly, the drivers formed by a *green status symbol* and a *source of community pride* can be combined, because both concern the image a green energy production installation (which includes solar panels) has. Fourthly, *peer effects* and an *act of neighbourliness* can be combined, because both concern the influence that neighbours (and other close citizens) can have on citizens' willingness to participate by informing and inviting each other. Fifthly, *information meetings* can be combined with *debates and consultation*, because both concern meetings between the project organiser(s) and the citizens. Sixthly, a *fair distribution of potential benefits* can be combined with a *combination of personal and (immediate) societal benefits*, because both concern the idea that benefits of the program should not only be used for the citizens that participate personally, but also for the neighbourhood. The last two drivers that can be combined are a *democratic decision making process* and the *influence of citizens in the planning and decision making process*. Both concern the fact that the willingness of citizens to participate is positively influenced if they are able to influence the project.

2.5.2. Combining the barriers that influence citizens' willingness to participate

Besides drivers, a number of the barriers found in the scientific literature can also be combined. Firstly, *high up-front costs* and *discouragement from having to make a financial contribution* both concern the high investment costs which solar panels require and can therefore be combined. Secondly, *long payback times* and a *lack of strategic financial resilience* can also be combined, because a lack of strategic financial resilience means the payback time becomes longer (or payback does not even happen). Thirdly, three barriers can be combined into one. These are a *lack of information concerning the technologies*, a *lack of access to knowledge* and a *knowledge and skills gap*. All three concern the fact that citizens' willingness to participate is negatively influenced by a lack of knowledge and skills concerning the techniques that are used and required in solar panel projects. Finally, two more barriers can be combined into one. These are a *lack of time* and a *lack of time during involvement*. Both concern the fact that citizens do not have enough time, or are not

⁶² If researchers found related or similar drivers or barriers that were of influence in the same pillar, they have already been combined in the description of the drivers and barriers of that pillar (i.e. sections 2.2, 2.3 and 2.4).

willing to spend enough time on the project and are therefore not willing to participate in the project.

2.5.3. Drivers and barriers identified in the scientific literature

In tables 2.7 (drivers) and 2.8 (barriers) the final lists of drivers and barriers that influence the willingness of citizens to participate according to previous scientific research are presented. If drivers and barriers overlapped they have been combined in these tables. All drivers and barriers presented in the tables are 'potential drivers and barriers'.

Number	Driver	Source(s)
1	Saving energy	Caird et al. (2008)
2	Reducing bills and making money	Caird et al. (2008); Walker (2008)
3	Ethical and environmental commitment that leads to concerns for the environment	Caird et al. (2008); Palm and Tengvard (2011); Walker (2008)
4	Green status symbol as a source of (community) pride	Caird et al. (2008); Faiers and Neame (2006); Hoffman and High-Pippert (2010); Palm and Tengvard (2011)
5	Higher income	Caird et al. (2008); Jager (2006); Kwan (2012)
6	Higher education level	Jager (2006); Kwan (2012)
7	Age	Kwan (2012)
8	Peer effects that are spread through acts of neighbourliness	Bollinger and Gillingham (2012); Hinshelwood and Tawe (2000); Hoffman and High-Pippert (2010); Jager (2006); Seyfang et al. (2013)
9	Information meetings, debates and consultation	Hinshelwood and Tawe (2000); Irvin and Stansbury (2004); Jager (2006)
10	Involvement via respected people in the community	Hinshelwood and Tawe (2000)
11	(Fear of) negative reactions of neighbours towards a renewable energy installation on citizens' own property	Palm and Tengvard (2011)
12	Fair distribution of potential benefits between personal and societal benefits	Boon (2012); Hoffman and High-Pippert (2005); Hoffman and High-Pippert (2010); Rogers et al. (2008); Seyfang et al. (2013); Walker (2008); Walker and Devine-Wright (2008)
13	Democratic decision making process that gives influence to citizens in the planning and decision making process	Arnstein (1969); Hinshelwood and Tawe (2000)
14	Local people's awareness of broader issues of renewable energy production installations	Hinshelwood and Tawe (2000)
15	Officials that demonstrate support to the process and are committed to implementing the results	Ho and Coates (2002)

Table 2.7: All drivers that influence citizens' willingness to participate in local solar panel projects according to scientific literature. The left column indicates the number of the (combined) drivers (for referencing in the next chapters).

Number	Barrier	Source(s)
i	High up-front costs citizens have to make	Boon (2012); Caird et al. (2008); Faiers and Neame (2006); Jager (2006); Palm and Tengvard (2011); Rogers et al. (2008); Watson et al. (2006)
ii	Long payback times, which may be a negative influence because of lack of strategic financial resilience	Caird et al. (2008); Faiers and Neame (2006); Jager (2006); Palm and Tengvard (2011); Seyfang et al. (2013); Watson et al. (2006)
iii	Perceived risk of new technologies	Palm and Tengvard (2011); Seyfang et al. (2013); Watson et al. (2006)
iv	Getting planning permission	Jager (2006); Watson et al. (2006);
v	Lack of knowledge concerning the technologies	Jager (2006); Leaney et al (2001); Rogers et al. (2008); Seyfang et al. (2013); Watson et al. (2006)
vi	Lack of access to capital	Caird et al. (2008); Watson et al. (2006)
vii	Lack of time during involvement	Rogers et al. (2008); Watson et al. (2006)
viii	Finding a suitable location	Caird et al. (2008)
ix	Finding a trustworthy installer	Caird et al. (2008); Palm and Tengvard (2011)
x	(Fear of) insufficient output	Caird et al. (2008)
xi	Lower education level	Kwan (2012)
xii	Age	Kwan (2012)
xiii	Lack of access to information	Leaney et al (2001)
xiv	Low local awareness of the organisation	Boon (2012)
xv	Low interest of citizens in energy issues	Boon (2012)
xvi	Unwillingness to be committed to an organisation	Boon (2012)
xvii	Lack of time to make a decision	Hinshelwood and Tawe (2000)
xviii	Lack of expert advice and support	Walker (2008)
xix	Lack of trust in the organisation	Seyfang et al. (2013); Walker et al. (2010)

Table 2.8: All barriers that influence citizens' willingness to participate in local solar panel projects according to scientific literature. The left column indicates the number of the (combined) barriers (for referencing in the next chapters).

2.6. Concluding remarks

Based on the analysis of the drivers and barriers that influence willingness to invest, join and sustain participation (see sections 2.2, 2.3 and 2.4) and after combining the overlapping drivers and barriers and presenting an overview of all drivers and barriers identified in scientific literature (see section 2.5) it is possible to answer sub-question 1. In total, 15 different drivers and 19 different barriers have been identified based on previous scientific research (see tables 2.7 and 2.8 for details). It is clear that although some drivers and barriers have been identified in multiple studies, there is also a large number of drivers and barrier which have only been identified in one study. The drivers and barriers differ greatly, and range from personal characteristics (e.g. age) to aspects of the project (e.g. high up-front costs citizens have to make).

In chapters 5 and 6 these potential drivers and barriers are analysed with help of the survey. A distinction is made between the potential drivers and barriers that are drivers and barriers in practice and those that are not drivers and barriers in practice in these chapters⁶³.

⁶³ Tables 2.7 and 2.8 do not present the final list of potential drivers and barriers that may influence citizens' willingness to participate. More potential drivers and barriers are discussed and added to the list of potential drivers and barriers in chapter 3, based on the pilot project of Waternet and reasoning of the author.

3. Drivers and barriers in the Zon op Waternet project

3.1. Introduction

A group of four Waternet employees (Gijs van der Meer, Enna Klaversma, Jos van der Meer and Ingrid Heemskerk) has, since early 2012, developed a solar panel project in which Waternet employees can participate. In this project, called Zon op Waternet, employees of Waternet were invited to buy a solar panel which would be placed on a roof of Waternet (Intranet, n.d.b). The profits made via these solar panels are divided among the participating employees.

Although the Zon op Waternet project is a stand-alone project, it is also used to gain more knowledge for future PV projects and can therefore be seen as a pilot for the citizen participation solar panel project which Waternet currently develops and may implement later (Van der Meer, 2014b). Although the scientific literature study showed a large number of potential drivers and barriers (see chapter 2), it is unlikely that these are all the potential drivers and barriers which exist that may influence citizens' willingness to participate in local solar panel projects. More potential drivers and barriers might exist, but have simply not been identified in scientific literature yet. It is therefore possible to learn valuable lessons concerning drivers and barriers for willingness to participate from this pilot project. More specifically, it is likely that new potential drivers and barriers can be identified based on this project. The focus of this chapter is therefore sub-question 2:

What lessons concerning drivers and barriers that influence citizens' willingness to participate can be learned from the pilot project Zon op Waternet?

First, in section 3.2 the characteristics of the Zon op Waternet project are discussed. These characteristics include the setup of the project, Waternet's reasons to start the pilot project and the means Waternet used to invite employees to participate. In section 3.3 these key characteristics are compared to the (potential) drivers found in the scientific literature research (see chapter 2) and new potential drivers are identified⁶⁴. In section 3.4 the same is done for the barriers.

Next to the drivers and barriers that influence citizens' willingness to participate found in the scientific literature (see chapter 2) and a number of new drivers and barriers identified based on the pilot project Zon op Waternet, it is likely that a number of potential drivers and barriers has not been identified in either. As these drivers and barriers may still influence the willingness of citizens to participate in Waternet's solar panel project, it is important that they are identified and subsequently researched in the survey (see chapters 5 and 6 for the results of the survey). Based on reasoning by the author a number of potential drivers and barriers that may influence the willingness to participate of citizens are therefore identified in section 3.5. In section 3.6 the answer to sub-question 2 is presented. Finally, in section 3.7 a synthesis of all potential drivers and barriers that have been identified in this thesis (both in this chapter and chapter 2) is presented. They form the complete lists of potential drivers and barriers which are analysed in the survey.

⁶⁴ By first comparing the pilot project with the potential drivers identified in scientific literature only the reasons and means which do not overlap with potential drivers already identified in scientific literature are analysed. Via this way new potential drivers can be identified which have not been identified in scientific literature before.

3.2. Characteristics of the Zon op Waternet project

3.2.1. Setup of Zon op Waternet

3.2.1.1. Before the implementation of the project

The employees of Waternet that wanted to participate in the project Zon op Waternet became members of the cooperative Zon op Waternet (created by Zon op Nederland, an external company which takes care of the organisation of this project). Via this cooperative the employees invested in solar panels that were placed on Waternet's roof. The roof that was used for this project is the roof of the technical building near sewage treatment installation De Ronde Venen (Waternet, 2013b). The energy these solar panels create is bought by Waternet⁶⁵ for the price it would normally pay for its electricity on the location where the solar panels are placed (currently about €0.125 per kWh (Intranet, n.d.b)). Every year, after subtracting the costs⁶⁶, the profit is divided by the cooperative (in ratio) among the participating employees (Intranet, n.d.d). The employees had to make a one-time investment of €400.00 per solar panel (Intranet, 2013c). The payback time for the solar panels is 10-15 years (with a yearly return of about 5 per cent⁶⁷), while the solar panels are planned to stay in operation for 25 years. After these 25 years employees will have doubled (possibly tripled) their original investment⁶⁸ (Heemskerk et al., 2012). If a participant decides to leave the project he/she may sell the solar panel through Waternet to another interested employee (Intranet, n.d.d).

The cooperative formed by the employees has taken over the control of the project after the installation of the solar panels. Waternet is of course still connected to the project as their roof is used, but the cooperative of employees participates in the governance of the project⁷⁰ because the time Waternet can invest in this is limited (Klaversma, 2014). This means the participation level of the employees in the cooperative is closest to the sixth step of Arnstein's (1969) citizen participation ladder: participation. On this step citizens (in this case employees) "negotiate and engage in trade-offs with traditional powerholders" (Arnstein, 1969, p. 217).

To research the viability of this project before it was implemented a poll was organised on Waternet's intranet⁷¹. This poll was used to measure Waternet's employees' willingness to participate. The results of this poll with 180 respondents (almost 10 per cent of Waternet's employees (Heemskerk et al., 2012; Rustveld, 2014)) can be found in table 3.1. Although reliability and validity cannot be fully guaranteed (because certain groups of employees may be more likely to participate in the poll than others⁷² and the costs of the solar panels were eventually lower than expected at the moment of

	Response	Percentage
Interested if the payback time is max. 10 years	73	40.6
Interested if the payback time is max. 25 years	15	8.3
Not interested because €500 investment-costs are too high	48	26.7
Not interested for another reason	44	24.4

Table 3.1: Distribution of the response by Waternet's employees to the question "If I get the possibility to invest in my own solar panel of about €500.00 that will be placed on a roof of Waternet, I am:"⁶⁹, which was presented in a poll on Waternet's Intranet. Source: Heemskerk et al., 2012.

⁶⁵ Because Waternet buys the electricity, this means it may be counted as green energy by Waternet, which can be used to become CO₂ neutral.

⁶⁶ Costs of Zon op Nederland and the costs to insure the solar panels (Intranet, n.d.d).

⁶⁷ Exact payback time and yearly return are dependent on the sun and future fluctuations of the electricity price.

⁶⁸ Of course there is always a risk. The calculations assume prices of electricity will increase in the future. However, if prices instead go down (or stay the same) the calculations will be different and the payback time will increase. This risk is carried by the employees, not by Waternet (Heemskerk et al., 2012).

⁶⁹ This is a translation by the author of this thesis. The answers in the table have also been translated.

⁷⁰ In the employees' own time, not during the hours they work at Waternet.

⁷¹ At the time the poll was organized the costs for the participants were expected to be €500.00 per solar panel. When the project was implemented they were €400.00 per solar panel instead (Heemskerk et al, 2012; Intranet, 2013c).

⁷² For example, employees that work in an office may be more likely to participate in the poll than those that work 'in the field'. Furthermore, employees that are interested in sustainability and/or solar panels may also have been more likely to participate in the poll.

the poll) it shows that interest in this project was relatively high at the moment the poll was organized, as almost 50 per cent of the respondents showed at least some level of interest.

Niks (2012) held a discussion session with a number of Waternet's employees concerning the Zon op Waternet project while it was still in its planning phase⁷³. During this discussion session it became clear that idealism and financial means were an important driver and barrier for Waternet's employees' willingness to participate. One employee for example stated⁷⁴ about idealism that "not everyone will participate for purely idealistic reasons" to which another employee responded: "I won't. At least not purely because of ideals. It is also about the combination of costs and payback time", while another responded: "I'm idealistically in this project. At least I have no high hopes concerning the payback time". Concerning the influence of financial means a number of employees showed that they worried about the initial investment costs⁷⁵. One employee stated: "I can imagine that for some people of Waternet €500 is a lot. Can people also participate for a lower amount?", to which another employee responded: "I think it is regrettable if it [the Zon op Waternet project] would become something that only people that earn a lot can do"⁷⁶.

3.2.1.2. Implementation of the project

On 1 March 2013 the Zon op Waternet project was launched. This was the moment the project was made public for Waternet's employees. Via the intranet more information was made available for Waternet's employees (Intranet, 2013b). The pre-registration for the project was opened for Waternet's employees on 17 June 2013 (Intranet, 2013c) and closed on 13 September 2013 (Intranet, n.d.d). The definitive registration was opened after this, but all solar panels were already sold to employees that registered during the pre-registration period. Those that registered during the normal registration period were placed on a backup-list⁷⁷ (Van der Meer, 2013f).

The number of employees that was willing to participate was lower than the poll suggested, which may be explained by the fact that a large percentage of the employees that indicated in the poll they were interested was only interested if payback times were maximally ten years⁷⁸. In the real project they are expected to be between 10 and 15 years (Heemskerk et al, 2012). Still, enough employees wanted to participate to sell all solar panels. In total, 57 employees showed interest and were willing to participate. Of these, due to unforeseen circumstances, six were eventually unable to participate. This means 51 employees (2.9 per cent of Waternet's employees (Rustveld, 2014)) bought one or two solar panels. Although a number of employees would have liked to buy more solar panels (27.5 per cent of the participants was willing to buy three or more solar panels⁷⁹), this was not possible, because the roof of the building on which the solar panels have been placed cannot support more than 74 solar panels (Inschrijvingen, 2013). The solar panels have officially been in use since 1 February 2014⁸⁰ (Van der Meer, 2014a). Based on the fact that all solar panels were quickly sold the project can be called a success.

⁷³ Unfortunately, the author was unable to trace back who exactly participated in this discussion session. All participants are therefore simply called 'employee'.

⁷⁴ All quotes concerning the discussion have been translated from Dutch to English by the author of this thesis.

⁷⁵ The investment costs were still thought to be €500.00 per solar panel at the time of the discussion session.

⁷⁶ Eventually it was not possible for people to participate for less than one solar panel, due to administrative problems this would pose (Van der Meer, 2014a). However, costs per solar panel were reduced from €500.00 to €400.00 (Intranet, 2013c).

⁷⁷ If an employee that registered during the pre-registration changed his/her mind an employee on the backup-list would be offered the opportunity to participate (Van der Meer, 2013f).

⁷⁸ This is a finding that is not unique to Waternet, as Watson et al. (2006) made a similar discovery.

⁷⁹ Of which a number of employees even would have liked to buy ten solar panels according to Klaversma (2014).

⁸⁰ Originally, the solar panel installation was planned to go in operation in the week of 2 December 2013 (Intranet, n.d.c), but due to the bankruptcy of the installer (Energieker) this had to be postponed (Van der Meer, 2014a).

3.2.2. Waternet's reasons to start Zon op Waternet

Waternet had multiple reasons to create the Zon op Waternet project. In total, 11 reasons can be distinguished. In table 3.2 a summary of these reasons is presented. Below, they are discussed in more detail one by one (although in reality they overlap (Heemskerk, 2014)). The interviewees saw different reasons as important or less important (or even purely positive side effects of the project).

Because of this in this thesis no distinction has been made between important and less important reasons (or positive side effects) to start the project, although it is noted when an interviewee saw the reason as very important or only a positive side effect. The order in which the reasons are discussed (and presented in table 3.2) therefore does not indicate their importance.

The first reason for Waternet to start the Zon op Waternet project is connected to their goal of becoming CO₂ neutral in 2020 (Van der Meer, 2013a; Van Odijk, 2012). By increasing the amount of green energy Waternet uses instead of grey energy, a step towards CO₂ neutrality for Waternet is made⁸¹.

A second reason to create the project for Waternet was that it had won a sustainability contest organised by Jong Waternet. The reward of the contest was that Jong Waternet would help to create and carry out the project (Heemskerk, 2014; Intranet, n.d.a; Klaversma, 2014).

Thirdly, Waternet hopes this project will increase the awareness of sustainability among its employees (Heemskerk et al., 2012; Internal Network, 2013a; Van der Meer, 2014b). This awareness may subsequently trickle down into other projects and behaviour, helping Waternet to reach its goal of becoming CO₂ neutral in 2020 (Heemskerk, 2014; Van der Meer, 2014b). To increase the awareness of its employees as much as possible, Waternet decided to focus on a large number of participating employees with a low number of solar panels per employee, rather than a low number of participating employees with a large number of solar panels per employee⁸² (Van der Meer, 2014a).

Next to awareness raising among all employees in the organisation, Heemskerk (2014) stated that the Zon op Waternet project was a useful method to show the possibilities of solar panels to those

Reasons
Help Waternet to reach its goal of becoming CO ₂ neutral in 2020
Winner of the sustainability contest
Increase awareness of sustainability among employees
Show the possibilities of solar panels to those with a higher position in the organisation
Present employees without a (suitable) roof the ability to invest in solar panels
A focus on implementation of the project, next to design
Innovative project
Strengthen connections between employees
Improve Waternet's image
Create knowledge about PV projects for future project for Waternet, possibly involving citizens
Personal development of the project team

Table 3.2. Waternet's reasons to start Zon op Waternet.

⁸¹ The installation that is financed by the employees for the Zon op Waternet project produces around 15,300 kWh per year according to the original installer (Energieker, 2013). The building on which the installation is placed uses 13,000 kWh per year on average, which means this building is CO₂ neutral because of this project. But although this project helps Waternet to reach its goal, the step the Zon op Waternet project contributes is small. The installation has a Watt-peak (Wp) of 18,000 (Energieker, 2013), while if all available terrain of Waternet is used 10,000,000 Wp would be available (which is about 10 per cent of Waternet's current electricity use) (Van der Meer, 2013a). This installation therefore provides about 0.02 per cent of Waternet's current yearly electricity use.

⁸² The registration was therefore open longer than necessary to sell all solar panels (which happened in less than a day (Van der Meer, 2014a)) to present more employees the opportunity to participate. It should be kept in mind however they were not all sold to different employees in order to spread the effects as much as possible in the organisation. This can be concluded from the fact that a number of employees bought two solar panels (Inschrijvingen, 2013). If Waternet would have been able to create more willingness to participate among a number of currently non-participating employees these employees might have bought these solar panels, instead of them being sold to participants that had already bought a solar panel from Waternet. This would have led to a project in which no participant had bought more than one solar panel. It should however be noted that, as indicated by J. van der Meer (Klimaatverbond, 2014), Heemskerk (2014) and Klaversma (2014) that although Waternet opened the registration period for a longer time, they did not actively attempt to create a greater willingness to participate after all solar panels were sold (i.e. the first day of the pre-registration period).

who have a higher position in the organisation of Waternet. According to her this project would be a good example of these possibilities. It is therefore the fourth reason to start this project.

Fifthly, according to Heemskerk et al. (2012) and Heemskerk (2014), an important reason to create this project for Waternet was that it presented employees that cannot invest in solar panels on their own roof (for example because they own no roof (e.g. they live in an apartment) or because their house is a monument) an alternative method to invest in solar panels. These employees can still produce green energy via solar panels if they would like to in this project.

A sixth reason to start this project according to Van der Meer (2014b) was that it was a project in which the step between design and implementation was relatively small. According to him this might stimulate employees of Waternet who work on other projects to also focus more on the implementation of projects next to their design.

Seventhly, the innovativeness of this project was a motivation (and therefore reason) to implement it. The innovation can be found in the fact that with this project Waternet has created the first (Dutch) PV cooperative which consists entirely of employees of one company (Internal Network, 2013a).

This is connected to the eighth reason to create this project. As the participating employees together create a cooperative aimed at the long-term, Heemskerk (2014), Klaversma (2014) and Van der Meer (2014b) expect that this will increase and strengthen the connections between them. This will not only help to make the project a success, but is also expected to help create and strengthen the horizontal connections in the organisation as employees of different sectors work together (Internal Network, 2013a). According to Klaversma (2014) this can be seen as a positive side effect of the project. Creating stronger horizontal ties is one of the six development themes of Waternet for 2014. Zon op Waternet is officially recognized by Waternet as a project to improve these (Intranet, 2013e; Intranet, 2014).

Ninthly, the project may result in an improved image for Waternet in two ways. Firstly, the sustainability aspect combined with the innovative aspect of a PV cooperative of employees has created interest from other organisations, such as PWN Waterleidingbedrijf Noord-Holland, Hoogheemraadschap Hollands Noorderkwartier, Hoogheemraadschap de Stichtse Rijnlanden, Dunea, Vitens and the municipality of Amsterdam (Internal Network, 2013a). Secondly, the project has created expertise among Waternet's employees concerning the legislation surrounding this type of projects, which they can use in the national discussion concerning such projects, which may also improve their reputation (Heemskerk et al., 2012). Although this was not a direct reason to create the project according to Heemskerk (2014), but rather a positive side effect, it may have played a role in the decision to implement the project.

Connected to the interest of other organisations and the expertise this project may create for Waternet is the tenth reason Waternet has to create this project. Waternet states that it may expand this project towards the municipality of Amsterdam or AEB (Afval Energie Bedrijf, a waste disposal company) if it is successful⁸³ (Heemskerk et al., 2012; Internal Network, 2013a). Furthermore, the project can also be expanded towards the customers of Waternet (citizens living in Amsterdam and surroundings) (Internal Network, 2013a; Intranet, n.d.a). The Zon op Waternet project is used as a pilot project in this case, using the knowledge gained in this project in the larger project involving citizens (as also indicated in section 1.3) (Internal Network, 2013a; Heemskerk, 2014; Van der Meer, 2014b). Van der Meer (2014b) indicated that this project indeed led to a large number of new insights in the development of this type of projects, which can be used to design the citizen

⁸³ Although this was originally planned in practice this has not been done yet and at the moment Waternet is unsure whether it will try to expand this project towards the municipality or AEB in the future (Van der Meer, 2014a).

participation project. More specifically he indicated that according to him this may be the most important reason to start the project when looking back upon it, as the insight it showed Waternet into this type of projects is highly valuable for future (larger) solar panel projects, such as the citizen participation project.

Finally, personal development of the project team (i.e. Gijs van der Meer, Enna Klaversma, Jos van der Meer and Ingrid Heemskerk) was also a reason to start this project (Internal Network, 2013a). Van der Meer (2014b) stated that although it was a reason to start the Zon op Waternet project, it was something natural, which happens in all projects in which people of different backgrounds work together.

3.2.3. Means to create willingness to participate in Zon op Waternet

To invite Waternet's employees' into the Zon op Waternet project (and increase their willingness to participate), Waternet has used a number of means. Not all means have directly been aimed at increasing Waternet's employees' willingness to participate in the project, but all may have done so, possibly indirectly. In total, seven reasons can be identified. In table 3.3 a summary of these means is

Means
Information on the intranet not directly aimed at increasing willingness to participate
Information on the intranet aimed at increasing willingness to participate
Presentations about the project
A poster to spread information about the presentation
Articles in the digital sector-magazine Waterdruk and Waternet's magazine Helder
The ability for employees to ask questions via different contact methods even after the presentations and not exclusively at the presentation
Relations in the network of the project team

Table 3.3: Means Waternet used to invite employees to participate in Zon op Waternet.

presented, while below a more detailed description is given⁸⁴. It is important to note that although Waternet's employees were allowed to invest time in this project, Waternet did not invest financial means directly into this project and is unable to do so in the future, according to Van der Meer (2014a), as is also the case for the citizen participation project (see section 1.3).

Firstly, the project Zon op Waternet was part of a sustainability contest organised by Jong Waternet as discussed in section 3.2.2. For this contest, a poll was created on the intranet in which employees could vote which project they would like to win. Zon op Waternet was one of the options (Heemskerk et al., 2012) and final winner of the contest. This poll on the intranet was the first time employees heard of Zon op Waternet. Although this poll was not directly aimed at increasing the willingness to participate of employees, it may have done so indirectly.

Secondly, the intranet was used to spread information about the project, thereby directly aiming to increase the willingness to participate of employees. Brief news articles with updates concerning the state of the project were posted. Furthermore, a specific page on the intranet was dedicated to the project, with more in-depth information (Intranet, n.d.c) and a website is available on which the participants can see how much green electricity is produced by their solar panels every day (Van der Meer, 2014d). According to Heemskerk (2014) the intranet is an important method to spread information among the employees, as a large number of Waternet's employees regularly reads this.

Thirdly, during the final round of the sustainability contest in March 2012 all nominees gave a speech about their project for all employees that were interested (Intranet, n.d.a). Furthermore, a 'lunch-meeting' was organized on 24 June 2013, during which a presentation with details concerning the project (including a brief discussion of (financial) costs and benefits) was presented. Part of the presentation was given by Zon op Nederland (Klaversma, 2014). This presentation directly aimed at

⁸⁴ It is important to note that these means were not used one by one time-wise. Instead, they sometimes overlapped in time. The order in which they are presented here therefore does not indicate the order in which Waternet used them.

increasing the employees' willingness to participate. Klaversma (2014) thinks this presentation was one of the most important means Waternet used to increase willingness to participate.

Fourthly, information that a presentation would be given was communicated via the intranet and via posters on the day of the presentation. The poster did not go into detail about the project (Internal Network, 2013b). In total, about 39 employees visited the presentation (Van der Meer, 2013f).

Fifthly, in the monthly sector-magazine ('Waterdruk'), which is spread among the employees via email, Zon op Waternet was briefly discussed. All employees receive a notification via email when the new magazine is available (Waterdruk, 2013). Similar to this a number of articles were published in Helder, the company magazine (Heemskerk, 2014; Helder, 2012a; Helder, 2012b). In contrast to Waterdruk, this magazine was printed instead of digitally distributed.

Sixthly, employees were invited to ask questions about the project at any moment, instead of exclusively at the presentations (the invitation for this was published on the intranet). Questions could be asked via email, via the intranet, via the telephone or in person. The number of employees that asked questions via the intranet was small, as only two employees contacted the project team for questions via the intranet (Intranet, 2013d). No information was available about the number of employees that asked questions via email, telephone or in person.

Finally, Heemskerk (2014) and Klaversma (2014) noted that next to these company-wide means of creating willingness to participate, the project team members also used their network in the organisation. Via their networks they gained an impression of the interest of other employees (next to the official poll on the intranet) and invited employees to participate. Concerning the amount of employees that were reached via this method Heemskerk (2014) stated "I know we [the project team] all have a large number of people surrounding us. We do not reach the whole company, certainly not. (...) But we meet a lot of people". The importance of this personal network was also noted by Mol (2014a), who stated he first became aware of the project via Enna Klaversma, a colleague of him, who discussed it with him. On the other hand, Klaversma (2014) stated that although the personal network of the project team was important, there was a large number of employees that participates in the project whom she and the others of the project team did not know before the project⁸⁵. These employees therefore decided to participate not because they were invited via the network of the project team, but because they heard of the project via one (or multiple) of the other means discussed here.

3.3. Drivers for participation

The previous section has presented an overview of the setup of Zon op Waternet, the reasons for Waternet to start the project and the means they used to invite employees to participate. In section 3.3.1 these are compared to the drivers identified in the scientific literature (see chapter 2) and it is discussed in how far Waternet used these drivers in the Zon op Waternet project. It is possible that a number of potential drivers were not identified in the scientific literature research, but were present in the pilot project. Therefore the potential drivers that were not identified in the scientific literature research but are present in the pilot project are identified in section 3.3.2.

⁸⁵ One of these was Kessler (2014).

3.3.1. Drivers identified in the scientific literature and Zon op Waternet

When reviewing the drivers that make citizens (or in this case employees) willing to participate found in scientific literature, it is clear that Waternet used a number of them in the pilot project. Although they were used, this does not mean they also influenced all employees. It is possible that only the willingness to participate of some employees was positively influenced by the drivers⁸⁶. Furthermore, the use of some drivers may have simply been the result of the project's setup, without Waternet consciously trying to use the driver. In table 3.4 an overview of which driver was used and which was not used in the Zon op Waternet project can be found. In total, Waternet (partially) used 11 of the 15 potential drivers identified in scientific literature. Below they are discussed in more detail, starting with the drivers that were used, followed by the drivers that were not used.

Number	Driver	Used in the pilot project
1	Saving energy	Partially
2	Reducing bills and making money	Yes
3	Ethical and environmental commitment that leads to concerns for the environment	Yes
4	Green status symbol as a source of (community) pride	No
5	Higher income	Yes
6	Higher education level	Yes
7	Age	No
8	Peer effects that are spread through acts of neighbourliness	Yes
9	Information meetings, debates and consultation	Yes
10	Involvement via respected people in the community	No
11	(Fear of) negative reactions of neighbours towards a renewable energy installation on citizens' own property	Yes
12	Fair distribution of potential benefits between personal and societal benefits	No
13	Democratic decision making process that gives influence to citizens in the planning and decision making process	Yes
14	Local people's (employees in this case) awareness of broader issues of renewable energy	Yes
15	Officials that demonstrate support to the process and are committed to implementing the results	Yes

Table 3.4: Drivers found in the scientific literature and whether they were used in the pilot project Zon op Waternet.

Driver 2 was used by Waternet because they offered employees a financial compensation for the energy their solar panels produced. Driver 3 was also used, because the environment benefits from the reduction of CO₂ emissions of Waternet. It was confirmed that this was a driver to participate for some employees during the discussion of Niks (2012) and the interview with Mol (2014a). Driver 5 is used, as at least a part of Waternet's employees has a relatively high income (as indicated by Mol (2014a)). The same goes for driver 6, a higher education level, as a part of Waternet's employees has a higher education (Mol, 2014a). Furthermore, driver 8 is used in this project. One of the means used to invite employees was the personal network of the project group. This can be seen as involvement via peer effects. Driver 9 was also used in the pilot project, as Waternet held information meetings about the project. Driver 11 was also used. By placing the solar panels on the roofs of Waternet, the participating employees did not have to fear for a negative reaction of their neighbours. Driver 13 was used as well. Although Waternet's employees did not have a large influence when the project was organised, they now form a cooperative which is responsible for the governance of the solar panels, as indicated by Klaversma (2014). It was confirmed that this was a driver to participate for some employees by Kessler (2014). Furthermore, driver 14 was used in this project. At least a part of Waternet's employees is aware of broader issues of renewable energy, as was indicated by Mol

⁸⁶ The fact that not all employees of Waternet were willing to participate in the project already shows that the drivers that were used did not increase the willingness to participate of all employees enough to make them participate.

(2014a). Finally, officials demonstrated support to the project by spending time on the project, among others in the form of meetings. Therefore driver 15 is used in the pilot project. It was confirmed that this was a driver to participate for some employees by Kessler (2014).

One driver was partially used by Waternet. This is driver 1. Although the participating employees do not reduce the amount of grey energy they use themselves (as the green energy that is produced is sold to Waternet), they can use a website (see section 3.2.3) to review how much green energy was produced by their installation. Because citizens can see how much green energy their solar panels have produced, it can be concluded this driver is partially used.

But next to the drivers that were (partially) used by Waternet in the pilot project, there are also drivers that were not used in the pilot project. These are the following. Firstly, driver 4 was not used. The solar panel(s) the employee bought is not placed on the employee's roof, thereby not making it a green status symbol that can be shown to neighbours. By not focussing on a specific age group in their project, Waternet did not use driver 7. Driver 10 was also not used in this project. Although the project team invited some employees personally (driver 8), no respected people in the community (or Waternet) did⁸⁷. Finally, driver 12 was not used. All benefits of the project were for the participants and not (partly) for other Waternet employees.

3.3.2. Transforming the reasons and means of Waternet in new drivers

Although it has become clear from the previous section that Waternet used a large number of the drivers found in the scientific literature, Waternet did more.

Waternet had a total of 11 reasons to create the Zon op Waternet project and the project team used 7 means to

invite employees and increase their willingness to participate. Some reasons and means may influence the willingness to participate of employees and can therefore be seen as a driver or barrier. This was already shown in the previous section, in which two of Waternet's means overlapped with two drivers that have been identified in scientific literature⁸⁸. Next to the two means that overlapped with two drivers identified in scientific literature, a number of the reasons and means of Waternet form potential drivers that have not been identified in scientific literature. Table 3.5 presents an overview of the new potential drivers that are identified based on the reasons and means of Waternet in the Zon op Waternet project. Below they are discussed in more detail. Only the reasons and means that form new potential drivers are discussed.

Firstly, the reason 'presenting employees without a (suitable) roof the ability to invest in solar panels', may be a driver for employees that before could not participate in solar panel investments. A number of employees may have been willing to invest in solar panels, but unable to do so before because they do not own a roof or they own a roof which is unsuitable for solar panels. This reason can therefore be seen as the following driver: '*the option to invest in solar panels without a suitable roof*'. Kessler (2014) and Mol (2014a) indicated this was indeed a driver for them to participate. Waternet's reason to 'strengthen connections between employees' also forms a potential driver.

Number	Driver
16	The option to invest in solar panels without a suitable roof
17	Creating better ties with neighbours
18	Indirect information available on a website
19	Information about the project published via a website
20	Posters to introduce the presentations
21	Flyers with information
22	The option to ask questions via the telephone, a website or by email

Table 3.5: Potential drivers that may have influenced Waternet's employees' willingness to participate in the Zon op Waternet project based on the reasons and means of Waternet.

⁸⁷ This does not mean the employees and project team that stimulated others to participate are not respected by other employees, but rather that they are not seen as an authority among Waternet employees.

⁸⁸ The 'relations in the network of the project team' and the 'presentations about the project' overlapped with drivers 8 and 9.

Creating better relations with colleagues by working together in a solar panel cooperative for a longer period of time may have increased the willingness to participate of some employees, as the idea of working together with colleagues may have appealed to them. It can therefore be seen as a driver. Because in the citizen participation project colleagues play no role but instead neighbours do, ‘colleagues’ is changed to ‘neighbours’ for this driver. The potential driver is therefore identified as “*creating better ties with neighbours*”.

Although only two new potential drivers can be identified based on the reasons of Waternet to start Zon op Waternet, more potential drivers can be identified based on Waternet’s means to invite employees. All seven means used may have influenced the willingness of employees to participate, even though not all directly aimed at doing so. Two means (the third mean, ‘presentations about the project’, and the seventh mean, ‘relations in the network of the project team’) may have influenced the willingness to participate via drivers already discovered in the scientific literature and are therefore not discussed here.

The first mean used by Waternet was ‘information on the intranet not directly aimed at increasing willingness to participate’. Although it was not aimed at increasing willingness to participate, it may have done so indirectly and can thus be seen as a driver which influences willingness to participate. Although this information was spread via the intranet, this is similar to a website (which can also be reached from outside Waternet, e.g. by citizens). The driver this mean forms therefore is the following: ‘*indirect information available on a website*’.

The second mean used by Waternet was that of ‘information on the intranet aimed at increasing willingness to participate’. In contrast to the previous driver, this information was specifically placed on the intranet to increase Waternet’s employees’ willingness to participate and invite them into the project. It therefore constitutes the following driver: ‘*information about the project published via a website*’⁸⁹. Kessler (2014) stated that this was the only method via which he received information about the project⁹⁰, thereby noting the importance of this driver.

The fourth⁹¹ mean aimed at increasing the number of employees present at the presentations. Waternet used posters to invite employees to visit the presentations. As these posters did not contain exact information about the project, but just an invitation for the presentation (at which more information was given) the posters constitute the following driver: ‘*posters to introduce the presentations*’.

The fifth mean Waternet has used to increase willingness to participate were articles in Waternet’s magazine Helder and the (digital) sector magazine Waterdruk. As these articles may have increased the willingness to participate of Waternet’s employees they constitute a driver. It may prove difficult for Waternet to spread information via a magazine to citizens (Helder and Waterdruk are not available for citizens). A (although not exactly similar) comparable method to spreading information via magazines is spreading information via a flyer. Therefore, a driver for willingness to participate is formed by ‘*flyers with information*’.

The sixth mean Waternet used to increase the willingness to participate of employees was presenting them the option to ask questions via different contact methods, such as email, telephone, the intranet and in person. Although asking questions in person will be difficult (unless they are

⁸⁹ Intranet is replaced with website because a website is similar in layout as the intranet, but can also be reached from outside Waternet’s network (by citizens).

⁹⁰ Although it was the only method by which Kessler (2014) received information about the project, this does not mean it was the only driver (or barrier) that influenced his willingness to participate, as not all drivers and barriers focus on transferring information about the project.

⁹¹ The third mean was ‘presentations about the project’. As this overlapped with the drivers found in the scientific literature research (see section 3.3.1) it is not discussed here.

asked at a presentation), a driver for citizens may be formed by *'the option to ask questions via the telephone, a website or by email'*.

3.4. Barriers for participation

The previous section has discussed which potential drivers identified in scientific literature were used in Zon op Waternet, and which new potential drivers were formed by the reasons and means of Waternet. In this chapter the same is done for the barriers. First, in section 3.4.1 the Zon op Waternet project is compared to the barriers identified in scientific literature (see chapter 2). Secondly, in section 3.4.2 it is analysed whether new potential barriers, which have not been identified in scientific literature, can be identified in the Zon op Waternet project.

3.4.1. Barriers identified in the scientific literature and Zon op Waternet

When reviewing the barriers discovered in the scientific literature research, it becomes clear that a number of them has been tackled in the Zon op Waternet project. Similar to the drivers used by Waternet, it does not mean they were intentionally tackled by Waternet⁹². In table 3.6 an overview of which barriers were tackled and which were not can be found. In total, 11 of the 19 potential barriers identified in scientific literature were tackled by Waternet. Below they are discussed in more detail, starting with the barriers that were tackled, followed by the barriers that were not tackled.

Number	Barrier	Tackled in the pilot project
i	High up-front costs citizens (employees in this case) have to make	No
ii	Long payback times, which may be a negative influence because of lack of strategic financial resilience	No
iii	Perceived risk of new technologies	No
iv	Getting planning permission	Yes
v	Lack of knowledge concerning the technologies	No
vi	Lack of access to capital	No
vii	Lack of time during involvement	Yes
viii	Finding a suitable location	Yes
ix	Finding a trustworthy installer	Yes
x	(Fear of) insufficient output	Yes
xi	Lower education level	No
xii	Age	No
xiii	Lack of access to information	Yes
xiv	Low local awareness of the organisation	Yes
xv	Low interest of citizens (employees in this case) in energy issues	No
xvi	Unwillingness to be committed to an organisation	Yes
xvii	Lack of time to make a decision	Yes
xviii	Lack of expert advice and support	Yes
xix	Lack of trust in the organisation	Yes

Table 3.6: Barriers found in the scientific literature and whether they were tackled in the pilot project Zon op Waternet.

Barrier iv was tackled by Waternet, as the employees who participated in the project did not have to worry about getting permission for their solar panels, because Waternet took care of this. The same goes for barriers viii and ix, as Waternet also took care of finding a location and installer. Furthermore, the problem of lack of time during involvement (barrier vii) was tackled by Waternet, as Zon op Nederland takes care of the (time-consuming) requirements during the lifetime of the solar panels and the governance of the cooperative is mostly performed by a small group of members of

⁹² It should be noted that although Waternet tackled these barriers, for some employees they may still have influenced their willingness to participate negatively, but the amount of employees that are influenced is most likely smaller than it would have been if the barriers were not tackled.

the cooperative (currently the project team, but this may change in the future). During a lunch-meeting Waternet also showed the participants that gaining sufficient output was no problem, thereby tackling barrier x. This lunch-meeting, combined with information available via the intranet tackled barrier xiii. As experts⁹³ are involved (they also gave the presentation) barrier xviii was tackled. Furthermore, low awareness of the organisation and a lack of trust in the organisation were most likely no barrier either, as all participants are employees of the organisation (i.e. barriers xiv and xix). Waternet also tried to tackle the problem of unwillingness to be committed to the organisation (barrier xvi), by allowing the participants who would like to leave the project and allowing other interested employees to take over their solar panels. Finally, Waternet gave the employees almost three months to register during the pre-registration, meaning that a lack of time to make a decision whether to participate or not most likely formed no barrier (i.e. tackling barrier xvii).

Although Waternet tackled a large number of barriers in this project, there is also a number of barriers that was not tackled. First of all, investment costs (€400.00) were still relatively high (barrier i) as also indicated by a number of employees during the discussion of Niks (2012) and the payback time is long (10 to 15 years) (barrier ii). Furthermore, Waternet did not provide specific information about the exact technologies (barrier v) and did not provide methods for its employees to help them gain access to capital (barrier vi). Waternet did not tackle the barriers formed by a lower education (barrier xi) and age (barrier xii). As indicated by Mol (2014a) a part of Waternet's employees has a lower education level. Furthermore, Waternet has employees of all ages. Finally, Waternet did not tackle the low interest in energy issues some of Waternet's employees may have had (barrier xv) (this project is a method to increase their interest in sustainability, meaning interest most likely comes after the project started).

3.4.2. Transforming the reasons and means of Waternet in new potential barriers

Although Waternet has a large number of reasons to start Zon op Waternet and used a number of means to invite employees, they do not form new potential barriers that have not been identified in scientific literature. The reason for this is that Waternet did not (consciously) create barriers. It can therefore be concluded no new potential barriers can be identified based on the pilot project.

3.5. Additional drivers and barriers

Although a large number of drivers and barriers that may influence the willingness to participate of citizens has been identified, a small number of drivers and barriers which may influence the willingness to participate of a citizen has not been identified yet, neither in the scientific literature nor in the pilot project. Therefore the author has identified a number of potential drivers and barriers that he thinks may also be of influence on citizens' willingness to participate. As explained in section 3.1 these have been identified based on reasoning. In tables 3.7 and 3.8 an overview of these new potential drivers (table 3.7) and barriers (table 3.8) can be found. Below they are discussed in more detail.

Firstly, '*information spread via a letter*' may be a driver. Generally, an official letter is seen as a trustworthy type of contact from an official agency. Especially at the beginning of the project it may

Number	Driver
23	Information spread via a letter
24	Information spread via email
25	Information spread via an app
26	A guarantee of a minimum profit
27	Location
28	Gender

Table 3.7: Drivers that may influence citizens' willingness to participate in a local solar panel project based on reasoning.

⁹³ Both from Waternet and from Zon op Nederland.

be effective to invite citizens into the project (or a presentation about the project) and spread information about the project via (a) letter(s), instead of or next to using another contact method.

However, modern technique presents Waternet the option to contact citizens digitally. Next to a website (see section 3.2.3) this can also be done via email. *'Information spread via email'* therefore constitutes a possible driver.

Thirdly, next to a website, information may also be spread via an application for smartphones and/or tablets (i.e. an 'app'). 'De Windcentrale', a Dutch initiative in which citizens can purchase a small part of a windmill, has such an app (De Windcentrale, n.d.). This app is used to increase citizens' willingness to participate, as it is available to both participants and non-participants (which may become participants (because they become enthusiastic when using the app) in the future). *'Information spread via an app'* is therefore also a possible driver. It is important to note that the app is complementary to the website (in the case of De Windcentrale), rather than a replacement (ibid).

Fourthly, to increase the willingness of citizens to participate in a project in which financial revenues are uncertain, Waternet could provide a guarantee of a minimum financial return. This guarantee would mean that Waternet carries the risk that the solar panels produce a lower financial return than expected, by paying the difference between the expected and real return if the real return is lower than the expected return. This driver is therefore *'a guarantee of a minimum profit'⁹⁴*.

Connected to this driver is a barrier. It may be a barrier for citizens that the *'financial revenues cannot be guaranteed'*, and are dependent on the sun as well as the government. If there is less sun, or if the government decides to abolish the current regulation in which citizens may deduct a part of their energy taxes, financial revenues may be lower than currently expected (see section 1.3.2 and the appendix, section 2, for details on the expected financial revenues).

Another barrier might be that citizens already invested in solar panels on their own roof, or via a similar project as that of Waternet on another location. Because the tax reduction is only applicable over the amount of electricity that citizens buy from an electricity company, it is not attractive for citizens to participate if they only buy a small amount of electricity (because they have solar panels on their own roof⁹⁵) or already subtract taxes from their energy bill (because they already participate in a similar project as that of Waternet from a different organisation). This barrier is therefore the following: *'already invested in solar panels'*.

Seventhly, the location where a citizen lives may also be of influence on his/her willingness to participate. A citizen who lives in a rural village may for example be more likely to invest because he/she has a greater connection with nature than a citizen living in an urban area. However, the influence of the location where a citizen lives may also be the other way around. A citizen living in an urban area might see the impact of humanity on the environment better than a citizen living in a rural area, thereby creating more willingness to participate in this project for the urban citizen. Because the exact influence of location is unknown, *'location'* is identified as a driver, rather than a barrier.

Number	Barrier
xx	Financial revenues cannot be guaranteed
xxi	Already invested in solar panels

Table 3.8: Barriers that may influence citizens' willingness to participate in a local solar panel project based on reasoning.

⁹⁴ Although this may be a driver, Waternet is unable to invest financial means in the citizen participation project as indicated in section 1.3.2.

⁹⁵ Currently, citizens do not pay taxes over the amount of electricity solar panels on their own roof produce, not even if the electricity is not immediately used by them (a process called balancing (salderen in Dutch)) (Nuon, n.d.b). Because they do not pay taxes over this electricity, they can also not subtract a discount of these (not existing) taxes.

Finally, there is a chance that gender is of influence. Similar to the influence of the location where a citizen lives, it can currently not be said what the implications of the gender of a citizen may be (if it exists). Therefore, gender is seen as a driver.

3.6. Concluding remarks

Generally speaking Waternet's project Zon op Waternet, in which employees could buy solar panels that were placed on Waternet's roof for which they are financially compensated by Waternet for the electricity produced, can be called a success. All available solar panels were sold to employees that were willing to participate (which means enough willingness to participate was created among the employees to sell all solar panels), the installation of the solar panels has taken place and the project is officially running. Setting up the project was mostly done by Waternet and Zon op Nederland. They invited employees to participate, found a roof to install the solar panels and made sure they were installed. However, after installation the participating employees participate in the governance of the project (in their own time) via the cooperative that was created. As has become clear from section 3.2.2, Waternet had 11 reasons to start the Zon op Waternet project and invite its employees to participate. Furthermore, Waternet used seven means to increase its employees' willingness to participate as has become clear from section 3.2.3.

With this overview of the Zon op Waternet project in mind it is possible to answer sub-question 2 and discuss the lessons that can be learned from the pilot project concerning the drivers and barriers that influence citizens' willingness to participate. Firstly, it is clear that not all potential drivers and barriers identified in scientific literature are automatically used and tackled if Waternet would set up the citizen participation solar panel project in the same way as it did Zon op Waternet, as only 11 of the 14 potential drivers and 11 of the 19 potential barriers were (partially) used or tackled in the pilot project. Secondly, the pilot project has shown that more drivers exist that were not found in scientific literature. In total, the pilot project has shown seven new potential drivers for willingness to participate.

3.7. A synthesis of all potential drivers and barriers

Next to the drivers and barriers found in the scientific literature and the new drivers identified in the pilot project, the author of this thesis has distinguished six more potential drivers and two more potential barriers based on reasoning that were not identified in either the scientific literature or the pilot project (see section 3.5).

With all these potential drivers and barriers in mind it is possible to create a synthesis of all potential drivers and barriers identified in this thesis. In total, 28 drivers and 21 barriers that possibly influence the willingness of citizens to participate in local solar panel project have been identified in this thesis. These are the 'potential drivers and barriers'. This means that they have not been analysed yet. Generally speaking, the potential drivers and barriers can be ordered into three classes. First, there are drivers and barriers that concern the aspects (i.e. setup) of the project. Secondly, there are drivers that concern the methods used to spread information to the citizens. Finally, there are drivers and barriers that concern characteristics of the citizens. The overview of all potential drivers and barriers can be found in tables 3.9 (drivers) and 3.10 (barriers). In these tables it is also indicated to which class they belong: 'aspects of the project', 'information spreading' or 'characteristics of the citizens'⁹⁶.

⁹⁶ It should be noted that some potential drivers and barriers could belong to multiple classes. This is especially the case for a number of barriers. Often, barriers can be classified as both 'aspects of the project' and 'characteristics of the citizens'. An example is barrier vii, 'lack of time during involvement'. This is both a characteristic of the citizen (the time the citizen has available) and an aspect of the project (how

Number	Driver	Driver class
1	Saving energy	Aspects of the project
2	Reducing bills and making money	Aspects of the project
3	Ethical and environmental commitment that leads to concerns for the environment	Characteristics of the citizens
4	Green status symbol as a source of (community) pride	Aspects of the project
5	Higher income	Characteristics of the citizens
6	Higher education level	Characteristics of the citizens
7	Age	Characteristics of the citizens
8	Peer effects that are spread through acts of neighbourliness	Aspects of the project
9	Information meetings, debates and consultation	Information spreading
10	Involvement via respected people in the community	Aspects of the project
11	(Fear of) negative reactions of neighbours towards a renewable energy installation on citizens' own property	Characteristics of the citizens
12	Fair distribution of potential benefits between personal and societal benefits	Aspects of the project
13	Democratic decision making process that gives influence to citizens in the planning and decision making process	Aspects of the project
14	Local people's awareness of broader issues of renewable energy production installations	Characteristics of the citizens
15	Officials that demonstrate support to the process and are committed to implementing the results	Aspects of the project
16	The option to invest in solar panels without a suitable roof	Aspects of the project
17	Creating better ties with neighbours	Aspects of the project
18	Indirect information available on a website	Aspects of the project
19	Information about the project published via a website	Information spreading
20	Posters to introduce the presentations	Information spreading
21	Flyers with information	Information spreading
22	The option to ask questions via the telephone, a website or by email	Information spreading
23	Information spread via a letter	Information spreading
24	Information spread via email	Information spreading
25	Information spread via an app	Information spreading
26	A guarantee of a minimum profit	Aspects of the project
27	Location	Characteristics of the citizens
28	Gender	Characteristics of the citizens

Table 3.9: All potential drivers that may influence citizens' willingness to participate in local solar panel projects and the classes to which they belong.

much time is required from the participating citizens). In these cases the drivers and barriers have been placed in the class to which they are closest.

Number	Barrier	Barrier class
i	High up-front costs citizens have to make	Aspects of the project
ii	Long payback times, which may be a negative influence because of lack of strategic financial resilience	Aspects of the project
iii	Perceived risk of new technologies	Characteristics of the citizens
iv	Getting planning permission	Aspects of the project
v	Lack of knowledge concerning the technologies	Characteristics of the citizens
vi	Lack of access to capital	Characteristics of the citizens
vii	Lack of time during involvement	Characteristics of the citizens
viii	Finding a suitable location	Aspects of the project
ix	Finding a trustworthy installer	Aspects of the project
x	(Fear of) insufficient output	Characteristics of the citizens
xi	Lower education level	Characteristics of the citizens
xii	Age	Characteristics of the citizens
xiii	Lack of access to information	Aspects of the project
xiv	Low local awareness of the organisation	Characteristics of the citizens
xv	Low interest of citizens in energy issues	Characteristics of the citizens
xvi	Unwillingness to be committed to an organisation	Characteristics of the citizens
xvii	Lack of time to make a decision	Characteristics of the citizens
xviii	Lack of expert advice and support	Aspects of the project
xix	Lack of trust in the organisation	Aspects of the project
xx	Financial revenues cannot be guaranteed	Aspects of the project
xxi	Already invested in solar panels	Characteristics of the citizens

Table 3.10: All potential barriers that may influence citizens' willingness to participate in local solar panel projects and the classes to which they belong.

4. Characteristics of the survey

4.1. Introduction

To analyse the real influence of the potential drivers and barriers that have been identified in this thesis a survey has been used. In this chapter the key characteristics (e.g. population, sample, response, operationalization et cetera) of the survey are discussed. In chapter 5 the analysis of the potential drivers based on the survey is presented, while in chapter 6 the analysis is presented for the potential barriers. The survey has created a distinction between the potential drivers and barriers that in reality have (almost) no influence on the willingness to participate of most respondents and the potential drivers and barriers that influence the willingness to participate of most respondents (i.e. drivers and barriers in practice). The insight the survey creates allows Waternet to focus on the most important drivers and barriers (i.e. the drivers and barriers in practice) and also creates more scientific insight into the influence of the different drivers and barriers. The full questionnaire can be found in the appendix, section 4.

The questionnaire used for the survey starts with a brief introduction of the project, which is followed by a set of standard questions, such as the respondents' age, gender and living location. This is followed by more specific questions which focus on solar panels and Waternet's solar panel project. The survey was in Dutch, as not all respondents may have had sufficient knowledge of the English language to fill out the questionnaire and an English questionnaire in general may have diminished their willingness to fill out the questionnaire. It was indicated on the questionnaire it was conducted in the name of Waternet by a student of Utrecht University. The survey was carried out from 19 March 2014 through 9 April 2014.

In section 4.2 the population is discussed, as well as how the sample for the survey was formed and what the response was. In section 4.3 the key aspects that are used in the questionnaire are operationalized and it is discussed how they are measured and statistically analysed. In section 4.4 a short overview of the characteristics of the respondents is given. Finally, in section 4.5 the concluding remarks of this chapter are presented.

4.2. Population, sample and response

The terrains Waternet has available on which solar panels can be placed range from very small (30m²) to very large (around 21,000m²) (Van der Meer, 2013a). Although Waternet has a large number of locations at which it would be possible to install solar panels, they research the options of five locations for the citizen participation solar panel project. These properties are water treatment installation De Ronde Venen, drinking water production location Leiduin, pre-treatment installation Nieuwegein, drinking water production location Weesperkarspel and water treatment installation Westpoort (Van der Meer, 2013h). The citizens (of 20 years and older) living in the postal code circles of these locations form the population of the survey, as they can use the tax reduction regulation when they participate in the project, which is the only way to make this project financially viable (see section 1.3). In table 4.1 an overview is presented of the locations, which postal code circle belongs to which location and the number of households per postal code circle.

Waternet location	Postal codes in the postal code circle	Number of households
Water treatment installation De Ronde Venen	1188, 1422, 1427, 3641, 3642, 3643, 3646, 3648	19,285
Drinking water production location Leiduin	2106, 2111, 2114, 2116, 2121, 2182, 2191	12,600
Pre-treatment installation Nieuwegein	3431, 3432, 3433, 3438, 3439, 3524, 3525, 3526, 3991, 3992, 3998	36,640
Drinking water production location Weesperkarspel	1104, 1106, 1107, 1108, 1109, 1112, 1391,	30,365
Water treatment installation Westpoort	1043, 1044, 1045, 1046, 1047, 1507, 1551	7,070

Table 4.1: The locations Waternet researches for the citizen participation solar panel project, the postal codes in the postal code circles belonging to these locations and the number of households in these postal code circles. Sources: Geodan, n.d.; Statistics Netherlands (Centraal Bureau voor de Statistiek), 2013.

To conduct the survey two locations of Waternet have been chosen. These locations have been chosen because they are part of the five locations Waternet currently researches for the citizen participation solar panel project, have a relatively large area available for solar panels (Van der Meer, 2013a) and are located close to two different areas, one urban and the other rural. The two chosen locations are Weesperkarspel (an urban area) and Leiduin (a rural area). The survey was conducted in the areas with houses closest to these Waternet locations that are also part of the postal code circle. These are Gein (a residential area near Weesperkarspel in Amsterdam-Zuidoost (i.e. an urban area⁹⁷)) and Vogelenzang (a small village near Leiduin to the west of Amsterdam (i.e. a rural area)). Citizens living in these areas therefore constitute the operationalized population. The confinement of the survey areas was the following⁹⁸:

- Gein⁹⁹: the area confined by Wageningendreef (west), Gerrit van den Boschpad (south), Hendrik Hosstraat (east) and nature (north) – near Weesperkarspel
- Vogelenzang: the village of Vogelenzang¹⁰⁰ – near Leiduin

Detailed maps of the two areas, as well as a map on which their locations relative to Amsterdam are marked can be found in the appendix, section 5. Table 4.2 presents an overview of the two locations where the survey was conducted¹⁰¹.

A random sample of citizens of Gein and Vogelenzang has been created by inviting the main tenants¹⁰² to fill out the questionnaire via a door-to-door method¹⁰³ (conducted by the author of this thesis). (Semi-)randomization is based on the fact that only citizens that were home were able to fill out the questionnaire.

⁹⁷ In Gein, the houses that were the closest to the Waternet location were not part of the survey area, because these houses lay at the border of the built-up area of Amsterdam. As Gein was the urban area of the survey, part of the residential area was chosen as survey area that was a little farther away from the edge of the city, but still very close to Weesperkarspel.

⁹⁸ The streets that confine the areas are not part of the survey area.

⁹⁹ It should be noted that the residential area Gein is officially larger than the area that was confined for this survey. However, Gein is so large that, due to practical reasons, it would not be possible to conduct a survey for this thesis in the whole area. When referring to 'Gein' in this thesis, this refers to the part of the area in which the survey was conducted.

¹⁰⁰ A small number of the streets of Vogelenzang were not part of the survey area. These streets can be viewed on the map of Vogelenzang in the appendix, section 5. They lie outside the red markings (Van der Meer, 2013a).

¹⁰¹ Because the areas in which the survey was conducted are not the same as the postal code circles of the location of Waternet (which can be found in table 4.2) or consisted of exactly one postal code, the exact number of households in these areas is unknown.

¹⁰² The main tenants were asked to fill out the questionnaire because they are the only ones that may invest in solar panels in Waternet's project. Furthermore, this also prevented children from filling out the questionnaire.

¹⁰³ Citizens were asked to fill out the questionnaire themselves. They could either choose to fill it out immediately (while the author was waiting) or a time was chosen at which the author would come back to pick up the filled out questionnaire (either the same day or a different day). Because the respondents filled out the questionnaire themselves (and the author could not see what answers they gave) this most likely reduced the influence of social desirability on the answers given. For a small group of respondents the author read the questions aloud while writing down the respondent's answers, because they had trouble reading the questionnaire (due to poor vision et cetera).

Survey location	Waternet location	Area available for solar panels (m ²)	Address of Waternet's location	Postal codes in the postal code circle	Number of households in the postal code circle
Gein	Drinking water production location Weesperkarspel	21,000	Driemondweg 21, 1108 AJ Amsterdam Zuidoost (The Netherlands)	1108, 1104, 1106, 1107, 1391, 1109, 1112	30,365
Vogelenzang	Drinking water production location Leiduin	18,600	Vogelenzangseweg 21, 2114 BA Vogelenzang (The Netherlands)	2114, 2116, 2191, 2182, 2121, 2106, 2111	12,600

Table 4.2: The two locations where the survey was conducted, the Waternet location they are close to, the corresponding postal codes in the postal code circle and the number of households in the postal code circles. Sources: Intranet, 2013a; Geodan, n.d.; Statistics Netherlands, 2013; Van der Meer, 2013b.

To increase the response level a letter was delivered by the author of this thesis to the houses in the survey areas before the survey was carried out to inform the citizens a survey would be conducted in the next weeks. In total, 780 letters were delivered, 390 in Vogelenzang and 390 in Gein. The letters were delivered in two phases. The first half of the letters was delivered before the start of the survey (on 18 and 19 March 2014). The second half of the letters was delivered between 31 March and 4 April 2014. The reason to do so was to decrease the likeliness citizens would have forgotten about the letter before the questionnaire was conducted¹⁰⁴. The letter can be found in the appendix, section 6¹⁰⁵. Like the questionnaire, the letter was in Dutch.

All houses where the letter was delivered were visited. If the citizens were home, they were asked to fill out the survey. But not only houses where the letter was delivered were visited. In the Netherlands citizens have the option to put a 'no-no' or 'no-yes' sticker on their mailbox. This means they do not want to receive unaddressed mail. As this letter was not addressed, it might lower the willingness of the citizens living in these houses to participate in the survey if a letter was delivered there. Therefore no letter was delivered to the houses which had a 'no-no' or 'no-yes' sticker. Instead, the survey was briefly described when the author visited the house. This means the total of houses that was visited exceeds 780 (the number of houses at which the letter was delivered). In total 954 houses were visited (447 in Gein and 507 in Vogelenzang). As far as possible, the houses were visited twice (if needed), of which one time during a weekend to increase the chance citizens were home.

A total of 211 respondents filled out the questionnaire. Of these 211 respondents 99 respondents (46.9 per cent) lived in Gein, while 112 respondents (53.1 per cent) lived in Vogelenzang. As 211 questionnaires were filled out by the citizens the response rate was 22.1 per cent (i.e. the non-response was 77.9 per cent). Next to the 211 participating citizens, 543 citizens (56.9 per cent) did not answer the door, while 200 citizens (21.0 per cent) did answer the door, but did not fill out the survey¹⁰⁶ (which means the response rate among the citizens that answered the door was 51.3 per cent).

¹⁰⁴ The houses to which the letter was delivered between 31 March and 4 April 2014 were not visited before that date.

¹⁰⁵ As the letter was delivered in two phases with a few weeks between them, it should be noted the date on these letters differed. One noted the date of 17 March 2014 on the letter (this version can be found in the appendix, section 6), while the second version noted the date of 31 March 2014. Besides this difference in date there were no differences between the letters.

¹⁰⁶ There were multiple reasons why citizens answered the door but did not fill out the survey. A number of citizens simply stated they were not interested in filling out the survey. Another number of citizens stated they had no time (both at the first and second visit). Furthermore, some citizens did not speak Dutch. Finally, a number of citizens stated they were willing to fill out the survey when they could do it in their own time. A time was agreed upon when the author would pick up the survey. However, some citizens were unavailable at that time and it was impossible for the author to retrieve the survey. Even after multiple attempts the author was unable to retrieve the survey. They are therefore added to the number of citizens that answered the door but did not fill out the survey (in total eight surveys were not retrieved). Furthermore, a number of citizens agreed to fill out the survey, but did not do so and returned an (almost) empty survey (in total five citizens returned an (almost) empty survey). These are also added to the 'answered the door but did not fill out the

It is important to note that because two areas have non-randomly been chosen and a semi-random sample was created in these areas, neither internal nor external validity can be fully guaranteed, as bias in the respondents (towards those that are home more often) may have been present. To reduce this bias, part of the survey was conducted during weekends (when people that work during the week are at home). Reliability, which is based on the questions that were asked, was made as high as possible by basing the questions on the potential drivers and barriers identified in scientific literature and the pilot project Zon op Waternet as well as on reasoning of the author, as discussed in the previous chapters.

4.3. Operationalization of the key variables and a description of the statistical methods

In order to analyse the potential drivers and barriers in a survey they have been operationalized. Subsequently, statistical methods have been used to analyse the findings of the survey, using the computer programme SPSS. The operationalization of the drivers and barriers, as well as of 'willingness to participate' is discussed in this section. Furthermore, the statistical measures used are also discussed in this section.

All potential drivers and barriers have been operationalized as one or two questions or statements in the survey. Tables 4.3 (drivers) and 4.4 (barriers) show which potential driver or barrier is operationalized by which question or statement. The question and statement numbers refer to the questions and statements in the questionnaire¹⁰⁷, which can be found in the appendix, section 4.

A large number of the questions and statements (all questions and statements from 9 through 48¹⁰⁸) have been measured on an ordinal scale of measure consisting of five steps. These questions were used to analyse all drivers and barriers of two of the three classes as defined in section 3.7. These classes are 'aspects of the project' and 'information spreading'. Furthermore, of the third class ('characteristics of the citizens') some drivers and barriers were analysed via this method. Respondents were asked how much they agree with a statement, how important they found different elements et cetera. The steps range from totally agree to totally disagree, very important to very unimportant et cetera. Analysing whether the potential drivers and barriers measured by these questions/statements are drivers and barriers in practice is done via the following method. If 50 per cent or more of the respondents indicated they agree or totally agree (or find it important or very important et cetera) with a question or statement, it is concluded that the potential driver or barrier that is measured by the question or statement is a driver or barrier in practice. If less than 50 per cent of the respondents indicate he/she agrees or totally agrees (et cetera) with the question or statement, it is concluded the potential driver or barrier is not a driver or barrier in practice¹⁰⁹.

survey' number. When the door was answered, but the main tenant was unavailable (e.g. a child answered the door and his parents were not home) it is classified under 'not answered the door', rather than 'answered the door but did not fill out the survey'.

¹⁰⁷ Question 48 in the questionnaire is not related to the research into the drivers and barriers. Instead, Waternet was interested whether citizens would be willing to invite other citizens and requested this question to be part of the questionnaire. This question was not used for this thesis.

¹⁰⁸ Used to analyse potential drivers 1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 and 26 and potential barriers i, ii, iii, iv, v, vi, vii, viii, ix, x, xiii, xiv, xvi, xviii, xix, xx and xxi.

¹⁰⁹ A small number of questions and statements were presented reversed in the questionnaire (i.e. the potential driver/barrier that is linked to the question/statement is negative, while the question/statement is positively stated). In those cases one of the two following options (dependent on the question/statement) is used:

- a) Normally a potential driver/barrier is confirmed if 50 per cent or more of the respondents indicated they agree or totally agree with the statement/question. In this case 50 per cent or more should disagree or totally disagree (this method is used to analyse barriers xvi and xix).
- b) Instead of confirming a potential driver/barrier if 50 per cent or more of the respondents indicated they agree or totally agree with the statement/question, the potential driver/barrier is confirmed if less than 50 per cent indicated they agree or totally agree (this method is used to analyse barrier xviii).

Number	Driver	Operationalized as question(s) number
1	Saving energy	9
2	Reducing bills and making money	10
3	Ethical and environmental commitment that leads to concerns for the environment	11
4	Green status symbol as a source of (community) pride	12
5	Higher income	5 & 49
6	Higher education level	3 & 5
7	Age	2 & 5
8	Peer effects that are spread through acts of neighbourliness	32
9	Information meetings, debates and consultation	22
10	Involvement via respected people in the community	35
11	(Fear of) negative reactions of neighbours towards a renewable energy installation on citizens' own property	17
12	Fair distribution of potential benefits between personal and societal benefits	34
13	Democratic decision making process that gives influence to citizens in the planning and decision making process	37
14	Local people's awareness of broader issues of renewable energy production installations	5 & 8
15	Officials that demonstrate support to the process and are committed to implementing the results	43
16	The option to invest in solar panels without a suitable roof	13
17	Creating better ties with neighbours	33
18	Indirect information available on a website	38
19	Information about the project published via a website	24
20	Posters to introduce the presentations	23
21	Flyers with information	25
22	The option to ask questions via the telephone, a website or by email	28
23	Information spread via a letter	21
24	Information spread via email	26
25	Information spread via an app	27
26	A guarantee of a minimum profit	42
27	Location	4 & 5
28	Gender	1 & 5

Table 4.3: All potential drivers that may influence citizens' willingness to participate in local solar panel projects and the question(s) and statement(s) used to operationalize them.

Number	Barrier	Operationalized as question(s)/statements number
i	High up-front costs citizens have to make	29
ii	Long payback times, which may be a negative influence because of lack of strategic financial resilience	31
iii	Perceived risk of new technologies	20
iv	Getting planning permission	16
v	Lack of knowledge concerning the technologies	41
vi	Lack of access to capital	30
vii	Lack of time during involvement	39
viii	Finding a suitable location	14
ix	Finding a trustworthy installer	15
x	(Fear of) insufficient output	19
xi	Lower education level	3 & 5
xii	Age	2 & 5
xiii	Lack of access to information	36
xiv	Low local awareness of the organisation	45
xv	Low interest of citizens in energy issues	5 & 7
xvi	Unwillingness to be committed to an organisation	46
xvii	Lack of time to make a decision	6
xviii	Lack of expert advice and support	44
xix	Lack of trust in the organisation	47
xx	Financial revenues cannot be guaranteed	18
xxi	Already invested in solar panels	40

Table 4.4: All potential barriers that may influence citizens' willingness to participate in local solar panel projects and the question(s) and statement(s) used to operationalize them.

Questions 1, 2, 3, 4, 7, 8 and 49¹¹⁰ in the survey are of a different kind. The answers to these questions have been used to analyse some of the drivers and barriers in the class 'characteristics of the citizens' as defined in section 3.7. The concept of 'willingness to participate' in relation to these questions has been operationalized as question 5 in the survey, in which the respondents were asked to indicate how high the chance was they would participate in Waternet's citizen participation solar panel project (i.e. a high chance of participating is seen as a high willingness to participate and vice versa). The characteristics are analysed by dividing the respondents in groups and analysing these groups in crosstabs and with the statistical measure Kendall's Tau. First, via crosstabs an overview is presented of the percentages of respondents that indicated they have a very low, low, average, high and very high chance of participating divided in groups (e.g. age, gender et cetera). Then the Kendall's Tau association measure is used to analyse whether there are indeed (statistically significant) associations between a group and willingness to participate (i.e. chance of participating). Furthermore, the Kendall's Tau association measure indicates the direction of this association if it exists¹¹¹.

¹¹⁰ Used to analyse potential drivers 5, 6, 7, 14, 27 and 28 and potential barriers xi, xii and xv.

¹¹¹ Kendall's Tau is a statistical association measure. As discussed by De Vocht (2009) it can be used to measure the association between two ordinal variables or an ordinal and a dichotomous variable. It does not indicate which variable is the dependent variable and which variable is the independent variable. It does indicate the direction of the association however. A Kendall's Tau always lies between -1 and 1. -1 and 1 are a perfect association, while 0 means no association between the two variables exists. An association exists when the Kendall's Tau is greater than 0.05 or smaller than -0.05. If the Kendall's Tau lies between 0.05 and 0.25 (or -0.05 and -0.25) it is a weak association. Between 0.25 and 0.55 (or -0.25 and -0.55) it is moderately strong, while it is (very) strong when it lies between 0.55 and 0.95 (or -0.55 and -0.95). Above 0.95 (or below -0.95) it is viewed as a perfect association. The association of a positive Kendall's Tau goes from the upper left to the lower right in the crosstab, while the association of a negative Kendall's Tau goes from the upper right to the lower left in the crosstab. Finally, two types of Kendall's Tau can be used: Kendall's Tau-b and Kendall's Tau-c. Kendall's Tau-b is used in case the crosstab on which the Kendall's Tau is used has an equal number of rows and columns. If the crosstab has an unequal number of rows and columns Kendall's Tau-c is used (De Vocht, 2009).

Finally, question 6 concerns the time the respondents need to make a decision about whether to participate or not¹¹², which is part of the ‘characteristics of the citizens’ class. It is measured in a different way than the other drivers and barriers in this class. As Waternet gave its employees almost three months to decide whether or not to participate (see section 3.2.1), it is assumed that if 50 per cent or more of the respondents indicates they need maximally two months to decide a lack of time to make a decision is not a barrier in practice for willingness to participate.

It should be noted that even if a potential driver or barrier is analysed and it is found it is not a driver or barrier in practice for willingness to participate (as defined in this analysis), it may still be a driver or barrier for a smaller group of respondents (and most likely citizens as well). If for example only 10 per cent of the respondents indicates they agree or totally agree with a statement, it is not identified as a driver or barrier in practice in this thesis (it should have been 50 per cent or higher). However, for the 10 per cent of the respondents that indicated they agree or totally agree it is still a driver or barrier. This 50 per cent distinction is made to separate the drivers and barriers that have a real impact on participation (i.e. they influence large groups) from those that only have a small impact (i.e. they only influence a small group).

4.4. Characteristics of the sample

4.4.1. Description of the respondents

In this section a description of the respondents of the survey is given. Furthermore, for the variables gender and age Chi² goodness-of-fit tests are used to analyse whether there is a (statistically significant¹¹³) difference between the survey sample and the population (see section 4.2) for these variables. The distribution of gender and age of the citizens in the population is based on data from Statistics Netherlands (2013) (the data used is from the year 2013). Only for gender and age a Chi² goodness-of-fit test is used because Statistics Netherlands does not provide data for the other variables described in this section on postal code level. For the other variables only descriptive statistics have therefore been used in this section.

Almost as many women as men filled out the survey (see table 4.5). A Chi² goodness-of-fit test shows a Chi² of 0.564, with a $p > 0.05$ ($df^{114} = 1$; $n = 211$). This means there is no

significant difference in gender distribution between the respondents of the sample and the citizens of the population (see table 4.5 for the expected values).

	Gender	
	Male	Female
Percentage	51.2	48.8
Absolute	108	103
Expected	102.5	108.5

Table 4.5: Distribution of the respondents in gender. ‘Expected’ shows the expected values for the Chi² goodness-of-fit test (expected values are of citizens of age 20 or older) (n = 211).

	Education level			
	Low education	Medium education	High education	Other
Percentage	24.2	37.7	37.2	1.0
Absolute	50	78	77	2

Table 4.6: Distribution of the respondents according to their highest finished level of education (n = 207).

¹¹² Used to analyse potential barrier xvii.

¹¹³ The null hypothesis states there is no difference between the sample and the population, if $p < 0.05$ the null hypothesis is rejected and a significant difference exists between the sample and the population (De Vocht, 2009).

¹¹⁴ Degrees of freedom.

Furthermore, there was a relatively low number of respondents with a low education as highest finished education that filled out the survey, while the number of respondents with a medium or high education level was almost equal¹¹⁵ (see table 4.6).

Most respondents had a monthly net income for their household of either €1501 - €2500 or €2501 - €3500. Only a small group (14.0 per cent) had a net household income of €1500 or less per month¹¹⁶ (see table 4.7).

The mean age of the respondents was 56 years (n = 211). The youngest respondent was 25 years, while the oldest respondent was 86 years old. A Chi² goodness-of-fit test (see table 4.8 for the expected values) shows that the Chi² is 77.840, with a p < 0.01¹¹⁷ (df =6; n = 211). This means there is a significant difference between the distribution of age among the respondents of the survey and the distribution of age among the citizens of the population. Normally it would be possible to weigh the sample, but as the weight required for the group of respondents of 20-29 years would be higher than 2.5¹¹⁸ this is not possible as it might distort the outcomes too much (De Vocht, 2009). It can therefore be concluded the sample is representative for the population in the distribution of gender, but of age. There are no reasons to expect the sample not to be representative on the other variables discussed here, as measures were taken to reduce the influence of aspects that might have impacted this (e.g. conducting a part of the survey during weekends), as also discussed in section 4.2.

4.4.2. Willingness to participate

In the questionnaire the willingness to participate of the respondents was measured. This was done by asking the respondents to indicate how high (or low) they thought the chance was they would participate in Waternet's citizen participation solar panel project¹¹⁹ (based on the information provided on the front page of

	Income			
	€1500 or less	€1501 - €2500	€2501 - €3500	€3501 or more
Percentage	14.0	31.6	33.1	21.3
Absolute	19	43	45	29

Table 4.7: Distribution of monthly net household income in classes among the respondents (n = 136).

	Age (in years)						
	20-29	30-39	40-49	50-59	60-69	70-79	80+
Percentage	2.8	8.1	15.2	35.5	25.6	8.1	4.7
Absolute	6	17	32	75	54	17	10
Expected	35.7	35.5	42.2	42.2	31.0	16.5	9.9

Table 4.8: Respondents divided on the basis of their age, divided in classes of ten years. 'Expected' shows the expected values for the Chi² goodness-of-fit test (n = 211).

	Chance to participate				
	Very low	Low	Average	High	Very high
Percentage	19.3	21.3	40.1	14.5	4.8
Absolute	40	44	83	30	10

Table 4.9: Distribution of the response to the statement 'How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?' (n = 207).

¹¹⁵ Low education is: no education, basisonderwijs/lagere school (elementary school) and VMBO (LBO/VBO, MAVO/MULO). Medium education is Middelbaar Beroeps Onderwijs (MEAO, MTS et cetera) and HAVO, VWO, HBS, Atheneum & Gymnasium. High education is Hogeschool, Universiteit or Hoger Beroeps Onderwijs (HTS, Kweekschool et cetera) (comparable to university of applied sciences and university). 'Other' was an option that respondents could choose if none of the options fitted their highest finished education level. Only two respondents chose this option. They indicated the highest education they finished were the following: 'master of advanced nursing practice' and 'onderwijs voor de scheepvaart' (education for ship transport).

¹¹⁶ It should be kept in mind that the response for this question was low, because only 136 (64.5 per cent) respondents answered it. A large group (75 respondents (35.5 per cent of the respondents)) did not fill out this question. Of those who did not indicate their net monthly income 93 per cent indicated they did not want to answer this question, 5 per cent indicated they did not know their monthly net income and 1 per cent simply did not answer the question. It should be kept in mind that a bias may be present in this question, as certain groups may have been more likely not to answer this question than others.

¹¹⁷ In order to conduct a Chi² goodness-of-fit test the age of the respondents has been grouped in classes of ten years (see table 4.8).

¹¹⁸ Calculating the weight is done via the following formula: weight = (percentage of the population) / (percentage of the sample) (De Vocht, 2009). In this case the calculation would be the following: 16.9/2.8 = 5.95.

¹¹⁹ As stated in section 4.3, willingness to participate is operationalized in the survey as the chance citizens think they have to participate.

the questionnaire). Almost 20 per cent of the respondents indicated they thought the chance they would participate in this project was 'high' or 'very high', while a little over 40 per cent indicated the chance was 'low' or 'very low' (see table 4.9).

It should be kept in mind that only the answers of the citizens who were willing to participate in the survey are analysed. At least a part of the citizens that answered the door but did not want to fill out the survey did not want to do so because they were not interested in the project (as a number of citizens indicated to the author). It is unlikely that these citizens have a high or very high chance (i.e. willingness) to participate in this project. Hypothetically speaking the following can be said. If all citizens that did answer the door but did not want to fill out the survey (200 citizens) did not want to do this because they were not interested in Waternet's citizen participation solar panel project and therefore have a low or very low chance to participate and those respondents that filled out the questionnaire but skipped this question (4 respondents) also have a low or very low chance to participate, 9.7 per cent¹²⁰ of the citizens would still have a 'high' or 'very high' chance to participate.

However, it is impossible to conclude that all citizens that answered the door but did not fill out the survey are unlikely to join. Some citizens had other reasons not to fill out the survey (language problems, sickness, a lack of time et cetera), as some also indicated to the author. Therefore only the filled out surveys are used in this analysis. It should however be kept in mind that it is possible that the percentage of citizens that has a 'low' or 'very low' chance (i.e. willingness) to participate may be higher than represented in this survey.

4.5. Concluding remarks

The survey has been discussed above. This includes a discussion of the population, the response group and the operationalization of the key aspects that are measured in the survey, as well as a discussion of how the survey was conducted. Multiple statistical measures are used to analyse the results (which is presented in chapters 5 and 6), including both descriptive statistics and statistical tests.

A relatively large group of respondents indicated they have a high willingness to participate in Waternet's citizen participation solar panel project, as almost 20 per cent of the respondents indicated they have a (very) high chance of participating. Whether they will indeed participate is dependent on the drivers and barriers in practice and whether Waternet uses or tackles them.

Although it cannot be guaranteed that the sample is fully random, action has been taken to make it as random as possible, for example by conducting a part of the survey during the weekend (see section 4.2). There are therefore no reasons to expect the sample is not representative of the population, with the exception of age distribution. The survey therefore gives an indication of what can be expected from the population. This means the results of the survey can be used to make a distinction between potential barriers and drivers that are a driver or barrier in practice for willingness to participate of citizens and those that are not a driver or barrier in practice, which is done in chapters 5 and 6.

¹²⁰ $40/411 = 0.097$. The 40 is based on the number of citizens that indicated on the questionnaire they were 'likely' (30) or 'very likely' (10) to join, while the 411 is based on the number of citizens that filled out this question in the survey (207), those that filled out the questionnaire but skipped this question (4) and those that answered the door but did not want to fill out the questionnaire (200).

5. Drivers in practice

5.1. Introduction

In this chapter the step from ‘potential drivers’ to ‘drivers in practice’ is made. In order to conclude whether a potential driver indeed influences the willingness to participate of citizens (and thus is a ‘driver in practice’) they have all been researched in similar conditions in one case study (i.e. the citizen participation solar panel project of Waternet). Sub-question 3 is therefore answered in this chapter:

Which of the potential drivers are drivers in practice which influence the willingness of citizens to participate in Waternet’s solar panel project?

The discussion whether the potential drivers are also drivers in practice is divided in three sections in this chapter. In section 5.2 the drivers are analysed which belong to the class ‘aspects of the project’ (as defined in section 3.7). In section 5.3 the drivers of the class ‘information spreading’ are analysed. In section 5.4 the drivers that belong to the class ‘characteristics of the citizens’ are analysed. Finally, in section 5.5 the concluding remarks of this chapter are presented. Sub-question 3 is answered there and an overview of all potential drivers that have been found to be drivers in practice is presented.

5.2. Aspects of the project

In this section the drivers are researched which are classified as ‘aspects of the project’ in section 3.7. The drivers in this class are analysed via the same method. If 50 per cent or more of the respondents indicated they (totally) agreed with a statement¹²¹ it can be concluded that the driver that is analysed via that statement is a driver in practice. If less than 50 per cent (totally) agreed, it is not a driver in practice¹²² (see section 4.3 for more details). Table 5.1 shows the statements, the drivers they operationalize and the distribution of the reactions of the respondents. Below, the drivers are discussed one by one and it is analysed whether they are a driver in practice or only a potential driver.

¹²¹ It should be kept in mind that, as indicated in section 4.1, the questionnaire was conducted in Dutch. The author of this thesis has translated the statements and questions into English as close to the Dutch version as possible. The original Dutch version of the questions and statements can be found in the questionnaire in the appendix, section 4.1.

¹²² An exception is driver 26. Instead of asking the respondents to indicate to what degree they (dis)agreed with a statement, they were asked how (un)important they found an aspect. Similar to the other drivers analysed here only if 50 per cent of the respondents or more indicated it is (very) important to them it is concluded it is a driver in practice. Details of this method of analysis can be found in section 4.3. The results of the survey concerning this driver are presented in section 5.2.12.

Driver number	Statement	n	Totally agree (%)	Agree (%)	Do not agree/do not disagree (%)	Disagree (%)	Totally disagree (%)
1	If I buy solar panels I find it important that this reduces the amount of environmentally polluting electricity I use (e.g. coal, gas or nuclear energy).	209	31.6	57.4	8.6	2.4	0.0
2	If I buy solar panels it is important that I will earn or save money with them.	210	27.6	55.2	15.7	1.4	0.0
4	If I buy solar panels I find it important that my neighbours can see that I have solar panels.	208	1.9	7.2	24.5	39.4	26.9
8	If I know my neighbours participate in this project it is likely I will also participate.	210	1.9	19.0	35.7	31.9	11.4
10	I would be more willing to join this project if a famous person from the municipality/neighbourhood would invite me (for example an alderman or a famous neighbour).	210	0.5	3.8	19.0	54.8	21.9
12	I find it important that everyone in the neighbourhood can profit from this project (whether they participate or not), for example by investing a part of the profit in neighbourhood improvements.	209	3.3	17.2	40.7	28.2	10.5
13	If I participate in this project I find it important to be involved in the decision-making process of the project.	209	8.6	48.8	34.4	7.7	0.5
15	If Waternet is clearly visible involved in this project I would be more willing to participate.	209	2.4	36.8	39.2	19.1	2.4
16	I would like to have solar panels, but my roof is not suitable for solar panels/I have no roof of my own.	208	4.3	12.0	24.5	34.1	25.0
17	I find it important to strengthen my relations with my neighbours via this solar panel project.	209	1.0	5.3	29.7	47.4	16.7
18	If I see news articles about this project on the internet I would most likely be more willing to participate.	209	1.0	25.4	45.9	22.0	5.7

Table 5.1: Distribution of the reactions to the statements in the survey which were used to analyse the drivers in the 'aspects of the project' class. The first column indicates which driver the statement operationalizes, the second column shows the statement and the third column shows the number of respondents who answered this question. The last five columns present the distribution of the reactions of the respondents.

5.2.1. Driver 1: Saving energy

The influence on the willingness to participate of citizens of driver 1, saving energy, has been measured in the survey by the statement "If I buy solar panels I find it important that this reduces the amount of environmentally polluting electricity I use (e.g. coal, gas or nuclear energy)". It is clear that this is an important driver for many respondents: 89.0 per cent indicated they found a reduction in the amount of polluting energy they used important when they invested in solar panels (see table 5.1). This means that driver 1, saving energy, is a driver in practice for willingness to participate.

5.2.2. Driver 2: Reducing bills and making money

The influence on the willingness to participate of citizens of driver 2, reducing bills and making money, has also been measured by a statement in the survey. The statement was "If I buy solar panels it is important that I will earn or save money with them". Similar to driver 1, it is clear that reducing bills and making money is an important driver for many respondents to invest in solar panels (including solar panel projects like the project of Waternet). 82.8 per cent of the respondents indicated they agreed or totally agreed with this statement (see table 5.1). It can therefore be concluded that reducing bills and making money is a driver in practice for willingness to participate.

5.2.3. Driver 4: A green status symbol as a source of (community) pride

The influence on the willingness to participate of citizens of the fourth driver, a green status symbol as a source of (community) pride, was also measured by a statement in the questionnaire. This statement was "If I buy solar panels I find it important that my neighbours can see that I have solar panels". It is clear that the green status symbol a solar panel can form by showing it off to neighbours is not very important to most respondents. Only 9.1 per cent of the respondents agreed

or totally agreed with the statement (see table 5.1). It is therefore not a driver in practice for the willingness to participate of citizens.

5.2.4. Driver 8: Peer effects that are spread through acts of neighbourliness

To measure the influence on the willingness to participate of citizens of driver 8, *peer effects that are spread through acts of neighbourliness*, a statement was used in the survey. This statement was “*If I know my neighbours participate in this project it is likely I will also participate*”. It is clear that only a small group of the respondents is influenced by their neighbours. Only 20.9 per cent of the respondents indicated they agree or totally agree with the statement that knowing that the neighbours participate will make them more likely to participate as well (see table 5.1). This is related to driver 4, from which it has become clear that showing off solar panels as green energy symbols was not a driver for citizens. This means it works both ways. On the one hand citizens are not driven to participate to show off their solar panels, and on the other hand citizens showing their solar panels off to their neighbours do not stimulate these neighbours to participate. Peer effects that are spread through acts of neighbourliness are therefore not a driver in practice for willingness to participate.

5.2.5. Driver 10: Involvement via respected people in the community

The influence on the willingness to participate of citizens of the tenth driver, *involvement via respected people in the community*, was measured in the survey by a statement. This statement was the following: “*I would be more willing to join this project if a famous person from the municipality/neighbourhood would invite me (for example an alderman or a famous neighbour)*”. It is clear that an invitation by a famous person only increases the willingness to participate of a very small group of respondents, as only 4.3 per cent agreed or totally agreed with the statement (see table 5.1). It can therefore be concluded that involvement via respected people in the community is not a driver in practice for willingness to participate.

5.2.6. Driver 12: Fair distribution of potential benefits between personal and societal benefits

To measure the influence on the willingness to participate of citizens of driver 12, *a fair distribution of potential benefits between personal and societal benefits*, a statement was used in the survey. This statement was “*I find it important that everyone in the neighbourhood can profit from this project (whether they participate or not), for example by investing a part of the profit in neighbourhood improvements*”. The distribution of the reactions (see table 5.1) shows that a large part of the respondents does not view a fair distribution of the (potential) benefits between personal and societal benefits as important. Only 20.5 per cent of the respondents indicated they agree or totally agree with the statement. It can therefore be concluded that this potential driver is not a driver in practice for citizens’ willingness to participate.

5.2.7. Driver 13: Democratic decision making process that gives influence to citizens in the planning and decision making process

The influence on willingness to participate of citizens of the thirteenth driver, *a democratic decision making process that gives influence to citizens in the planning and decision making process*, was also measured by a statement in the survey. This statement was “*If I participate in this project I find it important to be involved in the decision-making process of the project*”. The distribution of the reactions (see table 5.1) shows that a large part of the respondents indeed finds it important to be involved in the decision making process, as 57.4 per cent of the respondents indicated they agreed or totally agreed with this statement. It can therefore be concluded that a democratic decision making

process that gives influence to citizens in the planning and decision making process is a driver in practice for citizens' willingness to participate.

5.2.8. Driver 15: Officials that demonstrate support to the process and are committed to implementing the results

To measure the influence on willingness to participate of citizens of driver 15, *officials that demonstrate support to the process and are committed to implementing the results*, a statement was used in the survey. This statement was the following: *"If Waternet is clearly visible involved in this project I would be more willing to participate"*. The distribution of the reactions (see table 5.1) shows that although there is a respectable amount of citizens that finds this important (39.2 per cent indicated they either agree or totally agree with the statement), this is not the majority. It is therefore concluded this is not a driver in practice for willingness to participate.

5.2.9. Driver 16: The option to invest in solar panels without a suitable roof

The influence of driver 16, *the option to invest in solar panels without a suitable roof*, on the willingness to participate of citizens was measured in the survey by a statement as well. This statement was *"I would like to have solar panels, but my roof is not suitable for solar panels/I have no roof of my own"*. The distribution of the reactions (see table 5.1) shows that only a small group of respondents is stimulated to participate in Waternet's citizen participation solar panel project because their own roof is not suitable for solar panels (or they have no roof of their own¹²³). Only 16.3 per cent of the respondents agrees or totally agrees with the statement. This means that, although this was a reason to start the Zon op Waternet project (see section 3.2.2), it is not a driver in practice for willingness to participate.

5.2.10. Driver 17: Creating better ties with neighbours

The influence on the willingness to participate of citizens of the seventeenth driver, *creating better ties with neighbours*, was measured in the survey via the following statement: *"I find it important to strengthen my relations with my neighbours via this solar panel project"*. The distribution of the reactions (see table 5.1) shows that this is not an important reason for most respondents to participate in the project. Only 6.3 per cent of the respondents indicated they agree or totally agree with the statement. It can therefore be concluded this is not a driver in practice for willingness to participate. This means that, although creating better ties (horizontal connections) between colleagues was a reason to start Zon op Waternet (see section 3.2.2), it should not be expected that citizens will be more willing to participate in the project because it allows them to create better ties with their neighbours.

5.2.11. Driver 18: Indirect information available on a website

To measure the influence on the willingness to participate of citizens of driver 18, *indirect information available on a website*, a statement was used in the survey. This statement was *"If I see news articles about this project on the internet I would most likely be more willing to participate"*. This distribution shows that indirect information on a website only influences a small group of the respondents, as only 26.4 per cent of the respondents agrees or totally agrees with the statement (see table 5.1). It can therefore be concluded that although Waternet (indirectly) used this type of information to increase the willingness to participate of its employees for Zon op Waternet (see section 3.2.3), it is not a driver in practice for the willingness to participate of citizens.

¹²³ E.g. they rent their house or live in an apartment.

5.2.12. Driver 26: The role of a guarantee of a minimum profit

A potential driver for citizens' willingness to participate is *a guarantee of a minimum profit*. To measure the influence on willingness to participate of this driver the following question was used in the survey: *"The amount of money which you earn with a solar panel is dependent on the sun. Do you find it important that Waternet guarantees a minimum financial return of the solar panels? In case the minimum return is not reached Waternet will compensate the difference"*. The distribution of the answers the respondents gave to this question can be found in table 5.2.

The distribution shows that a large part of the respondents finds a guarantee of a minimum profit important: 65.8 per cent of the respondents indicated they find this either important or very important. It can therefore be concluded that a guarantee of a minimum profit is a driver in practice for willingness to participate, as was also reasoned by the author (see section 3.5).

Answer	Percentage
Very important	15.6
Important	50.2
Not important/not unimportant	24.9
Unimportant	6.3
Very unimportant	2.9

Table 5.2: Distribution of the answers to the question "The amount of money which you earn with a solar panel is dependent on the sun. Do you find it important that Waternet guarantees a minimum financial return of the solar panels? In case the minimum return is not reached Waternet will compensate the difference" (n = 205).

5.3. Methods to spread information

A number of potential drivers concerns spreading information about the project to the citizens. They are therefore classified as 'information spreading' in section 3.7. In this section it is analysed whether the methods to spread information to the citizens that are potential drivers are a driver in practice or not. As discussed in section 4.3, this is based on whether 50 per cent or more of the respondents indicated they find it (very) important or not to receive information via a certain method. In table 5.3 an overview is presented of the distribution of the reactions of the respondents towards the different methods to spread information. Below, they are discussed in more detail.

Driver number	Receiving information via the following method is...	n	Very important (%)	Important (%)	Not important/not unimportant (%)	Unimportant (%)	Very unimportant (%)
9	Presentations followed by the option to ask questions	204	4.4	39.2	35.8	13.2	7.4
19	A website	207	18.8	56.5	17.9	3.9	2.9
20	Posters to announce the presentation (for example at bus stops)	204	1.0	16.7	41.7	29.9	10.8
21	Paper information flyers	206	5.8	49.0	26.2	9.2	9.7
22	The option to ask questions via telephone, email or website	207	15.5	55.1	15.5	9.7	4.3
23	A letter	203	10.8	49.3	21.7	10.8	7.4
24	An email	201	13.4	40.8	27.4	13.9	4.5
25	An app (for a smartphone/tablet)	203	4.9	23.6	29.1	30.5	11.8

Table 5.3: Distribution of the reactions to the question how important the respondents found it to receive information about the project via a certain method. The first column indicates which driver is operationalized, the second column shows the method to spread information and the third column shows the number of respondents who answered this question. The last five columns indicate the distribution of the reactions of the respondents.

5.3.1. Driver 9: Information meetings, debates and consultation

The influence on the willingness to participate of citizens of driver 9, *information meetings, debates and consultation*, was measured in the survey by asking the respondents how important they found it to receive information via “*presentations followed by the option to ask questions*”. It is clear that a majority of the respondents does not think that information meetings, debates and consultation are important for them to receive information about the project. Only 43.6 per cent of the respondents indicated that they are important or very important to them (see table 5.3). It can therefore be concluded that information meetings, debates and consultation are not a driver in practice for the willingness to participate of citizens.

5.3.2. Driver 19: Information about the project published via a website

The influence on the willingness to participate of citizens of driver 19, *information about the project published via a website*, was measured in the survey by asking the respondents how important it was for them to receive information about Waternet’s project via “*a website*”. The distribution of the reactions (see table 5.3) shows that a large part of the respondents (75.3 per cent) indicated a websites is an important or very important method to spread information about this project to them. This means that a website to communicate information about the project is a driver in practice for citizens’ willingness to participate. This is similar to the purpose for which it was used in the Zon op Waternet project for Waternet’s employees (although in that case it was an internal website) (see section 3.2.3).

5.3.3. Driver 20: Posters to introduce the presentations

To measure the influence on the willingness to participate of citizens of driver 20, *posters to introduce the presentations*, a question was used in the survey. In this question the respondents were asked to indicate how important they found “*posters to announce the presentation (for example at bus stops)*” to receive information about the project. It is clear from the distribution of the reactions (see table 5.3) that most respondents do not think that posters announcing the presentation(s) about Waternet’s solar panel project are important to receive information about the project. Only 17.7 per cent of the respondents stated they find posters to announce the presentation important or very important. This means this is not a driver in practice for citizens’ willingness to participate, although it was used to increase the willingness of employees to participate in Waternet’s project Zon op Waternet (see section 3.2.3).

5.3.4. Driver 21: Flyers with information

The influence on the willingness to participate of citizens of driver 21, *flyers with information*, was measured in the survey by asking the respondents to indicate how important it was to them to receive information about Waternet’s project via “*paper information flyers*”. The distribution of the answers (see table 5.3) shows that over half the respondents (54.8 per cent) finds it important or very important that information about the project is spread to them via a paper flyer. It can therefore be concluded that flyers with information are a driver in practice for willingness to participate. This is similar to the use of Helder and Waterdruk by Waternet in the Zon op Waternet project (see section 3.2.3).

5.3.5. Driver 22: The option to ask questions via the telephone, a website or by email

To measure the influence on the willingness to participate of citizens of driver 22, *the option to ask questions via the telephone, a website or by email*, the respondents were asked to indicate how important they found “*the option to ask questions via telephone, email or website*” about the project.

It is clear that this is important to a large part of the respondents. 70.6 per cent of the respondents indicated they find this method of information acquiring important or very important (see table 5.3). It can therefore be concluded that the option to ask questions via telephone, email or website is a driver in practice for willingness to participate, for which purpose it was also used in the Zon op Waternet project for Waternet's employees (see section 3.2.3)

5.3.6. Driver 23: Information spread via a letter

The influence on the willingness to participate of citizens of driver 23, *information spread via a letter*, was measured in the survey by the question how important the respondents found it to receive information about Waternet's project "by letter". The distribution of the answers (see table 5.3) shows that receiving information via a letter is important to a large part of the respondents, as 60.1 per cent of the respondents indicated they find it either important or very important to receive information via a letter about the project. It can therefore be concluded that information spread via a letter is a driver in practice for the willingness to participate of citizens, as was also reasoned by the author of this thesis (see section 3.5).

5.3.7. Driver 24: Information spread via email

The influence on the willingness to participate of citizens of driver 24, *information spread via email*, was measured in the survey by asking the respondents how important they found it to receive information about the project "by email". Similar to information spread via a letter, it is clear that a majority of the respondents finds it important to receive information about the project via email, as 54.2 per cent of the respondents indicated they either find it important or very important to receive information about the project by email (see table 5.3). It can therefore be concluded that information spread via email is a driver in practice for willingness to participate. This is in accordance with the reasoning of the author (see section 3.5).

5.3.8. Driver 25: Information spread via an app

The influence on the willingness to participate of citizens of driver 25, *information spread via an app*, was, like the other methods of information spreading, measured in the survey by asking the respondents a question. The respondents were asked how important they found it to receive information about the project "via an app (for a smartphone/tablet)". The distribution of the reactions (see table 5.3) shows that the majority of the respondents does not view information spread via an app as important. Only 28.5 per cent of the respondents indicated they find it important or very important to receive information about the project via an app. It can therefore be concluded that an app for a smartphone and/or tablet is not a driver in practice for the willingness of citizens to participate. This is in contrast with the project of De Windcentrale, in which an app is used to create more willingness to participate among potential participants (see section 3.5).

5.4. Characteristics of the citizens

The last class of drivers concerns the characteristics of the citizens. They are discussed here. Some of these drivers are analysed by analysing how large the group of respondents is that (totally) agrees with a statement, while others are analysed via a crosstab and a Kendall's Tau (see section 4.3 for details). Because two different methods are used to analyse these drivers the tables are presented below, next to the detailed discussion per driver.

5.4.1. Driver 3: Ethical and environmental commitment that leads to concerns for the environment

The influence on the willingness to participate of citizens of the third driver, *ethical and environmental commitment that leads to concerns for the environment*, was measured by a statement in the questionnaire. This statement was “An important reason for me to buy solar panels is the environment”. Like the previous two drivers, it is clear that ethical and environmental commitment that lead to concerns for the environment are an important driver for the respondents, as 75.4 per cent indicated they (totally) agree with the statement (see table 5.4). Ethical and environmental commitment that leads to concerns for the environment is therefore a driver in practice for willingness to participate.

Reaction	Percentage
Totally agree	22.7
Agree	52.7
Do not agree/do not disagree	21.7
Disagree	2.9
Totally disagree	0.0

Table 5.4: Distribution of the reactions to the statement “An important reason for me to buy solar panels is the environment” (n = 207).

5.4.2. Driver 5: The role of income

The influence on the willingness to participate of citizens of driver 5, *a higher income*, was measured in the survey by two questions. First, citizens were asked the following question: “How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?”. Secondly, citizens were asked what the net income of their household per month was. Table 5.5 shows a crosstab between the answers the respondents gave to these two questions. For clarity, income has been ordered in four classes (all amounts are the net income per month per household): < €1501; €1501 - €2500; €2501 - €3500 and > €3500. Respondents could choose between five options concerning the chance they would participate in the project (very high, high, average, low and very low).

Kendall's Tau: -0.167 (p < 0.05)		Monthly net household income							
		< €1501		€1501 - €2500		€2501 - €3500		> €3500	
		Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage
Chance of participating in Waternet's solar panel project	Very high	1	5.3	2	4.7	3	6.8	3	10.3
	High	1	5.3	6	14.0	7	15.9	9	31.0
	Average	9	47.4	16	37.2	20	45.5	8	27.6
	Low	3	15.8	9	20.9	7	15.9	7	24.1
	Very low	5	26.3	10	23.3	7	15.9	2	6.9
	Total	19	100.0	43	100.0	44	100.0	29	100.0

Table 5.5: Crosstab and Kendall's Tau of the distribution of the answers to the questions “How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?” and “What is the monthly net income of your household?” (n = 135).

When combining the ‘high’ and ‘very high’ chance responses, it becomes clear that the respondents with a higher income more often indicate they think they have a high or very high chance of participating in this project. Especially the group of respondents that has a net income per month of more than €3500 far more often indicates they have a high or very high chance to participate in this project than the groups with a lower income. Over 41 per cent of the respondents with a monthly net household income of more than €3500 indicated they have a high or very high chance to participate. This group is almost four times the size of those earning €1500 or less, more than two times the size of those with a monthly net household income of €1501 – €2500 and almost double the size of those earning €2501 - €3500 (all relative numbers).

The Kendall's Tau¹²⁴ of these two variables (see table 5.5) shows that there is indeed a statistically significant weak association between income and chance of participating. Because the Kendall's Tau is negative this means that a higher income is associated with a higher chance of participating. Because a weak statistically significant association exists between income and chance of participating it is concluded that a higher income is a driver in practice for willingness to participate.

It should be kept in mind that the non-response for this question was high. Only 64 per cent of the respondents filled out both questions this is based on. Especially the question about income has a high non-response. Only 64.5 per cent of the respondents answered this question (see section 4.4.1 for more details).

5.4.3. Driver 6: The role of a higher education

Like the driver formed by a higher income, the influence on the willingness to participate of citizens of driver 6, a *higher education level*, was researched by two questions. The respondents were asked "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?" (i.e. the same question as was used to measure the importance of driver 5), and they were asked what the highest education level was which they had finished. The highest finished education level has been grouped in three classes: low education, medium education and high education (see section 4.4.1 for details about the differences between low, medium and high education). In table 5.6 the crosstab of the answers provided by the respondents to these two questions is shown.

(p < 0.01)		Kendall's Tau: -0.239							
		Highest finished education							
		Low education		Medium education		High education		Other	
		Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage
Chance of participating in Waternet's solar panel project	Very high	0	0.0	2	2.6	7	9.3	1	50.0
	High	4	8.2	8	10.4	17	22.7	0	0.0
	Average	17	34.7	36	46.8	28	37.3	1	50.0
	Low	13	26.5	18	23.4	12	16.0	0	0.0
	Very low	15	30.6	13	16.9	11	14.7	0	0.0
	Total	49	100.0	77	100.0	75	100.0	2	100.0

Table 5.6: Crosstab and Kendall's Tau of the distribution of the answers to the questions "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?" and "What is the highest level of education you have finished?" (n = 203). The n for the Kendall's Tau is 201, because the 'other' section is left out in the calculations.

After combining the high and very high answers as well as the low and very low answers to the first question, it becomes clear that those with a higher education more often indicate they have a high or very high chance to participate in Waternet's project. The respondents with a high education level almost four times more often indicate they think they have a high or very high chance to participate in Waternet's project than those that have a low education level. Those with a medium education indicate more than 1.5 times more often that they have a high or very high chance to participate than those with a low education level.

The Kendall's Tau¹²⁵ of the crosstab of these two variables (see table 5.6) shows that there is indeed a statistically significant weak association between highest finished education level and chance of participating. Because the Kendall's Tau is negative this means that a higher finished

¹²⁴ This Kendall's Tau is based on table 5.5. This means the chance of participating has five possibilities: very high, high, average, low and very low. Income is divided in four classes. This means the number of columns (four) and rows (five) differs. Kendall's Tau-c is therefore used.

¹²⁵ This Kendall's Tau is based on table 5.6. This means the chance of participating has five possibilities: very high, high, average, low and very low. Education has only three possibilities, as 'other' has been left out in the calculations for the Kendall's Tau. This means the number of columns (three) and rows (five) differs. Kendall's Tau-c is therefore used.

education level is associated with a higher chance of participating. Because a weak significant association exists between education level and chance of participating it is concluded that a higher finished education is a driver in practice for willingness to participate.

5.4.4. Driver 7: The role of age

The influence of driver 7, *age*, on the willingness to participate of citizens was measured by two questions. These were the questions “*How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?*” (i.e. the same question as was used for drivers 5 and 6) and “*What is your age?*”. To analyse the results of the survey, the age of the respondents has been divided into classes. Firstly, all ages are researched. The class division used is the same division as was used in section 4.4.1 (20-29, 30-39, 40-49, 50-59, 60-69, 70-79 and 80+¹²⁶ years). After this, the age class is analysed for which Kwan (2012) found that neighbourhoods with a large group of this age had a (statistically significant) larger amount of solar panels installed than average¹²⁷ (45-54 years) (see section 2.2.1).

To research the influence of age on willingness to participate for all ages, table 5.7 shows all ages, divided in the groups used in section 4.4.1 (i.e. in classes of ten years). It is clear from this table that there are indeed differences in the chance of participating (i.e. willingness to participate) between the age groups. The groups of 40-49, 50-59 and 60-69 years have relatively more respondents that indicate they have a high or very high chance of participating than average (respectively 25.0 per cent, 23.3 per cent and 20.8 per cent compared to the average of all ages of 19.3 per cent). However, the age group of 60-69 years also has a relatively large group (larger than average) that indicates they have a low or very low chance of participating (41.5 per cent compared to 40.6 per cent on average). It can therefore be concluded that, based on the crosstab, the group of 40-59¹²⁸ years has a relatively high willingness to participate¹²⁹.

		Age (in years)															
		20-29		30-39		40-49		50-59		60-69		70-79		80+		All respondents	
Chance of participating in Waternet's solar panel project		Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage
	Very high	0	0.0	2	11.8	1	3.1	6	8.2	1	1.9	0	0.0	0	0.0	10	4.8
	High	1	16.7	1	5.9	7	21.9	11	15.1	10	18.9	0	0.0	0	0.0	30	14.5
	Average	2	33.3	11	64.7	13	40.6	31	42.5	20	37.7	2	11.8	4	44.4	83	40.1
	Low	0	0.0	3	17.6	7	21.9	15	20.5	12	22.6	5	29.4	2	22.2	44	21.3
	Very low	3	50.0	0	0.0	4	12.5	10	13.7	10	18.9	10	58.8	3	33.3	40	19.3
	Total	6	100.0	17	100.0	32	100.0	73	100.0	53	100.0	17	100.0	9	100.0	207	100.0

Table 5.7: Crosstab of the distribution of the answers to the questions “How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?” and “What is your age?”. Age is combined in classes of ten years, similar to the classification in section 4.4.1 (n = 207).

¹²⁶ No respondents were below 20 years of age.

¹²⁷ More specifically, Kwan (2012) found that neighbourhoods (based on ZIP code) with greater proportions of the population between the age of 45-54 years had a significantly larger amount of residential solar panels installed than average.

¹²⁸ 60-69 years has been left out, because this group also contains a relatively large group with a low or very low chance of participating.

¹²⁹ Because the middle group (40-59 years) has the highest chance of participating, using a Kendall's Tau to measure the association between age and the chance of participating is not possible. Because of this this driver is analysed only on the basis of the crosstab.

Table 5.8 shows the age-group which had a relatively high chance to participate according to Kwan (2012) (45-54 years) and the distribution of the response of all age groups combined. It shows that of the age group of 45-54 years slightly more respondents than average indicated they have a high or very high chance to participate (25.5 per cent of the 45-54 year group indicated they have a high or very high chance to participate, compared to the average of all ages of 19.3 per cent). This confirms the finding of Kwan (2012).

Based on these tables it can be concluded that Kwan (2012) pointed out correctly that the age group of 45-54 years has a larger chance of participating than average. However, more age groups exist that have a relatively large group (compared to the average of all ages) that indicates they have a high or very high chance (i.e. willingness) to participate (the age groups 40-49 and 50-59 years). It can therefore be concluded that an age of 40 to 59 years is a driver in practice for willingness to participate.

5.4.5. Driver 11: (Fear of) negative reactions of neighbours towards a renewable energy installation on citizens' own property

The influence on the willingness to participate of citizens of driver 11, *(fear of) negative reactions of neighbours towards a renewable energy installation on citizens' own property*, was measured in the survey by a statement. This statement was *"I am afraid that when I place solar panels on my roof I will receive negative feedback from my neighbours"*. It is clear that only a very small group of respondents is afraid of the reaction of neighbours, as only 3.3 per cent of the respondents agrees or totally agrees with this statement (see table 5.9). This means that it is unlikely that citizens will participate in Waternet's project because they are afraid to place solar panels on their own roof (and would therefore like to place them on Waternet's roof, thereby preventing a negative reaction of neighbours). A (fear of) negative reactions of neighbours towards a renewable energy installation on citizens' own property is therefore not a driver in practice for citizens' willingness to participate.

5.4.6. Driver 14: The role of local people's awareness of broader issues of renewable energy production installations

To measure the influence on the willingness to participate of citizens of driver 14, *local people's awareness of broader issues of renewable energy production installations*, two questions were used in the survey. These questions were *"How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?"* (i.e. the same question as was used for drivers 5 and 6) and *"How*

		Age			
		45-54		All respondents	
		Absolute	Percentage	Absolute	Percentage
Chance of participating in Waternet's solar panel project	Very high	4	7.8	10	4.8
	High	9	17.6	30	14.5
	Average	25	49.0	83	40.1
	Low	6	11.8	44	21.3
	Very low	7	13.7	40	19.3
	Total	51	100.0	207	100.0

Table 5.8: Crosstab of the distribution of the answers to the questions "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?" and "What is your age?". Shown is the class that, according to Kwan (2012), has a statistically significant greater amount of solar panels installed than average and the distribution of all respondents (Kwan's (2012) age group column n = 51, all respondents column n = 207).

Reaction	Percentage
Totally agree	1.4
Agree	1.9
Do not agree/do not disagree	11.8
Disagree	53.6
Totally disagree	31.3

Table 5.9: Distribution of the reactions to the statement "I am afraid that when I place solar panels on my roof I will receive negative feedback from my neighbours" (n = 211).

well aware are you in your opinion of the advantages and disadvantages of solar panels?”. Table 5.10 shows a crosstab of the answers the respondents gave to these two questions.

(p > 0.05)		Awareness of the advantages and disadvantages of solar panels									
		Very unaware		Unaware		Average		Well aware		Very well aware	
		Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage
Chance of participating in Waternet's solar panel project	Very high	0	0.0	1	3.3	4	4.0	3	5.6	2	10.0
	High	0	0.0	4	13.3	12	12.1	11	20.4	3	15.0
	Average	1	25.0	12	40.0	45	45.5	18	33.3	7	35.0
	Low	0	0.0	6	20.0	24	24.2	12	22.2	2	10.0
	Very low	3	75.0	7	23.3	14	14.1	10	18.5	6	30.0
	Total	4	100.0	30	100.0	99	100.0	54	100.0	20	100.0

Table 5.10: Crosstab and Kendall's Tau of the distribution of the answers to the questions "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?" and "How well aware are you in your opinion of the advantages and disadvantages of solar panels" (n = 207).

Combining the responses of those who indicated they have a high or very high chance to participate and those who indicated they have a low or very low chance shows that the respondents who have a higher awareness of the advantages and disadvantages more often indicated they have a (very) high chance of participating. Roughly 25 per cent of the respondents who are very well aware indicate they have a high or very high chance of participating. The same goes for the respondents who indicated they are well aware of the advantages and disadvantages. Roughly 16 per cent of the respondents that have an average awareness of the advantages and disadvantages of solar panels indicated they have a high or very high chance of participating. The same goes for the respondents who indicated they are unaware of the advantages and disadvantages of solar panels. Of the respondents that are very unaware 0 per cent indicated they had a high or very high chance of participating (though it should be taken into account that only four respondents indicated they were very unaware of the advantages and disadvantages of solar panels).

The Kendall's Tau¹³⁰ of the crosstab of these two variables (see table 5.10) shows that, even though the crosstab seems to show there is a connection between awareness of advantages and disadvantages and chance (i.e. willingness) to participate, no association exists between awareness of the advantages and disadvantages of solar panels and chance of participating. The p, which is larger than 0.05, also shows this as the Kendall's Tau is not significant. This means that awareness of the advantages and disadvantages of solar panels is not a driver in practice for citizens' willingness to participate.

5.4.7. Driver 27: The role of location

The influence on willingness to participate of driver 27, location, is researched by asking the respondents two questions: "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of

(p > 0.05)		Location			
		Gein (urban)		Vogelenzang (rural)	
		Absolute	Percentage	Absolute	Percentage
Chance of participating in Waternet's solar panel project	Very high	9	9.1	1	0.9
	High	16	16.2	14	13.0
	Average	37	37.4	46	42.6
	Low	17	17.2	27	25.0
	Very low	20	20.2	20	18.5
	Total	99	100.0	108	100.0

Table 5.11: Crosstab and Kendall's Tau of the distribution of the answers to the questions "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?" and "What is your postal code" (postal codes have been transformed in the names of the location for clarity) (n = 207).

¹³⁰ This Kendall's Tau is based on table 5.10. This means the chance of participating has five possibilities: very high, high, average, low and very low. Awareness of the advantages and disadvantages of solar panels also has five possibilities. This means the number of columns (five) and rows (five) is the same. Kendall's Tau-b is therefore used.

Waternet?" (i.e. the same question as was used for drivers 5, 6, 7 and 14), and where they live (Gein or Vogelenzang¹³¹). Table 5.11 shows the crosstab between the answers the respondents provided to these questions. The table shows that of the respondents living in Gein a greater percentage indicated they have a high or very high chance of participating in Waternet's solar panel project than the respondents living in Vogelenzang. With 25.3 per cent of the respondents in Gein indicating they have a high or very high chance of participating, this is almost double the percentage of respondents that indicate this in Vogelenzang (13.9 per cent).

The Kendall's Tau¹³² (see table 5.11) suggests there is a weak association between location and the chance of participating¹³³. The fact that the Kendall's Tau is positive suggests that the respondents living in Gein (i.e. an urban area) are associated with having a higher chance of participating than those living in Vogelenzang (i.e. a rural area). However, the Kendall's Tau is not significant (see table 5.11). It can therefore be concluded that location is not a driver in practice for willingness to participate. This is in contrast with the reasoning of the author, as it means there are no (statistically significant) differences between the willingness to participate of citizens living in urban and rural areas.

5.4.8. Driver 28: The role of gender

The influence on the willingness to participate of citizens of driver 28, *gender*, was measured in the survey in a similar way as driver 27. The respondents were asked "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar

panel project on terrain of Waternet?" (i.e. the same question as was used for drivers 5, 6, 7, 14 and 27) and also what their gender was. Table 5.12 shows the crosstab of the responses to these two questions. This table shows there is indeed a difference between the chance of participating of men and women. 24.0 per cent of the female respondents indicated they either have a high or very high chance to participate, compared to 15.0 per cent of the male respondents.

The Kendall's Tau¹³⁴ (see table 5.12) shows there is indeed a statistically significant weak association between gender and chance of participating. Furthermore, it means that women are associated with a higher chance of participating than men. It can therefore be concluded that gender is a driver in practice for willingness to participate. More specifically, the female gender is a driver in practice for citizens' willingness to participate.

Kendall's Tau: -0.189 (p < 0.05)		Gender			
		Male		Female	
		Absolute	Percentage	Absolute	Percentage
Chance of participating in Waternet's solar panel project	Very high	2	1.9	8	8.0
	High	14	13.1	16	16.0
	Average	39	36.4	44	44.0
	Low	28	26.2	16	16.0
	Very low	24	22.4	16	16.0
Total		107	100.0	100	100.0

Table 5.12: Crosstab and Kendall's Tau of the distribution of the answers to the questions "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?" and "What is your gender?" (n = 207).

¹³¹ This was asked via the postal code of the citizens. Gein is viewed as an urban area, while Vogelenzang is viewed as a rural area.

¹³² This Kendall's Tau is based on table 5.11. This means the chance of participating has five possibilities: very high, high, average, low and very low. Location has only two possibilities: Gein (urban) or Vogelenzang (rural). This means the number of columns (two) and rows (five) differs. Therefore, Kendall's Tau-c is used.

¹³³ Although table 5.11 combines an ordinal and a nominal variable it is possible to use a Kendall's Tau to analyse the association between them, as indicated by De Vocht (2009, p. 126). Some caution should however be taken in mind when reviewing the results (ibid). The same goes for the other Kendall's Tau which are based on a combination of a nominal and ordinal variable in this chapter.

¹³⁴ This Kendall's Tau is based on table 5.12. This means the chance of participating has five possibilities: very high, high, average, low and very low. Gender has only two possibilities. This means the number of columns (two) and rows (five) differs. Therefore, Kendall's Tau-c is used.

5.5. Concluding remarks

After having operationalized the potential drivers in section 4.3 they have been analysed with the help of the survey in this chapter. After analysing all potential drivers a distinction can be made. On the one side there are potential drivers that, as shown by the analysis in sections 5.2, 5.3 and 5.4, have little to no influence on the willingness to participate of citizens and are therefore not drivers in practice. On the other side (as also shown in sections 5.2, 5.3 and 5.4) there are potential drivers that indeed influence the willingness of citizens to participate and are therefore drivers in practice. Sub-question 3 can therefore be answered.

The potential drivers that are drivers in practice can be found in table 5.13. In total, 14 of the 28 potential drivers were found to be drivers in practice. This means these drivers are of influence on citizens' willingness to participate in local solar panel projects. On the other hand, 14 potential drivers were found to be no driver in practice¹³⁵.

Number	Driver	Remarks
1	Saving energy	
2	Reducing bills and making money	
3	Ethical and environmental commitment that leads to concerns for the environment	
5	A higher income	
6	Higher education level	
7	Age	Age is a driver for those of 40 years to 59 years
13	Democratic decision making process that gives influence to citizens in the planning and decision making process	
19	Information about the project published via a website	
21	Flyers with information	
22	The option to ask questions via the telephone, a website or by email	
23	Information spread via a letter	
24	Information spread via email	
26	A guarantee of a minimum profit	
28	Gender	A driver is formed by the female gender

Table 5.13: Overview of the potential drivers that are drivers in practice and therefore influence citizens' willingness to participate in local solar panel projects.

¹³⁵ This does not mean they will not influence any citizen at all concerning their willingness to participate. However, the influenced group is so small that it is not seen as a driver in practice (see section 4.3 for more information about why a potential driver is seen as a driver in practice or not).

6. Barriers in practice

6.1. Introduction

A total of 21 potential barriers which may influence the willingness to participate of citizens has been identified in chapters 2 and 3, based on scientific literature and reasoning of the author. In this chapter the step is made from 'potential barriers' towards 'barriers in practice', by analysing which barriers indeed influence the willingness to participate of citizens in practice and which do not. Sub-question 4 is therefore answered in this chapter:

Which of the potential barriers are barriers in practice which influence the willingness of citizens to participate in Waternet's solar panel project?

Similar to chapter 5, in which the potential drivers were analysed, the analysis of the potential barriers is grouped in this chapter. Again, the classes in which the potential barriers were divided in section 3.7 are used. In section 6.2 the barriers that are part of the 'aspects of the project' class are discussed. In section 6.3 the barriers that were part of the 'characteristics of the citizens' class are discussed. Because no potential barriers were part of the class 'information spreading' this class is not present in this chapter. Finally, in section 6.4 the concluding remarks of this chapter are presented. This includes an overview of all potential barriers that have been found to be barriers in practice.

6.2. Aspects of the project

In this section the potential barriers that are part of the 'aspects of the project' class are analysed. These barriers were all measured in the survey via the same method. The respondents were presented a statement and could indicate to what degree they (dis)agreed with it. If 50 per cent or more (totally) agreed with the statement the barrier that was operationalized via that statement is a barrier in practice. If less than 50 per cent (totally) agreed, it is not a barrier in practice (see section 4.3 for details and exceptions). Table 6.1 presents an overview of the statements and the distribution of the reactions. Below, they are discussed one by one in more detail and it is concluded whether they are a barrier in practice or not.

Barrier number	Statement	n	Totally agree	Agree	Do not agree/do not disagree	Disagree	Totally disagree
i	I find the price of €400 to buy a solar panel for this project too high.	209	3.8	23.4	45.0	23.0	4.8
ii	The time needed to earn my original investment of €400 back (about 13 years) is too long.	209	23.0	46.4	16.3	12.0	2.4
iv	I find it difficult/annoying to gain permission from the municipality and therefore I do not buy solar panels.	209	3.8	8.6	38.3	36.8	12.4
viii	I find it difficult/annoying to find a suitable location and therefore I do not buy solar panels.	210	1.9	13.8	28.1	35.7	20.5
ix	I find it difficult/annoying to find a trustworthy installer and therefore I do not buy solar panels.	211	1.4	12.8	33.6	36.5	15.6
xiii	I will only consider participating in this project if I have access to all information about the project.	209	16.7	46.9	23.0	11.0	2.4
xviii	Because experts of Waternet are involved in this project I am more willing to participate.	209	5.3	39.2	33.5	19.6	2.4
xix	I think Waternet is capable of organising this project well.	208	8.2	45.7	45.2	1.0	0.0
xx	Because the revenues of solar panels are not fixed (but are dependent on the sun) I do not buy them.	211	1.9	12.3	28.9	41.7	15.2

Table 6.1: Distribution of the reactions to the statements in the survey which were used to analyse the barriers in the 'aspects of the project' class. The first column indicates which barrier the statement operationalizes, the second column shows the statement and the third column shows the number of respondents who answered this question. The last five columns indicate the distribution of the reactions of the respondents.

6.2.1. Barrier i: High up-front costs citizens have to make

The influence on the willingness to participate of citizens of barrier i, *high up-front costs citizens have to make*, was measured in the survey by the following statement: "I find the price of €400 to buy a solar panel for this project too high". The distribution of the reactions of the respondents (see table 6.1) shows that the costs of €400 per solar panel for most respondents are not a problem, as only 27.2 per cent of the respondents indicated they either agree or totally agree with the statement. This means that high up-front costs (of €400 per solar panel) citizens have to make in this project are not a barrier in practice for their willingness to participate¹³⁶.

6.2.2. Barrier ii: Long payback times, which may be a negative influence because of lack of strategic financial resilience

The influence on the willingness to participate of citizens of barrier ii, *long payback times, which may be a negative influence because of lack of strategic financial resilience*, was also measured by a statement in the survey. This statement was the following: "The time needed to earn my original investment of €400 back (about 13 years) is too long". The distribution of the reactions of the respondents (see table 6.1) shows that a long payback time, which may lead to a lack of strategic financial resilience, is a barrier in practice for willingness to participate, as 69.4 per cent of the respondents indicated they agree or totally agree with the statement¹³⁷.

¹³⁶ It should be kept in mind this was a very specific statement, strongly linked to this project. The high up-front costs of €400 are found not to be a barrier in practice, but they may of course be if the price changes or if it is a different project.

¹³⁷ Similar to barrier i, it should be kept in mind this was a very specific statement, strongly linked to this project. In this project the time required before the original investment is earned back is 13 years. In other projects, in which a different payback time is applicable, the respondents might have reacted differently.

6.2.3. Barrier iv: Getting planning permission

The influence on the willingness to participate of citizens of barrier iv, *getting planning permission*, was measured by a statement in the survey. This statement was the following: *“I find it difficult/annoying to gain permission from the municipality and therefore I do not buy solar panels”*. The distribution of the reactions of the respondents (see table 6.1) shows that getting planning permission is not viewed as a problem by most respondents. Only 12.4 per cent of the respondents indicated they agree or totally agree with the statement. This is therefore not a barrier in practice for willingness to participate.

6.2.4. Barrier viii: Finding a suitable location

The influence on the willingness to participate of citizens of barrier viii, *finding a suitable location*, was measured in the survey by the following statement: *“I find it difficult/annoying to find a suitable location and therefore I do not buy solar panels”*. The distribution of the reactions of the respondents (see table 6.1) shows that a large part of the respondents does not think finding a suitable location for solar panels would be a problem when they would want to invest in solar panels, as only 15.7 per cent of the respondents agreed or totally agreed with the statement. The task of finding a suitable location is therefore not a barrier in practice for willingness to participate.

6.2.5. Barrier ix: Finding a trustworthy installer

The influence on the willingness to participate of citizens of barrier ix, *finding a trustworthy installer*, was also measured in the survey by a statement. This statement was *“I find it difficult/annoying to find a trustworthy installer and therefore I do not buy solar panels”*. As only a small group of respondents (14.2 per cent) indicated they agreed or totally agreed with this statement (see table 6.1), it can be concluded that finding a trustworthy installer is not a barrier in practice for willingness to participate.

6.2.6. Barrier xiii: Lack of access to information

The influence on the willingness to participate of citizens of barrier xiii, a lack of access to information, was measured in the survey by the following statement: *“I will only consider participating in this project if I have access to all information about the project”*. As 63.6 per cent of the respondents indicated they agree or totally agree with the statement (see table 6.1), it can be concluded that a lack of access to information is a barrier in practice for willingness to participate.

6.2.7. Barrier xviii: Lack of expert advice and support

The influence on the willingness to participate of citizens of barrier xviii, *lack of expert advice and support*, was measured in the survey by the following statement: *“Because experts of Waternet are involved in this project I am more willing to participate”*. This statement was asked in a reversed way compared to the potential barrier. Instead of asking whether a lack of expert advice and support would reduce willingness to participate, citizens were asked to indicate whether it would increase their willingness to participate if experts were involved. Therefore if less than 50 per cent agrees or totally agrees with the statement it is assumed that expert advice and support is not of influence¹³⁸.

The distribution of the reactions of the respondents (see table 6.1) shows that only 44.5 per cent of the respondents agrees or totally agrees with this statement. This means that for a majority of the respondents the availability of expert advice and support does not increase their willingness to participate. This subsequently means that a lack of expert advice and support is not a problem for a

¹³⁸ See section 4.3 for details concerning this method.

majority of the respondents. It is therefore concluded that a lack of expert advice and support is not a barrier in practice for willingness to participate.

6.2.8. Barrier xix: Lack of trust in the organisation

The influence on the willingness to participate of citizens of barrier xix, *lack of trust in the organisation*, is measured in the survey by a statement. This statement was “*I think Waternet is capable of organising this project well*”. As this statement was asked in a reversed way¹³⁹ (similar to the statement used for barrier xvi), instead of looking at those that agree and totally agree with this statement, the percentage of respondents that disagrees or totally disagrees with the statement is used (see section 4.3 for details). Only 1.0 per cent of the respondents stated they disagreed with the statement, and no respondents stated they totally disagreed (see table 6.1). It can therefore be concluded that a lack of trust in the organisation is not a barrier in practice for willingness to participate¹⁴⁰.

6.2.9. Barrier xx: Financial revenues cannot be guaranteed

The influence on the willingness to participate of citizens of barrier xx, *financial revenues cannot be guaranteed*, was also measured in the survey by a statement. This statement was: “*Because the revenues of solar panels are not fixed (but are dependent on the sun) I do not buy them*”. The distribution of the reactions of the respondents (see table 6.1) shows that only 14.2 per cent of the respondents agrees or totally agrees with the statement. Because less than 50.0 per cent of the respondents agrees or totally agrees with the statement, it can be concluded that the fact that financial revenues cannot be guaranteed is not a barrier in practice for willingness to participate.

6.3. Characteristics of the citizens

In this section the potential barriers that were part of the ‘characteristics of the citizens’ class are analysed. Multiple methods have been used to analyse these barriers in the survey (see section 4.3 for details). A number of them is analysed in the same way as the barriers in the ‘aspects of the citizens’ class: a statement was presented and if 50 per cent or more of the respondents (totally) agreed¹⁴¹ with the statement the barrier is a barrier in practice. In table 6.2 these statements are presented together with the distribution of the reactions. For some barriers other methods were used. The tables with these results are presented when applicable below, where the barriers are analysed in more detail one by one.

¹³⁹ The potential barrier assumes citizens lack trust in the organisation, while the statement asks whether the respondents trust the organising capacities of Waternet.

¹⁴⁰ Similar to barrier xiv and xvi (see sections 6.2.12 and 6.2.13) it should be kept in mind this statement is quite specific for Waternet. In the case of other organisations it may be a barrier in practice.

¹⁴¹ Some exceptions exist, see section 4.3 for details.

Barrier number	Statement	n	Totally agree	Agree	Do not agree/do not disagree	Disagree	Totally disagree
iii	I think solar panels are a technique that is too new to trust.	211	2.4	10.9	24.2	48.8	13.7
v	I do not have enough knowledge about solar panels to decide whether I want to participate in this project or not.	209	2.9	19.6	34.9	32.1	10.5
vi	I do not have enough money available to participate in this solar panel project.	208	6.3	19.7	32.7	32.2	9.1
vii	I do not have the time to be involved in this project the next years.	207	1.4	12.6	47.3	32.4	6.3
x	I am afraid that solar panels will not produce enough electricity in order to earn (enough) from them.	210	2.9	16.7	34.8	35.7	10.0
xiv	I do not know Waternet very well and am therefore not willing to participate in this project.	210	1.0	5.2	33.3	47.1	13.3
xvi	I would like to cooperate with Waternet in this project.	206	3.9	24.3	51.9	15.5	4.4
xxi	I already have solar panels and therefore do not want to participate in this project.	206	6.3	1.9	7.8	46.1	37.9

Table 6.2: Distribution of the reactions to the statements in the survey which were used to analyse the barriers in the ‘characteristics of the citizens’ class. The first column indicates which barrier the statement operationalizes, the second column shows the statement and the third column shows the number of respondents who answered this question. The last five columns indicate the distribution of the reactions of the respondents.

6.3.1. Barrier iii: Perceived risk of new technologies

The influence on the willingness to participate of citizens of barrier iii, a *perceived risk of new technologies*, was measured in the survey by a statement. This statement was: “*I think solar panels are a technique that is too new to trust*”. The distribution of the reactions of the respondents (see table 6.2) shows that most respondents do not view solar panels as a (too) new technique that cannot be trusted. Only 13.3 per cent of the respondents indicated they agree or totally agree with the statement. A perceived risk of new technologies is therefore not a barrier in practice for citizens’ willingness to participate.

6.3.2. Barrier v: Lack of knowledge concerning the technologies

The influence on the willingness to participate of citizens of barrier v, a *lack of knowledge concerning the technologies*, was measured by the statement “*I do not have enough knowledge about solar panels to decide whether I want to participate in this project or not*”. The distribution of the reactions of the respondents (see table 6.2) shows that a lack of knowledge concerning the technologies of solar panels has no negative influence on the willingness to participate of most of the respondents. Only 22.5 per cent of the respondents indicated they agree or totally agree with the statement. This means that a lack of knowledge concerning the technologies is not a barrier in practice for willingness to participate.

6.3.3. Barrier vi: Lack of access to capital

The influence on the willingness to participate of citizens of barrier vi, a *lack of access to capital*, was measured in the survey by a statement. This statement was “*I do not have enough money available to participate in this solar panel project*”¹⁴². The distribution of the reactions of the respondents (see table 6.2) shows that not having enough money available (i.e. a lack of access to capital) is not a problem for most respondents. Only 26.0 per cent indicated they agree or totally

¹⁴² The statement that was presented in the questionnaire before this statement noted that €400 was required for participation, thereby making sure that citizens knew how much money was required.

agree with the statement. This means that a lack of access to capital is not a barrier in practice for the willingness to participate of citizens.

6.3.4. Barrier vii: Lack of time during involvement

The influence on the willingness to participate of citizens of barrier vii, *a lack of time during involvement*, was measured in the survey by the following statement: *“I do not have the time to be involved in this project the next years”*. The distribution of the reactions of the respondents (see table 6.2) shows that only a small group has no time to be involved, as only 14.0 per cent of the respondents agrees or totally agrees with this statement. This means that a lack of time during involvement is not a barrier in practice for willingness to participate.

6.3.5. Barrier x: (Fear of) insufficient output

The influence on the willingness to participate of citizens of barrier x, *a (fear of) insufficient output*, was measured in the survey by the following statement: *“I am afraid that solar panels will not produce enough electricity in order to earn (enough) from them”*. As only 19.6 per cent of the respondents indicated they agree or totally agree with this statement (see table 6.2), (fear of) insufficient output is not a barrier in practice for willingness to participate.

6.3.6. Barrier xi: The role of a lower education

The influence on the willingness to participate of citizens of barrier xi, *a lower education level*, was measured in the survey in the same way as the driver formed by a higher education level (see section 5.4.3). The same two questions were therefore used: *“How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?”* (i.e. the same question as was used for drivers 5, 6, 7, 14, 27 and 28) and *“What is the highest level of education you have finished?”*. Table 5.6 shows the crosstab of the responses to these two questions.

It becomes clear from this crosstab that the respondents with a lower education level indeed indicate more often they are less likely to participate. Almost 60 per cent of the respondents with a low education level indicated they have a low or very low chance of participating, compared to only a little over 30 per cent of the respondents with a high education level. The respondents with a medium education level are situated between these levels with a little over 40 per cent indicating they have a low or very low chance to participate. The Kendall's Tau¹⁴³ confirms this. The Kendall's Tau, which is statistically significant, shows that there is indeed a weak association between highest level of finished education and the chance of participating. Because the Kendall's Tau is negative this association means that respondents with a lower education have a lower chance (willingness) to participate. It can therefore be concluded that a lower education level is a barrier in practice for willingness to participate.

6.3.7. Barrier xii: The role of age

The influence on the willingness to participate of citizens of barrier xii, *age*, was measured in a similar way as the driver age (see section 5.4.4). Two questions were used to measure the influence: *“How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?”* (i.e. the same question as was used for drivers 5, 6, 7, 14, 27 and 28 and barrier xi) and *“What is your age?”*

¹⁴³ This Kendall's Tau is based on table 5.6. This means the chance of participating has five possibilities: very high, high, average, low and very low. Education has only three possibilities, as 'other' has been left out in the calculations for the Kendall's Tau. This means the number of columns (three) and rows (five) differs. Kendall's Tau-c is therefore used.

(i.e. the same question as was used for driver 7). The age of the respondents is divided in groups, as was also done to measure the influence of age as a driver. First, all ages are researched. The groups are the same as the groups used to research driver 7 (see section 5.4.4) and to create an overview of the respondents in section 4.4. After this, the age classes for which Kwan (2012) found that they had a (statistically significant) lower amount of solar panels installed than average are analysed (25-34 years and 55-64 years) (see section 2.2.2).

Table 5.7 shows the division of all respondents in age groups of ten years. It shows that there are indeed groups that have a smaller than average group of respondents that indicates they have a high or very high chance of participating. The age groups of 20-29 and 30-39 years have a slightly smaller group that indicates they have a high or very high chance of participating than average (respectively 16.7 per cent and 17.6 per cent compared to an average of 19.3 per cent). The age groups of 70-79 and 80+ both have no respondents that indicated they have a high or very high chance of participating¹⁴⁴. Furthermore, the age groups 20-29, 60-69, 70-79 and 80+ all have a relatively large group (larger than average) that indicated they have a low or very low chance of participating (respectively 50.0 per cent, 41.5 per cent, 88.2 per cent and 55.6 per cent compared to an average of all ages of 40.6 per cent).

Table 6.3 shows the age groups which had a relatively low chance to participate according to Kwan¹⁴⁵ (2012) (25-34 years and 55-64 years) and their chance of participating. Furthermore, the average of all ages is also presented in this table. The table shows that the findings made by Kwan (2012) are not found in the survey¹⁴⁶. Instead, the age groups of 25-34 years and 55-64 years indicated a little more often they have a high or very high chance to participate than average (respectively 26.7 per cent (25-34 years) and 22.9 per cent (55-64 years) indicated they have a high or very high chance to participate, compared to 19.3 per cent of all respondents). The groups that indicated they have a low or very low chance of participating were also smaller than average (respectively 20.0 per cent (25-34 years) and 37.1 per cent (55-64 years), compared to 40.6 per cent for all respondents).

Based on the results of the crosstab¹⁴⁷ it can be concluded that there are indeed age groups that have a smaller chance of participating than average as Kwan (2012) indicated, but these age groups differ from the groups Kwan (2012) found. It was found in this survey that especially for the group of respondents of 70 years and older age is a barrier in practice (most likely due to the long payback time). Furthermore, for the age group of 20-29 years it is also a barrier in practice¹⁴⁸ (although not as strong as for the 70 years and older group). A possible reason for this might be that they have relatively little purchasing power available for green products, as was also indicated by Kwan (2012) for the age group of 25-34 years (see section 2.2.2). Concluding, it can be stated that age is a barrier in practice for willingness to participate for those of 20-29 years and even more for those of 70 years and older.

¹⁴⁴ The fact that no respondent of 70 years or older indicated they have a high or very high chance of participating is most likely influenced by the fact that the payback time of the solar panels is 13 years, and it takes 25 years before the full benefits have been acquired. This was also indicated by a number of respondents on the questionnaire, where they made statements such as "Taken my age into account it is not interesting for me to invest in this project" (man, 70 years old) and "I am 84 years old and will not invest in such a project anymore" (woman, 84 years old).

¹⁴⁵ More precisely, Kwan (2012) found that neighbourhoods (based on ZIP code) with greater proportions of the population between the age of 24-35 and/or 55-64 had a significantly smaller amount of residential solar panels than average.

¹⁴⁶ It should be noted that the groups of respondents of 25-34 years consists of only 15 respondents in this survey, which is relatively small.

¹⁴⁷ Using Kendall's Tau to analyse whether an association between age and chance of participating exists is not possible, because the 40-59 years group (i.e. the middle-group) is the group with the highest chance of participation. This is the same as was the case for the driver formed by age (see section 5.4.4). Therefore, similar to driver 7, only crosstabs are used to analyse the influence of age.

¹⁴⁸ An age between 30-39 years and 60-69 years is not seen as a barrier in practice because of the following reasons. Although the class of 30-39 years has a relatively small group that indicates they have a (very) high chance of participating, they also have a relatively small group that indicates they have a (very) low chance of participating. Furthermore, although the group of 60-69 years has a relatively large group that has a (very) low chance of participating, they also have a relatively large group that has a (very) high chance of participating.

		Age (in years)					
		25-34		55-64		All respondents	
		Absolute	Percentage	Absolute	Percentage	Absolute	Percentage
Chance of participating in Waternet's solar panel project	Very high	2	13.3	4	5.7	10	4.8
	High	2	13.3	12	17.1	30	14.5
	Average	8	53.3	28	40.0	83	40.1
	Low	0	0.0	14	20.0	44	21.3
	Very low	3	20.0	12	17.1	40	19.3
	Total	15	100.0	70	100.0	207	100.0

Table 6.3: Crosstab of the distribution of the answers to the questions "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?" and "What is your age?". Age is combined in the classes that, according to the study of Kwan (2012), had a significantly lower amount of solar panels installed than average (Kwan's (2012) age groups columns n = 85, all respondents column n = 207).

6.3.8. Barrier xiv: Low local awareness of the organisation

The influence on the willingness to participate of citizens of barrier xiv, *low local awareness of the organisation*, was measured in the survey by the following statement: "I do not know Waternet very well and am therefore not willing to participate in this project". The distribution of the reactions of the respondents (see table 6.2) shows that low local awareness of the organization is not a barrier in practice for willingness to participate, as only 6.2 per cent of the respondents indicated they agree or totally agree with the statement¹⁴⁹.

6.3.9. Barrier xv: The role of a low interest of citizens in energy issues

The influence on the willingness to participate of citizens of barrier xv, *a low interest of citizens in energy issues*, was measured in the survey by a combination of two questions. These questions were the following: "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?" (i.e. the same question as was used for drivers 5, 6, 7, 14, 27 and 28 and barrier xi and xii) and "How much interest do you have for energy problems, such as climate change and the world running out of oil and gas in the future?". Table 6.4 shows the crosstab of the answers the respondents gave to these questions. This table shows that relatively more respondents with a lower interest in energy problems have a low or very low chance of participating in Waternet's project. An exception to this is the group that indicated they have 'very much' interest, as they have a (slightly) larger percentage that has a low or very low chance of participating than the respondents that indicated they have 'much' interest in energy problems.

The Kendall's Tau¹⁵⁰ of the crosstab (see table 6.4) shows there is indeed a weak statistically significant association between citizens' interest in energy problems and chance of participating. Because the Kendall's Tau is negative this means that a lower interest is associated with a lower chance (i.e. willingness) to participate. It is therefore concluded that a low interest in energy problems is a barrier in practice for willingness to participate¹⁵¹.

¹⁴⁹ It should be kept in mind this statement is quite specific for Waternet. In the case of other organisations it may be a barrier in practice.

¹⁵⁰ This Kendall's Tau is based on table 6.4. This means the chance of participating has five possibilities: very high, high, average, low and very low. The interest in energy problems of the respondents is also divided in five possibilities. This means the number of columns (five) and rows (five) is the same. Kendall's Tau-b is therefore used.

¹⁵¹ It should be kept in mind that the groups that indicated they had little or very little interest in energy problems are relatively small.

Kendall's Tau: -0.209 (p < 0.01)		Interest in energy problems									
		Very little		Little		Average		Much		Very much	
		Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute	Percentage
Chance of participating in Waternet's solar panel project	Very high	0	0.0	0	0.0	0	0.0	3	4.5	7	16.3
	High	0	0.0	1	12.5	9	10.6	14	21.2	6	14.0
	Average	0	0.0	2	25.0	38	44.7	28	42.4	15	34.9
	Low	0	0.0	1	12.5	24	28.2	13	19.7	6	14.0
	Very low	5	100.0	4	50.0	14	16.5	8	12.1	9	20.9
	Total	5	100.0	8	100.0	85	100.0	66	100.0	43	100.0

Table 6.4: Crosstab and Kendall's Tau of the distribution of the answers to the questions "How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?" and "How much interest do you have for energy problems, such as climate change and the world running out of oil and gas in the future?" (n = 207).

6.3.10. Barrier xvi: Unwillingness to be committed to an organisation

The influence on the willingness to participate of citizens of barrier xvi, *unwillingness to be committed to an organisation*, was measured in the survey by a statement. This statement was the following: "I would like to cooperate with Waternet in this project". As this statement was asked in a reversed way compared to the potential barrier¹⁵², instead of looking at the percentage of respondents that agrees and totally agrees with this statement, the percentage of respondents that disagrees or totally disagrees with the statement is researched¹⁵³. In total, 19.9 per cent of the respondents indicated they disagree or totally disagree with the statement (see table 6.2). It can therefore be concluded these respondents do not want to participate with Waternet in this project. As less than 50.0 per cent indicates this this means that unwillingness to be committed to an organisation is not a barrier in practice for willingness to participate¹⁵⁴.

6.3.11. Barrier xvii: The role of a lack of time to make a decision

The influence on the willingness to participate of citizens of barrier xvii, *lack of time to make a decision*, is measured in the survey by the following question: "At this moment you have only received a small part of the information concerning this project. How long do you think you will need to make a final decision to either participate or not participate in this solar panel project, after receiving all the information concerning this project?". The distribution of the answers

Answer	Percentage
Less than one week	26.3
More than one week, but less than one month	41.0
More than one month, but less than two months	8.3
More than two months, but less than six months	11.2
More than six months	13.2

Table 6.5: Distribution of the answers to the question "At this moment you have only received a small part of the information concerning this project. How long do you think you will need to make a final decision to either participate or not participate in this solar panel project, after receiving all the information concerning this project?" (n = 205).

given by the respondents to this question is presented in table 6.5. The distribution shows that the majority of the respondents (75.6 per cent) requires less than two months to decide whether they want to participate in Waternet's solar panel project or not. It is therefore unlikely that lack of time to make a decision is a problem, as it is likely that at least two months is provided to citizens to decide to participate or not, as was also the case for Waternet's employees in the Zon op Waternet

¹⁵² The potential barrier assumes that citizens do not want to be committed to an organisation, while the statement used to measure the barrier assumes they want to be committed.

¹⁵³ See section 4.3 for details concerning this method.

¹⁵⁴ Similar to barrier xiv it should be kept in mind this statement is quite specific for Waternet. In the case of other organisations it may be a barrier.

project¹⁵⁵ (see section 3.2). Because more than 50.0 per cent of the respondents indicated they require less than two months to decide whether to participate or not, it is concluded that lack of time to make a decision is not a barrier in practice for willingness to participate (see section 4.3 for details).

6.3.12. Barrier xxi: Already invested in solar panels

To measure the influence on the willingness to participate of citizens of barrier xxi, *having already invested in solar panels*, a statement was used in the survey. This statement was *“I already have solar panels and therefore do not want to participate in this project”*. Because only 8.2 per cent of the respondents indicated they agree or totally agree with the statement (see table 6.2), it can be concluded that this is not a barrier in practice for willingness to participate.

6.4. Concluding remarks

In this chapter the barriers that have been operationalized in chapter 4 have been analysed with the help of the survey. Based on this analysis a distinction can be made. On the one side there are potential barriers that are barriers in practice, while on the other side there are also potential barriers that are no more than potential barriers, as shown in sections 6.2 and 6.3. Sub-question 4 can therefore be answered.

The potential barriers that were found to be barriers in practice can be found in table 6.6. In total, 5 of the 21 potential barriers were found to be barriers in practice. These barriers negatively influence the willingness of citizens to participate in local solar panel projects if they are not tackled. Next to the 5 potential barriers that were identified as barriers in practice there are 16 potential barriers that were found not to be barriers in practice¹⁵⁶.

Number	Barrier	Remarks
ii	Long payback times, which may be a negative influence because of lack of strategic financial resilience	
xi	Lower education level	
xii	Age	Age is a barrier for those of 29 years and younger and even more for those of 70 years and older
xiii	Lack of access to information	
xv	Low interest of citizens in energy issues	

Table 6.6: Overview of the potential barriers that are barriers in practice and therefore influence citizens' willingness to participate in local solar panel projects.

¹⁵⁵ This means that it may become a barrier if time to decide is drastically shortened compared to the almost three months available in the Zon op Waternet project.

¹⁵⁶ When reviewing these results, it should be kept in mind that although these potential barriers were found to be no barriers in practice, this does not mean they will not influence any citizen at all concerning their willingness to participate. However, the influenced group is so small that it is not seen as a barrier in practice (see section 4.3 for details about why a potential barrier is seen as a barrier in practice or not).

7. Waternet's project and citizens' willingness to participate

7.1. Introduction

The analysis in chapters 5 and 6 has shown that a number of potential drivers and barriers are drivers and barriers in practice for citizens' willingness to participate in local solar panel projects. These drivers and barriers in practice also influence the willingness of citizens to participate in Waternet's solar panel project. This makes it important for Waternet to know whether they can use and tackle these drivers and barriers in their project. The drivers and barriers in practice are therefore analysed in the case of Waternet's project in this chapter. This is based on a comparison between the drivers and barriers in practice and the setup of Waternet's citizen participation solar panel project as well as their reasons and means. Sub-question 5 is therefore answered:

To what degree does and can Waternet use the drivers in practice and tackle the barriers in practice in their citizen participation solar panel project?

The drivers and barriers in practice are ordered in four classes, based on whether they are or can be used/tackled by Waternet in their citizen participation solar panel project:

1. *Is used/tackled by Waternet:* Waternet already uses/tackles this driver/barrier in the project as it currently is planned.
2. *Can be used/tackled by Waternet:* although this driver/barrier is not used/tackled in Waternet's project as it currently is planned, it can be used/tackled by Waternet (as effective as those already used/tackled).
3. *Can partly be used/tackled by Waternet:* although this driver/barrier is not used/tackled by Waternet in the project as it is currently planned, they can use/tackle it at least partly.
4. *Cannot be used/tackled by Waternet:* Waternet does not use/tackle this driver/barrier in the project as it is currently planned and it is not possible for Waternet to do so.

In section 7.2 the drivers in practice are discussed and whether Waternet uses them in their project. In section 7.3 the same is done for the barriers in practice. In section 7.4 the concluding remarks of this chapter are presented.

7.2. Waternet's project and the drivers in practice

As shown in chapter 5, 14 potential drivers have been identified as drivers in practice. These drivers influence citizens' willingness to participate in local solar panel projects (such as the citizen participation project of Waternet) in a positive way. Table 7.1 shows which of these drivers are already used by Waternet in their project, can be used, can partly be used or cannot be used. Below they are discussed in more detail.

Number	Driver	Remarks	Is used by Waternet	Can be used by Waternet	Can partly be used by Waternet	Cannot be used by Waternet
1	Saving energy				X	
2	Reducing bills and making money		X			
3	Ethical and environmental commitment that leads to concerns for the environment		X			
5	A higher income				X	
6	Higher education level				X	
7	Age	Age is a driver for those of 40 years to 59 years			X	
13	Democratic decision making process that gives influence to citizens in the planning and decision making process			X		
19	Information about the project published via a website			X		
21	Flyers with information			X		
22	The option to ask questions via the telephone, a website or by email			X		
23	Information spread via a letter			X		
24	Information spread via email			X		
26	A guarantee of a minimum profit					X
28	Gender	A driver is formed by the female gender				X

Table 7.1: The drivers in practice and whether they are used, can be used, can partly be used or cannot be used in Waternet's citizen participation solar panel project.

7.2.1. Driver 1: Saving energy

Driver 1, *saving energy*, means that citizens want to reduce the amount of grey energy they use because they bought solar panels. More specifically, this driver means that citizens' willingness to participate is increased if they reduce the amount of grey energy they use themselves via their solar panels. This driver is currently not used in Waternet's project because the green energy that is produced by the solar panels is not directly used by the participating citizens (but sold to an energy company) and the amount of grey energy participating citizens use is therefore not reduced (see section 1.3). Instead, the citizens still have to buy energy from the energy company¹⁵⁷.

Although it is difficult to use this driver in combination with the regulations stated in the Energy Agreement (SER, 2013), Waternet can communicate clearly to the participating citizens how much green energy is produced by their solar panels and how much grey energy therefore is saved via this project. A possible method to do this is by using a website on which the citizens can view how much green energy was produced by their solar panels, as was also done in the Zon op Waternet project (see section 3.2).

Based on this it can be concluded that although this driver is not used in Waternet's project as it is planned, *this driver can partly be used by Waternet*, by showing citizens how much their solar panel(s) reduced the amount of grey energy produced, by producing green energy instead.

¹⁵⁷ Depending on the contract the citizens have with their energy company this can be either grey or green energy.

7.2.2. Driver 2: Reducing bills and making money

Driver 2, *reducing bills and making money*, means that earning a financial return for their investment increases the willingness to participate of citizens. It is clear from the calculations made in section 1.3.2 and the appendix, section 2, that Waternet's project creates a positive financial return for citizens that participate by allowing them to make money and reduce their bills. On the one side they save money by saving tax-costs via the tax-reduction on their energy bill. On the other side they also make money by selling the produced energy to an energy company. The fact that this is important to Waternet is shown by one of the reasons they had to start this project, which was to reduce the tariff costs for citizens (see section 1.3.3). It should be kept in mind however that citizens would save more money if they installed the solar panels on their own roof, as they would be able to balance all their created energy with the energy they use. Still, the fact that Waternet uses this driver stimulates the willingness to participate of citizens in this project. It can therefore be concluded that *this driver is used by Waternet*.

It should be noted that only by using the regulations of the Energy Agreement Waternet is able to use this driver. As the calculations in section 1.3.2 and the appendix, section 2, show citizens would lose money (after adjusting the calculations for inflation) if the regulations of the Energy Agreement are not used.

7.2.3. Driver 3: Ethical and environmental commitment that leads to concerns for the environment

Driver 3, *ethical and environmental commitment that leads to concerns for the environment*, means that citizens' willingness to participate in local solar panel projects is higher when they feel they have a responsibility towards the environment. By reducing the amount of grey energy that is used they help save the environment because they reduce the impact energy production has on the greenhouse effect¹⁵⁸. As stated in section 1.3.3 this is one of the main reasons for Waternet to start this project, as ethical and environmental commitment is part of Waternet's goal of becoming CO₂ neutral in 2020. Because reducing environmental impact on the environment is one of the reasons for Waternet to start this project it can be concluded *Waternet uses this driver* in the project as it is currently planned and it may therefore increase the willingness of citizens to participate. It is of course important to clearly communicate the positive environmental effects of this solar panel project towards the citizens in order to use this driver and increase citizens' willingness to participate.

7.2.4. Driver 5: A higher income

Driver 5, *a higher income*, means that citizens who have a relatively high income have a higher willingness to participate in this project. Although the influence of income is not part of the setup of Waternet's project (as it is currently planned), or Waternet's reasons or means (see section 1.3) they could incorporate this driver in their project by focusing on citizens with a higher income. This could for example be done by focusing on certain neighbourhoods with a higher (than average) income. It can therefore be concluded that although Waternet currently does not use the driver that is formed by a higher income, *Waternet can partly*¹⁵⁹ *use this driver* in its project.

However, Waternet might also be able to reduce the negative impact of a lower income on willingness to participate and thereby also include (more) citizens with a lower income. To do so, they must reduce the influence of the reason why citizens with a lower income have a lower

¹⁵⁸ This means this driver is different from driver 1. Although both use energy saving to reduce the impact on the environment, driver 1 focusses on a reduction in grey energy used by the citizen him/herself. Driver 3 however focusses on ethical and environmental commitment which requires a reduction in grey energy used in general.

¹⁵⁹ Partly, because there are always citizens with a lower income living in areas in which most have a higher income.

willingness to participate, which is (at least partially) the fact that citizens with a lower income simply lack the financial means to participate. A method to reduce this impact is already researched by Waternet for this project. This method is giving citizens the option to buy their solar panels via a loan, which is paid back via the return of the solar panels (see section 1.3.2). Although this will not change the income of the citizens (which Waternet cannot influence), it may increase the willingness to participate of citizens with a lower income¹⁶⁰ (closer to that of the citizens with a higher income). It should be taken into account that due to interest on this loan the payback time will increase.

7.2.5. Driver 6: Higher education level

Driver 6, *a higher education level*, means that citizens who have followed a higher education have a higher willingness to participate. Similar to driver 5, this driver is not used in Waternet's citizen participation project as it is currently planned. However, Waternet could focus on neighbourhoods in which a relatively large group of citizens lives with a higher education level. It can therefore be concluded that, similar to driver 5, Waternet does not use this driver in its current project, but *Waternet can partly*¹⁶¹ *use this driver* in its project if they want to.

7.2.6. Driver 7: Age

It was found that citizens of 40 to 59 years are more willing to participate than average. Similar to drivers 5 and 6, Waternet does not incorporate this driver in its project as it is currently planned. However, they can incorporate it by focussing their project on certain age groups (i.e. 40-59 years). This can be done by focussing on neighbourhoods with a relatively large group of citizens of this age. It can therefore be concluded that although Waternet does not use this driver in its project as it is currently planned, *Waternet can partly*¹⁶² *use this driver* in its project.

7.2.7. Driver 13: Democratic decision making process that gives influence to citizens in the planning and decision making process

Driver 13, *a democratic decision making process that gives influence to citizens in the planning and decision making process*, means that citizens' willingness to participate is higher if they can influence the decision making and planning process. This driver is not part of Waternet's project as it is currently planned. Although a citizen cooperative needs to exist in order to use the tax-regulations from the Energy Agreement (see section 1.3.2), Waternet has made no decision yet about the power of the cooperative in the decision making and planning process. However, because this cooperative is required and part of the current design of the project, it should be possible for Waternet to incorporate a process that gives influence to the citizens in the planning and decision making process via this cooperative, thereby increasing the willingness to participate of the citizens. This means that *Waternet can use this driver* in its project.

It should be kept in mind that in order to effectively use this driver to increase citizens' willingness to participate it should be on step six or higher of Arnstein's (1969) citizen participation ladder (see section 2.4.1). This is possible, as Waternet has also done this in the pilot project Zon op Waternet for its employees (see section 3.2.1).

¹⁶⁰ It should be noted that there may be more reasons why citizens with a lower income have a lower willingness to participate than a lack of financial means (e.g. it is likely that citizens with a lower income also have a lower education level, which also is a barrier in practice as concluded in chapter 6). Offering a loan to buy the solar panels only influences the 'lack of financial means' reason.

¹⁶¹ Partly, because there are always citizens with a lower education level living in areas in which relatively many have a higher education level.

¹⁶² Partly, because although some areas will have a relatively high percentage of citizens in a certain age range there always live citizens of other ages in these areas.

7.2.8. Driver 19: Information about the project published via a website

Driver 19, *information about the project published via a website*, means that citizens' willingness to participate is higher if they are able to look up detailed information about the local solar panel project online. As Waternet currently has not yet decided what means it wants (and can) use to invite citizens (see section 1.3.2), it is unclear yet whether they will use a website to increase the willingness to participate of citizens. However, as the pilot project has shown Waternet is capable of doing so (see section 3.2.3). It can therefore be concluded that although Waternet currently has not planned to use a website to increase citizens' willingness to participate, *Waternet can use this driver* in their project. As stated in section 7.2.1, it might be stimulating for the willingness to participate of citizens if this website allowed the citizens to view how much green energy their solar panels produced.

7.2.9. Driver 21: Flyers with information

Next to a website, it was found in the survey that driver 21, *flyers with information*, also increases citizens' willingness to participate in local solar panel projects. As stated in section 1.3.2 Waternet has not yet decided what means they are going to use to inform the citizens about the project and increase their willingness to participate. However, flyers are most likely an option for Waternet, as a similar method (i.e. magazines) was also used by Waternet in the pilot project Zon op Waternet (see section 3.2.3). It can therefore be concluded that the driver formed by flyers with information *can be used by Waternet*.

7.2.10. Driver 22: The option to ask questions via the telephone, a website or by email

Driver 22, *the option to ask questions via the telephone, a website or by email*, was also found to increase citizens' willingness to participate. Similar to drivers 19 and 21, Waternet has not yet decided whether it wants to use this method of information communication (see section 1.3.2). Although it was used in the pilot project (see section 3.2.3), it was relatively informal in that project (all communication happened internally between Waternet employees). However, when communicating externally, this would require more formal procedures. It can be expected that Waternet is capable of doing so as is shown by the fact that they already have a customer support department which can be reached via phone, Waternet's website, Facebook and Twitter (Waternet, 2014b). It can therefore be concluded that although the option to ask questions via the telephone, a website or by email is not incorporated in the plans for Waternet's citizen participation solar panel project at the moment, this driver *can be used by Waternet* as a large part of the infrastructure is already in place.

7.2.11. Driver 23: Information spread via a letter

It became clear in chapter 5 that driver 23, *information spread via a letter*, is a driver in practice for citizens' willingness to participate. Again, because it is unclear which means Waternet will use to involve citizens in their solar panel project (see section 1.3.2), it cannot be said Waternet uses this method in their project as it is currently planned. However, Waternet is able to contact its customers via a letter, as they also send bills to their customers. This means that spreading information about the project via a letter towards (potential) participants is a possibility. This means this driver *can be used by Waternet*.

It is important to note that if Waternet decides to use an external organisation to develop and carry out this project (see section 1.3.2) that, in order to use this driver, they should be able to send a letter to the (potential) participants. This could be done by allowing them to use the communication

channels of Waternet, which is a possibility according to Van der Meer (2014b), although no official decision has been made about this yet (see section 1.3.2).

7.2.12. Driver 24: Information spread via email

Driver 24, *information spread via email*, was also found to be important for citizens and a driver in practice that increases their willingness to participate. Because Waternet has not yet decided which means they will use to invite citizens (see section 1.3.2) the driver for willingness to participate formed by information spread via email is not used by Waternet in the solar panel project as it is currently planned. However, Kortman (2014) indicated that Waternet does have the email addresses of its customers, which means this driver *can be used by Waternet*.

Similar to driver 23 (see section 7.2.11), if an external party carries out this project for Waternet it is important they have access to the communication channels of Waternet in order to send an email and thereby use this driver.

7.2.13. Driver 26: A guarantee of a minimum profit

Driver 26, *a guarantee of a minimum profit*, is also a driver in practice as was shown in section 5.2. This means that the willingness to participate of citizens is higher if Waternet would guarantee these citizens a minimum financial return, and would compensate the difference if it was not met. However, as indicated in section 1.3.2 Waternet is unable to directly invest financial means in this project. Because of this, this driver *cannot be used by Waternet* in their citizen participation solar panel project to create more willingness to participate among citizens.

7.2.14. Driver 28: Gender

The last driver in practice, *(female) gender*, means that women have a higher willingness to participate than men. This driver is also not used in Waternet's project as it is currently planned. Furthermore, it will be difficult (if not impossible) for Waternet to focus mainly on one gender. In contrast to income, education and age, men and women live equally divided among neighbourhoods and often in the same house. It can therefore be concluded that this driver *cannot be used by Waternet* in their citizen participation solar panel project by focussing on females.

7.3. Barriers in practice and Waternet's citizen participation solar panel project

As was shown in chapter 6, five of the potential barriers are barriers in practice. These barriers influence the willingness of citizens to participate in local solar panel projects in a negative way. A number of these barriers can (partly) be tackled by Waternet in their citizen participation solar panel project, while some barriers in practice cannot be tackled. In table 7.2 it is shown which barriers in practice can be tackled by Waternet, which can partly be tackled and which cannot be tackled. Below they are discussed in more detail.

Number	Barrier	Remarks	Is tackled by Waternet	Can be tackled by Waternet	Can partly be tackled by Waternet	Cannot be tackled by Waternet
ii	Long payback times, which may be a negative influence because of lack of strategic financial resilience					X
xi	Lower education level				X	
xii	Age	Age is a barrier for those of 29 years and younger and even more for those of 70 years and older			X	
xiii	Lack of access to information			X		
xv	Low interest of citizens in energy issues					X

Table 7.2: The barriers in practice and whether they are tackled, can be tackled, can partly be tackled or cannot be tackled in Waternet's citizen participation solar panel project.

7.3.1. Barrier ii: Long payback times, which may be a negative influence because of lack of strategic financial resilience

Barrier ii, *long payback times, which may be a negative influence because of lack of strategic financial resilience*, means that if long payback times exist (which may negatively influence financial resilience) the willingness to participate of citizens is smaller. In the current design of Waternet's citizen participation project this barrier is not tackled. The respondents indicated that the current payback time (13 years) was too long. As indicated by Watson et al. (2006) the payback time should be below 10 years and preferably 5 years (see section 2.2.2). The fact that the tax-reduction regulation of the Energy Agreement is only guaranteed for ten years by the government also reduces the strategic financial resilience (see also section 1.3.2).

Waternet's possibilities to influence the payback time are limited. As indicated in section 1.3 the citizen participation project's financial viability is dependent on the tax-regulations stated in the Energy Agreement. In order to reduce the payback time the tax-reduction should be larger (something which Waternet cannot influence). Investments by Waternet to reduce the payback time are also impossible, because they are not allowed by the Energy Agreement (see section 1.3.2). This means *Waternet cannot tackle this barrier*.

7.3.2. Barrier xi: Lower education level

Barrier xi, *a lower education level*, means that citizens with a lower education level have a lower willingness to participate. This barrier cannot directly be tackled by Waternet, as they cannot change the education level of citizens. They can tackle it indirectly, in a similar way as they can use the driver formed by a higher education level (see section 7.2.5), by focussing on an area with a relatively low number of citizens with a low education level. It can therefore be concluded that *Waternet can partly¹⁶³ tackle this barrier* in their citizen participation solar panel project.

¹⁶³ Partly, because there are always citizens with a lower education level living in areas in which most have a higher education level.

7.3.3. Barrier xii: Age

It was found that the chance of citizens of 29 years and younger and 70 years and older to participate was lower than average. This means they have a lower willingness to participate than average. Similar to the driver that is formed by age (see section 7.2.6) Waternet currently does not tackle this barrier in their citizen participation project as it is planned. However, *Waternet can partly¹⁶⁴ tackle this barrier* by focussing on neighbourhoods in which a relatively small group of citizens lives that is either 29 years or younger or older than 69 years.

7.3.4. Barrier xiii: Lack of access to information

Barrier xiii, *a lack of access to information*, means that citizens who do not have the information about the solar panel project available (because they have no access to it) have a lower willingness to participate in local solar panel projects. As Waternet currently has not decided yet what means they will use (see section 1.3.2), it is also unclear how they will communicate all information to the citizens. However, Waternet can do so if they want to, for example via a website. This means that *Waternet can tackle this barrier*.

7.3.5. Barrier xv: Low interest of citizens in energy issues

The last barrier in practice, *a low interest of citizens in energy issues*, is a characteristic of citizens. Citizens with a low interest in energy issues have a lower willingness to participate in Waternet's project. In contrast to barriers xi and xii (see sections 7.3.2 and 7.3.3) Waternet cannot tackle this barrier. There are always citizens that are simply not interested in energy issues and therefore have a low willingness to participate. Waternet cannot increase their interest in energy issues, and these citizens live in all areas (thereby making it impossible to focus on certain neighbourhoods). Furthermore, they cannot be identified from the outside. Because Waternet cannot change the interest in energy issues of these citizens and also cannot avoid these citizens *Waternet cannot tackle this barrier*.

7.4. Concluding remarks

After analysing both the drivers and barriers in practice in the context of Waternet's project it is possible to answer sub-question 5. As was shown in the analysis in section 7.2 and 7.3 Waternet currently only uses 2 of the 14 drivers in practice and tackles none of the barriers in practice in their project. However, if they want to they could at least partially use/tackle 13 other drivers and barriers in practice. This would require Waternet to further develop the citizen participation project and implement these drivers and barriers in their plans¹⁶⁵. Only four drivers/barriers in practice cannot be used/tackled by Waternet in their citizen participation solar panel project.

¹⁶⁴ Partly, because although some areas will have a relatively high percentage of citizens in a certain age range there always live citizens of other ages in these areas.

¹⁶⁵ It should be noted that although these drivers and barriers are not incorporated in Waternet's project (yet), this is not necessarily because Waternet does not want to incorporate them. Rather, the project has not yet reached the stage in which they are discussed and incorporated.

8. Discussion

8.1. Introduction

This research has focussed on citizens' willingness to participate, specifically in the case study of Waternet's solar panel project. As shown in chapters 5 and 6, a large number of potential drivers and barriers were found to be a driver or barrier in practice, which is in agreement with the scientific literature (see chapter 2). However, not all potential drivers and barriers identified in scientific literature were found to be a driver or barrier in practice. It is likely that this is at least partially the result of practical limitations that influenced this research and a number of key points on which this research differed from the studies used to conduct the scientific literature research. These, together with the possibilities to generalize this research, are discussed in this chapter. Sub-question 6 is therefore answered:

What are the limitations of this research and to what degree do they influence the possibilities to generalize the results of the case study?

Firstly, in section 8.2 the practical limitations of this research are discussed. After this, in section 8.3 the findings of this thesis are compared to the studies that formed the basis of the scientific literature research, and it is discussed on what key points these other studies differ from this research and how this may have influenced the differences in the results. In section 8.4 the findings of this study are compared to new research that has become available after the scientific literature research was conducted for this research. After this, in section 8.5 it is discussed in how far it is possible to generalize the findings made in this research beyond the case of Waternet's citizen participation solar panel project. In section 8.6 the concluding remarks of this chapter are presented.

8.2. Practical limitations that influenced this research

A number of practical limitations can be distinguished that may have influenced this research. A first limitation of the research was that a fully random survey sample cannot be guaranteed. This may have resulted in two forms of bias. Firstly, a bias may be present towards citizens that are home more often. Secondly, a bias may be present because citizens with a low willingness to participate in Waternet's solar panel project may be less likely to fill out the survey (see also section 4.4.2). Although both factors present a limitation, they have been reduced as much as possible. The bias towards citizens that were home more often was reduced as much as possible by conducting parts of the survey during weekends and visiting houses twice if possible (and needed) (see section 4.2). The bias that reduced the response of citizens with a low willingness to participate was reduced as much as possible by indicating clearly the survey did not obligate the respondent to anything. Furthermore, it was indicated to the citizens that both those that were interested and those that were not interested in the project were valuable respondents for the survey and the research.

Furthermore, two survey areas were chosen non-randomly. Although this creates a limitation for this research (as bias may also be present because of this choice) this limitation was also reduced as much as possible. This was done by choosing two different areas, one urban and one rural.

Another limitation of this study is that it was conducted ex-ante. Because of this, the results are based on the importance of drivers and barriers as reported by the respondents. It is not possible for the author of this thesis to indicate if and in how far this self-reported importance differs from the importance in reality. It is for example possible that although citizens indicate they do not invest in solar panels in order to show them off to neighbours (i.e. as a green energy symbol (driver 4)) they

may (unconsciously) do so in reality. The same goes for the influence of information meetings, debates and consultation (driver 9). Although based on the response of the survey this is not a driver in practice, it is possible the respondents underestimated the value this has for them.

Finally, global politics may have influenced the survey. At the time the survey was conducted a conflict took place between Russia and Ukraine. This resulted in an increased focus on the European dependency on Russian gas for energy in the Dutch news (see for example NRC (2014) and De Volkskrant (2014)). This may have resulted in a more positive response towards the solar panel project of Waternet (as these solar panels are placed in the Netherlands) than would have happened if this conflict would not have taken place at the same time as the survey was conducted. It cannot be said whether this increased positivity (if it exists) will remain over time or not.

The discussion above shows that practical limitations that may have influenced this research exist. However, the discussion also shows that their influence is relatively small, as multiple measures were taken to reduce their impact. It can therefore be assumed that the validity and usefulness of this research for Waternet, other organisations that would like to develop local citizen participation solar panel projects and other researchers is not negatively influenced by the practical limitations.

8.3. Key differences between this research and other studies

Generally speaking, it is likely that the fact that this project focussed on Waternet's project as a case study is (at least partially) a reason for the fact that the findings of this research differ from the findings of other researchers. This focus on Waternet's citizen participation solar panel project resulted in a number of key differences between this research and the studies by other researchers that were used in chapter 2. These key differences are discussed below. For every key difference an example is given of a driver or barrier that has possibly been influenced. It should be taken into account this is a possibility and it cannot be stated with certainty this key difference is indeed the reason for the different findings. Furthermore, differences in the findings of this research and other studies may have been the result of a combination of different key differences.

A first influence of the fact that this research focussed on Waternet's citizen participation solar panel project can be found in the fact that some potential drivers and barriers were operationalized in such a way that they focussed on the project of Waternet. An example is barrier xiv, a low local awareness of the organisation. Waternet was used as the organisation to analyse whether this was a barrier in practice, which was found not to be the case. However, in other projects (with another organisation) low local awareness of the organisation may be a problem because the organisation is less well known.

Secondly, Waternet's project is implemented in the Netherlands. This is in contrast with other studies that were used as a basis for the scientific literature research of this thesis. These were often conducted in other countries than the Netherlands, such as the United States of America (e.g. Hoffman and High-Pippert (2010) and Kwan (2012)), the United Kingdom (e.g. Caird et al. (2008) and Faiers and Neame (2006)) and Sweden (e.g. Palm and Tengvard (2011)). Only the studies of Boon (2012) and Jager (2006) were also conducted in the Netherlands. It is likely that differences exist between these other countries and the Netherlands which may have resulted in different results, such as differences in regulations or in the (intrinsic) value that citizens give to the environment. An example is barrier viii, finding a suitable location. It was found in this research this was not a barrier in practice, although Caird et al. (2008) (who conducted their study in the United Kingdom) indicated it was a barrier. It is possible that finding a suitable location is more difficult in the United Kingdom than in the Netherlands, thereby explaining the difference.

Thirdly, Waternet's project concerns solar panels. As discussed in section 2.1, the scientific literature research of willingness to join and willingness to sustain participation focussed on green energy projects in general. Some of the literature used to create an overview of potential drivers and barriers in the scientific literature research (chapter 2) therefore (partly) focussed on other methods of green energy production, such as wind turbines. Because the drivers and barriers that influence citizens' willingness to participate in projects which use other green energy production methods may differ from those that influence solar panel projects this may be an explanation for the differences between the findings of this study and some studies used as a basis for the scientific literature research. An example of such a difference is driver 11, (fear of) negative reactions of neighbours towards a renewable energy installation on citizens' own property. This driver was identified in a study of Palm and Tengvard (2011) who (partly) focussed their study on wind turbines, which most likely results more often in negative reactions from neighbours than solar panels. This may explain why this was not identified as a driver in practice in this study while Palm and Tengvard (2011) did identify its influence.

A fourth influence is similar to the third discussed above. Next to a focus on solar panel projects, rather than green energy projects in general, this study focussed on business initiated local solar panel projects. This can be seen as a top-down type of project. As discussed in section 1.7.1 the literature used for the scientific literature review focussed on both top-down and bottom-up projects. Reason to do so was that they showed great overlaps, as was also indicated by Hoffman and High-Pippert (2013). However, there are also differences. This may have resulted in potential drivers and barriers identified in scientific literature which were not a driver or barrier in practice in this project, because the fact the project is top-down rather than bottom-up influenced this. An example is driver 12, a fair distribution of potential benefits between personal and societal benefits, which was among others identified by Boon (2012). Boon (2012) focussed (among others) on bottom-up initiatives. In bottom-up projects a fair distribution between personal and societal benefits may be more important, as the project is started by society. This is not the case in Waternet's citizen participation project, thereby possibly explaining why this was not found to be a driver in practice.

Fifthly, some studies were conducted a number of years before this study was conducted. For example, the study of Leaney et al. (2001) was conducted 13 years before this study. In those 13 years a lot has changed in the field of solar panels. This may have led to a number of factors that were found to be a driver or barrier back in 2001, but are no longer a driver or barrier at this moment (and therefore not a driver or barrier in practice). An example of this is barrier v, a lack of knowledge concerning the technologies, which was among others found by Leaney et al. (2001) to be a barrier. In contrast to the findings of Leaney et al. (2001) the survey conducted for this thesis showed it was not a barrier in practice. It is likely that in the last 13 years most citizens have learned more about solar panels (which are now far more main stream) which has led to the fact that a lack of knowledge is no longer a barrier in practice.

Finally, this project focussed on the citizens. Some other studies focussed on the organisations and/or cooperatives behind the projects, thereby researching why citizens participate (drivers) or not (barriers) based on what these organisations/cooperatives thought, rather than what the citizens thought themselves. An example can be found in barrier xvi, unwillingness to be committed to an organisation. Boon (2012) found this to be a barrier, but the survey conducted for this thesis showed it was not a barrier in practice. However, Boon (2012) identified this to be a barrier based on what

the overarching organisations/cooperatives indicated, rather than what the citizens themselves thought, thereby possibly explaining (a part) of the difference in this finding¹⁶⁶.

8.4. New studies in the field of citizen participation in local green energy projects

The scientific literature research conducted for this research (see chapter 2) was conducted at the end of 2013 and in early 2014. Since then the results of two important studies in this field have become available. Although it was not possible to incorporate these in the empirical part of this research the findings made in these studies are discussed here and compared to the findings of this research.

Firstly, Yildiz (2014) has conducted a research into local green energy citizen participation projects in Germany. He found a number of drivers and barriers that may influence the willingness of citizens to participate in such projects. When reviewing these drivers and barriers it becomes clear they largely overlap with the findings made in this research. Firstly, Yildiz (2014) found that financial barriers are often not a large problem in this type of projects, a finding also made in this research (see section 6.2.1). Furthermore, Yildiz (2014) found that cooperatives in which citizens can influence the decision-making process are a driver for willingness to participate. This was also found in this research¹⁶⁷ (see section 5.2.7). Thirdly, he also found that a limited financial liability for citizens was a driver, which is in line with the fact that a driver in practice is formed by a financial guarantee (see section 5.2.12). Finally, he found that the fact that “cooperative members have to undertake material and immaterial efforts to influence decision-making” (Yildiz, 2014, p. 681) was a barrier. This barrier was not analysed in this thesis because it was not identified in the scientific literature research.

The second study that has become available after the scientific literature research for this research was completed focussed specifically on the Dutch situation and the possibilities for local green energy citizen participation projects created by the new Energy Agreement. The study was conducted by the Netherlands Environmental Assessment Agency¹⁶⁸ (2014). This study was highly critical of the possibilities for local green energy projects based on the postal code circle regulation offered by the new Energy Agreement. Financial resilience is for example difficult to guarantee, as the tax-reduction regulation is only guaranteed for ten years, while payback times are often much longer (as is also the case in Waternet’s citizen participation solar panel project (see section 1.3)). Furthermore, new and expensive connections to the grid are required, as existing connections may not be used. This increases the costs and payback time, thereby reducing the financial viability and resilience¹⁶⁹. This critical study has shown that making a financially viable and financially resilient project is difficult and (almost) impossible to guarantee. This may influence the possibilities Waternet has as well as the willingness of citizens to participate.

8.5. Generalizing the results of this research

Although this research focussed on the citizen participation solar panel project of Waternet, this research can be generalized towards other citizen participation solar panel projects because of the following two reasons.

¹⁶⁶ Part of the difference may also be explained by the fact that Boon’s (2012) study did not focus on Waternet, while this barrier was operationalized specifically for Waternet’s project in the survey. The influence this may have had is also discussed above.

¹⁶⁷ The reason why this is a driver differs between Yildiz (2014) study and this thesis. In Yildiz (2014) study it was found influence in the decision-making process led to better financial options, which is not the case in Waternet’s project.

¹⁶⁸ Planbureau voor de Leefomgeving in Dutch.

¹⁶⁹ The costs of a new connection to the grid are not incorporated in the calculations concerning the investments costs and financial return made for this research (see section 1.3 and the appendix, section 2). It is therefore likely that the costs and payback time are higher than discussed in this thesis because a new connection to the grid is required.

Firstly, a large number of the drivers and barriers that have been researched in this thesis have been researched in a general sense. Although they have been researched in the case of Waternet's citizen participation solar panel project (and the results can therefore of course be used for this project) they do not refer to Waternet specifically, making it possible to generalize the results towards other studies and projects.

Secondly, although some limitations influenced the survey and sample both validity and reliability were made as high as possible via different methods (see section 4.2). Furthermore, the limitations that influenced the survey and sample have been reduced as much as possible (see sections 4.2 and 8.2), the sample was representative for the population for the division in gender as was shown by a Chi² goodness-of-fit-test and there are no reasons to expect the sample was not representative for the other variables measured, besides age (see section 4.4). Because of this it can be expected that the results of this survey can be generalized towards other projects and studies.

Thirdly, many findings of this research were also found by other researchers. Of the 15 drivers found by other researchers (see section 2.5) 5 were also found in this study. Furthermore, of the 19 barriers found by other researchers (see also section 2.5) 5 were found in this study as well. Finally, the drivers and barriers found by Yildiz (2014) around the same time as this research was conducted were also found in this research¹⁷⁰.

8.6. Concluding remarks

Based on the discussion above it is possible to answer sub-question 6. A number of limitations which may have influenced this research were identified. These can generally be classified in practical limitations and aspects in which this research differed from other studies. As shown in section 8.2 although practical limitations may have influenced this research, measures were taken to reduce their impact. It is therefore expected their impact is small. As discussed in section 8.3 there are a number of key differences between this research and other research projects. However, as discussed in section 8.5 generalizing the results is most likely still possible, as a large number of drivers and barriers was measured in a more general sense and the limitations that influenced the survey were reduced as much as possible.

Because measures were taken to reduce the influence of the aspects that might have influenced the representativity of this research (both practical limitations and differences between this study and others), there are no reasons to expect the sample is not representative of the population, besides on the variable age (see sections 8.2, 8.3 and 8.5). It can therefore be concluded that generalizing the results of this research is possible. Of course, when reviewing the results of this study and generalizing them towards other local citizen participation solar panel projects it is important to keep the key points on which this research may differ from that project in mind (see section 8.3). Furthermore, the practical limitations that influenced this research should also be kept in mind (see section 8.2).

¹⁷⁰ An exception is the barrier found by Yildiz (2014) concerning the fact that "cooperative members have to undertake material and immaterial efforts to influence decision-making". This barrier was not analysed in this thesis (see section 7.3.2).

9. Conclusion

9.1. Introduction

Aim of this research is to create an overview of the drivers and barriers that influence citizens' willingness to participate in business initiated local solar panel projects in practice, investigate their influence in the case of Waternet's project and present recommendations to increase citizens' willingness to participate in Waternet's project based on this (see section 1.5.1). As discussed in section 1.1 and 1.5.1, this research aim is a combination of both the scientific and the societal focus of this research. The central research question is the following:

“Under which conditions can citizens be expected to be willing to participate in business initiated local solar panel projects, such as the project of Waternet?”

This central research question is answered based on the answers to the sub-questions presented in the previous chapters. A number of research methods have been used to answer the sub-questions: a scientific literature research, desk research, talks, meetings, interviews and a survey.

In section 9.2 the central research question is answered. In section 9.3 recommendations are presented for Waternet based on the results of this research. Lastly, in section 9.4 possibilities for future research created by this research are discussed.

9.2. Citizens' willingness to participate

To answer the central research question a division is made in this section. As has become clear from the research aim, this thesis has both a scientific and a societal focus. First, in section 9.2.1 the scientific focus is discussed. In this section it is discussed under which conditions citizens can be expected to be willing to participate in business initiated local solar panel projects. After this, in section 9.2.2, the societal focus is discussed. In this section the link to Waternet's citizen participation solar panel project is made by discussing how these conditions influence the willingness to participate of citizens in Waternet's project. Together these two sections present the answer to the central research question.

9.2.1. Drivers, barriers and citizens' willingness to participate

The success of citizen participation in local solar panel projects is largely dependent on the willingness to participate of citizens. This willingness to participate is influenced by both drivers and barriers. Drivers influence citizens' willingness to participate in a positive way, while barriers influence it negatively. It was found in this research that a large number of potential drivers and barriers exists, which may influence the willingness of citizens to participate in local solar panel projects. In total, 28 potential drivers and 21 potential barriers for citizens' willingness to participate in local solar panel projects were identified. This identification was based on previous scientific research, Waternet's pilot project Zon op Waternet and reasoning of the author.

However, the importance of drivers and barriers was often incomparable in previous research, which presented a knowledge gap in scientific research. Research conducted for this thesis with the help of a survey showed that only a number of the potential drivers and barriers were indeed a driver or barrier in practice. More precisely, only 14 of the 28 potential drivers and 5 of the 21 potential barriers are a driver or barrier in practice and really influence the willingness of citizens to participate in business initiated local solar panel projects. By researching all potential drivers and barriers in one case study this research has helped to fill the scientific knowledge gap. Although this research

focussed on Waternet's citizen participation solar panel project, it can be assumed that the same drivers and barriers in practice are of influence in other business initiated local solar panel projects as well (see chapter 8).

Below an overview is presented of the characteristics of an 'ideal project', in which the willingness to participate of citizens would be as high as possible¹⁷¹. This overview is ordered in the same three classes the drivers and barriers have been divided in in section 3.7 (aspects of the projects, characteristics of the citizens and information spreading).

Based on the drivers and barriers in practice, it can be concluded that the ideal business initiated local solar panel project with citizen participation would include the following aspects (in no particular order) in order to create a willingness to participate among citizens that is as large as possible:

- Allow participants to reduce the amount of grey energy they use via their own connection to the grid by using green energy produced via this project instead.
- Give the (potential) participants the option to see all information about the project before they decide to participate or not.
- Use a democratic decision making process in which the participating citizens also play a role in the governance of the project (step six or higher on Arnstein's (1969) citizen participation ladder).
- Reduce the (energy) bills of participating citizens via this project or allow them to make money via the project (or a combination of both).
- Have short payback times, preferably below five years.
- Guarantee the participants a minimum profit.
- Clearly show the positive effect of the project on the environment by showing how it is committed to the environment¹⁷² (i.e. how the project helps reduce environmental problems).

Furthermore, based on the drivers and barriers in practice, it can be concluded that the potential participants would ideally be informed about the project via a combination of the following methods (presented in no particular order):

- A website with information
- Flyer(s) with information
- The option to ask questions via the telephone, a website or by email
- Via a letter(s)
- Via email(s)

Finally, based on the drivers and barriers in practice, it can be concluded that the ideal potential participant (i.e. the potential participant with the highest willingness to participate) would have the following characteristics (in no particular order):

- 40-59 years old¹⁷³
- A higher education level¹⁷⁴

¹⁷¹ 'Ideal project' refers to a project in which the willingness to participate of citizens is as high as possible. There are of course many other aspects of an ideal project which are not discussed here.

¹⁷² Although 'ethical and environmental commitment that leads to concerns for the environment' is ordered in the 'characteristics of the citizens' class in section 3.7 it is placed in the 'aspects of the project' class here because the action an organisation can take to use this driver is an aspect that should be incorporated in the project.

¹⁷³ This is a combination of driver 7 and barrier xii.

- A higher income
- An (high) interest in energy issues
- Female

In order to answer the central research question of this thesis the focus is shifted towards Waternet's citizen participation solar panel project in the following section.

9.2.2. Citizen participation in Waternet's solar panel project

The survey conducted among citizens of Gein and Vogelenzang has shown that a large group of potential participants exists for Waternet's citizen participation solar panel project. Of the respondents 19.3 per cent indicated they had a high or even a very high chance (i.e. willingness) to participate in Waternet's project. But although these citizens indicated they have a high or a very high chance to participate, they will only make the decision to really participate if their willingness to participate is high enough. It is therefore important for Waternet to create such a high willingness to participate among the potential participants. The ability of Waternet to create a high willingness to participate is dependent on the drivers and barriers in practice, and how Waternet uses and tackles these.

It is unlikely that citizens will have a high willingness to participate in Waternet's citizen participation solar panel project as it is currently planned. Only 2 of the 14 drivers in practice are used¹⁷⁵ and none of the 5 barriers in practice are tackled in Waternet's project as it is currently planned. This means that Waternet only minimally stimulates the willingness to participate of citizens via two drivers in practice, and does not tackle the barriers in practice for citizens' willingness to participate at all. It is therefore unlikely that a large group of citizens will participate, as most citizens will most likely have a low willingness to participate. However, Waternet does have the opportunity to change this, as the project is still in its development phase. In the following section a number of recommendations for Waternet are therefore discussed.

9.3. Recommendations

Although Waternet cannot expect to create a high willingness to participate among citizens and therefore have a large group of participants in their solar panel project as it is currently planned, this can be changed. At the moment Waternet's citizen participation solar panel project is still in development. This means Waternet can still make changes in the setup of the project. The research for this thesis has shown that although currently the project does not use or tackle most drivers and barriers in practice, it has a large potential to do so. More detailed, the following is recommended to Waternet in order to increase the willingness of citizens to participate in Waternet's solar panel project¹⁷⁶.

1. Spread information about the project towards the (potential) participants via a combination of the following methods:
 - a. A website
 - b. Email(s)
 - c. Flyer(s)
 - d. Letter(s)

¹⁷⁴ This is a combination of driver 6 and barrier xi.

¹⁷⁵ Driver 2 (reducing bills and making money) and driver 3 (ethical and environmental commitment that leads to concerns for the environment).

¹⁷⁶ It should be noted some drivers and barriers in practice cannot be used or tackled by Waternet (see chapter 7). Because Waternet cannot use or tackle them they are not part of these recommendations.

2. Present (potential) participants the option to ask questions via the telephone, a website or by email.
3. Use a democratic decision making process which the participating citizens can influence (a form of citizen participation on step six or higher of Arnstein's (1969) citizen participation ladder).
4. Use a website to show the participating citizens how much green energy their solar panels have created and how much grey energy therefore has been saved.
5. Allow the citizens to view all information about the project before they decide to participate or not.
6. Focus on areas with a relatively large group of citizens with a higher income, higher education level and/or with a relatively large group of citizens with an age of 40 through 69 years.
7. Focus on areas with a relatively small group of citizens of 29 years or younger and 70 years or older, as well as a relatively small group of citizens with a lower education level.

Waternet can at least partially use ten more drivers in practice and tackle four barriers in practice if it takes these recommendations into account and further develops the project based on them. If Waternet can do so it is likely that they can expect a relatively high willingness to participate among citizens, as they use and tackle 15 out of the 19 drivers and barriers in practice at least partially.

9.4. Suggestions for future research

Based on the results of this research, as well as the limitations that influenced it, new possibilities for future research can be identified. Some of these possibilities are suggestions for Waternet, some for more fundamental research and some are suggestions for both.

Firstly, a possibility is presented by this research to conduct a similar research in an ex-post situation. This research has been conducted as an ex-ante research, because the citizen participation solar panel project of Waternet is still in development. It would be interesting and useful to conduct an ex-post version of this research, either of this project or a similar project, as it would be possible to research the influence of different drivers and barriers directly, rather than indirectly by asking the respondents to indicate the importance of the drivers and barriers for them.

Secondly, Waternet currently develops more projects with a focus on sustainability that require citizen participation and therefore willingness to participate of citizens. An example of such a project that is currently developed concerns a project in which heat is recovered from waste water in citizens' showers (Mol, 2014b; Van Odiijk, 2012). As citizens must be willing to participate to make this project a success, research into this would be helpful¹⁷⁷. This thesis could be used as a basis for a research project into the willingness to participate of citizens in the installation of a drain water heat recovery system.

Thirdly, it would be interesting in future research to go more in-depth concerning the drivers and barriers in practice. Because this research focussed on a large number of drivers and barriers, it was not possible to research every driver or barrier in great detail. However, as a distinction has now

¹⁷⁷ Although other options also exist, for example via a housing cooperative.

been made between the drivers and barriers in practice and those that are not drivers and barriers in practice, future research can solely focus on those that are drivers and barriers in practice and therefore go more in-depth.

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Appendix 1. Financial regulations which influence the citizen participation project

In section 1.3 the main characteristics of the financial regulations and the main results of the citizen participation solar panel project of Waternet are discussed. Here, they are discussed in more detail. Figure Appendix 1.1 presents an overview of the interactions between the different parties.

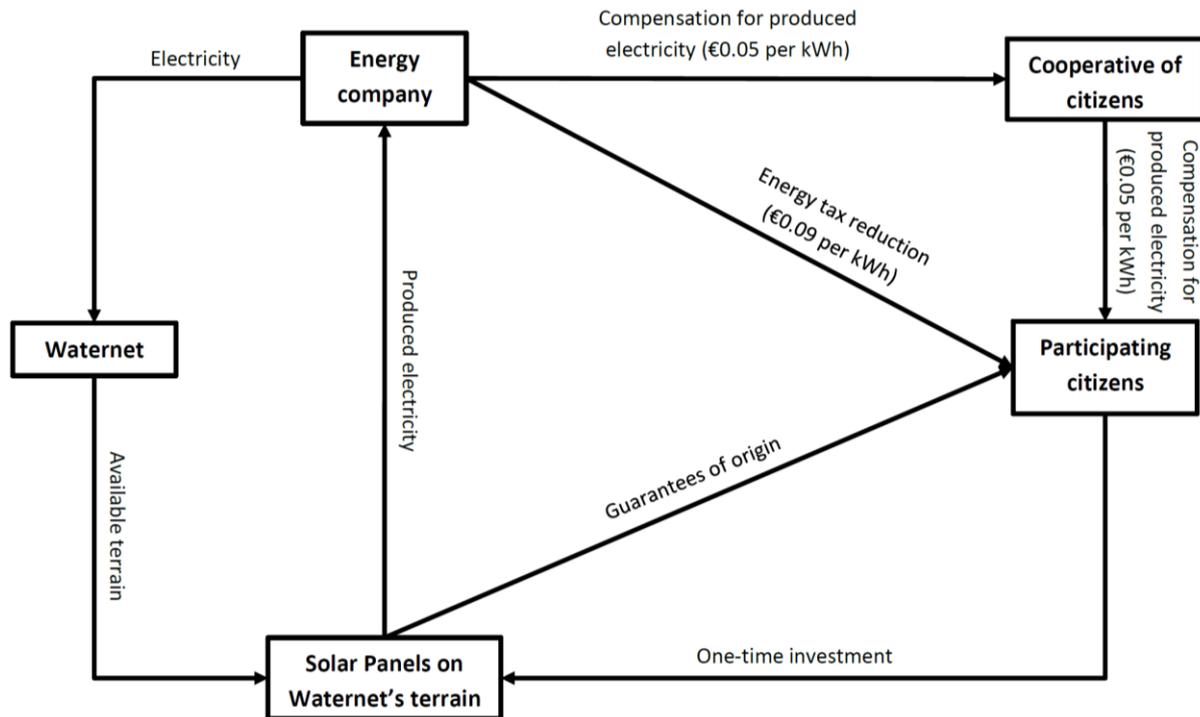


Figure Appendix 1.1: Interactions between the different parties in the construction in which Waternet involves citizens in a solar panel project.

The regulations work as following. Since 1 January 2014 citizens may deduct €0.075 of energy taxes per kWh they use¹⁷⁸ (Hier Opgewekt, 2013; SER, 2013). To do so, citizens must produce renewable energy in a cooperative with a green energy installation that is financed by the members (citizens) of the cooperative and placed in the postal code circle of the house in which the citizen lives¹⁷⁹ (Hier Opgewekt, 2013; SER, 2013; Van der Meer, 2013d). The €0.075 deduction per kWh does not include VAT yet (21 per cent (EnergieLeveranciers, n.d.)), which does not have to be paid over these €0.075. This means the total amount that can be deducted from the energy bill of the citizens per kWh is about €0.09 (Hier Opgewekt, 2013). The citizen may only deduct these €0.09 per kWh from his/her electricity bill for the amount of kWh his/her part of the installation produced. For example: if a citizen finances two solar panels via the cooperative and these solar panels produce 500 kWh in a year, he/she may deduct €45.00¹⁸⁰ from the taxes on his/her energy bill that year. A citizen cannot deduct taxes for more kWh than he/she uses. For example: if the part of the installation

¹⁷⁸ The new regulation will at least be in place for four years (i.e. until 31 December 2017). After those four years the regulation will be evaluated. The tax may at least be deducted for every project for a period of ten years, even if the tax regulation is changed because of the evaluation (Hier Opgewekt, 2013).

¹⁷⁹ But not on the property of the citizen (if the installation is connected to the grid via the citizens' connection (i.e. placed on the citizens' property) he/she does not have to pay any taxes over the produced energy he/she uses (a process called balancing (salderen in Dutch)) (Nuon, n.d.b).

¹⁸⁰ 500 * €0.09

financed by a citizen produces 4,000 kWh per year, but the citizen only uses 3,500 kWh per year, he/she can only deduct €315.00¹⁸¹ and not €360.00¹⁸² per year¹⁸³.

Next to a tax benefit, the citizens also earn money by selling the produced electricity. The electricity that is produced by the installation is sold to an energy company (e.g. Nuon) by the cooperative of citizens. The profits made by selling the produced electricity to an energy company (expected to be around €0.05 per kWh¹⁸⁴ (Van der Meer, 2013d)) are divided among the participating citizens proportionally to their investment¹⁸⁵.

Citizens will earn about €0.14 (€0.09 tax reduction and €0.05 by selling the electricity) per kWh that is produced by the installation they financed¹⁸⁶ (up to 10,000 kWh per year¹⁸⁷). Normally, citizens pay around €0.23 per kWh (Hier Opgewekt, 2013). This means this regulation can lead to a price reduction of 61 per cent¹⁸⁸ for citizens per kWh produced. Furthermore, by producing green energy, the producers create 'guarantees of origin'. These guarantees are the property of the citizens and show that the energy that is created is green. The guarantees can be sold, but this means the energy produced is no longer classified as green (Hier Opgewekt, 2013). Waternet still buys electricity from the electricity company (e.g. Nuon), because if Waternet would buy electricity directly from the citizens (or cooperative) the tax cut is no longer applicable (Hier Opgewekt, 2013; Van der Meer, 2013d).

¹⁸¹ 3,500 * €0.09

¹⁸² 4,000 * €0.09

¹⁸³ Another requirement is that a citizen may not deduct energy taxes above a use of 10,000 kWh per year, even if the part of the installation he/she financed produces more than 10,000 kWh per year and he/she uses more than 10,000 kWh per year (Hier Opgewekt, 2013). However, as a Dutch household uses on average 3,500 kWh per year (Nuon, n.d.a), this is unlikely to be a problem for many citizens.

¹⁸⁴ The exact amount has to be agreed on by the cooperative and the energy company (Hier Opgewekt, 2013).

¹⁸⁵ If Waternet uses an external organisation to guide the project, as happened in the Zon op Waternet project, citizens that participate will have to pay a yearly membership fee for this organisation (including insurance and maintenance), thereby reducing the yearly compensation citizens receive.

¹⁸⁶ The €0.14 per kWh that Waternet can offer to citizens is a little higher than the €0.125 it could offer to its employees in the Zon op Waternet project (Intranet, n.d.b).

¹⁸⁷ Because the tax reduction of €0.075 (€0.09 including VAT) may only be applied over the amount of kWh a citizen uses up to 10,000 kWh per year this means that if the part of the installation financed by a citizen produces more kWh per year than he/she uses (or more than 10,000 kWh), he/she cannot deduct this extra amount of kWh from his/her taxes. The citizen will however still receive €0.05 from the energy company for every kWh produced by their installation above their yearly electricity use and/or above 10,000 kWh per year.

¹⁸⁸ Although it is called a reduction of 61 per cent, only the €0.09 is actually reduced from the energy bill. The €0.05 is paid to the citizen by the utility company, which does not have to be done via the energy bill (thereby not reducing the bill, but increasing the earnings of a citizen). Because in the end both have the same effect on the financial situation of a citizen, they are combined to 61 per cent.

Appendix 2. Calculations of the profits for the participating citizens

In section 1.3 the costs and profits for the citizens are briefly discussed. Here they are discussed in more detail. Financially speaking, the costs and profits for the participating citizens are expected to be the following¹⁸⁹.

It is assumed that the investment costs for citizens are the same as they were for the employees of Waternet (€400.00 per solar panel) (Intranet, 2013c) and the price citizens receive for the electricity that is produced with their installation is €0.14 per kWh (€0.09 tax reduction and €0.05 for the sold electricity) (see appendix section 1). The profit made by a citizen in this project is spread over 25 years, the number of years the solar panels are in operation. Every year the citizen receives a small return for his/her solar panel. Because the total return is spread over such a long time inflation has an influence on the return citizens receive from their solar panels on Waternet's roof. In the following sections two calculations are therefore made, one without and one with a correction for inflation.

In appendix section 2.1 calculations are made without correcting for inflation. These calculations show that after 25 years citizens will have received a total profit¹⁹⁰ of €901.88 per solar panel, partly paid out by the energy company and partly as tax reduction on their energy bill. In appendix section 2.2 the calculations have been made taking into account inflation (of 2.0 per cent per year (Van der Meer, 2013g)). These calculations show a lower profit of €709.77¹⁹¹ per solar panel. However, the purchasing power of this profit is the same as the purchasing power money has at the time of installation (assumed to be 2014)¹⁹².

Both calculations are based on a citizen who buys one solar panel of €400.00. For both calculations the following assumptions have been made. The efficiency of a solar panel at the start is assumed to be 225 kWh per year (based on Zon op Nederland, n.d.). It is assumed that the price of energy increases every year by 4.5 per cent. Furthermore, it is assumed that the cooperative of citizens can negotiate with the energy company that buys the electricity that the yearly increase of energy prices (4.5 per cent) is also incorporated in the price they receive per kWh (which therefore increases yearly by 4.5 per cent). Finally, it is assumed that the solar panels will become less efficient every year. Assumed is a degradation of 0.8 per cent per year in the amount of kWh produced¹⁹³. Finally, it is expected that the solar panels will be in operation for 25 years (starting in year 1 until and including year 25). All assumptions (except the 225 kWh produced per solar panel per year (in the first year)) are based on Van der Meer (2013g). It is important to note that the increase in energy prices only influences the price the energy company pays for the electricity, not the tax reduction citizens may apply. Furthermore, it is assumed that this tax reduction measure is not discontinued by the government in the 25 years after installation.

¹⁸⁹ It is important to note that these calculations are a rough estimate. The exact costs and benefits cannot be calculated yet, as they are dependent on many factors, among others the location (e.g. the price of making a connection to the grid), the price the utility company is willing to pay for the produced energy, the number of participating citizens (as this will bring down the fixed costs per participant such as the connection to the grid), the installer and the sun. The calculations are therefore made to give an impression of the costs and benefits for citizens.

¹⁹⁰ The investment costs of €400.00 have not been subtracted yet.

¹⁹¹ Again, the investment costs of €400.00 have not been subtracted yet.

¹⁹² Simply speaking this means that with the profit made in real euros (€901.88) citizens can buy the same amount of items and services as they can buy at the time of installation (assumed to be 2014) with €709.77.

¹⁹³ This degradation of 0.8 per cent is a linear function. Every year the same amount of kWh is lost. This amount is 0.8 per cent of the production in the first year (i.e. a linear reduction and not an exponential reduction) (as indicated by Van der Meer (2014c)). In this case every year 1.8 kWh production capacity (0.8 per cent of 225) is lost per solar panel.

2.1. Profit calculations without a correction for inflation

In table Appendix 2.1 an overview can be found of the profit a citizen makes when he/she buys one solar panel in the citizen participation project of Waternet. This calculation has not been adjusted for inflation. It therefore presents the real amount of euros citizens will receive in total, via a combination of money paid by the energy company for the produced electricity and a reduction in energy taxes.

Year	kWh produced	Price per kWh (in euro)	Tax reduction per kWh (in euro)	Profit of the sold electricity (in euro)	Tax reduction profit (in euro)	Total profit per year (in euro)	Cumulative profit (in euro)
1	225.0	0.050	0.090	11.25	20.25	31.50	31.50
2	223.2	0.052	0.090	11.66	20.09	31.75	63.25
3	221.4	0.055	0.090	12.09	19.93	32.01	95.26
4	219.6	0.057	0.090	12.53	19.76	32.29	127.56
5	217.8	0.060	0.090	12.99	19.60	32.59	160.15
6	216.0	0.062	0.090	13.46	19.44	32.90	193.05
7	214.2	0.065	0.090	13.95	19.28	33.23	226.27
8	212.4	0.068	0.090	14.45	19.12	33.57	259.84
9	210.6	0.071	0.090	14.97	18.95	33.93	293.77
10	208.8	0.074	0.090	15.51	18.79	34.31	328.08
11	207.0	0.078	0.090	16.07	18.63	34.70	362.78
12	205.2	0.081	0.090	16.65	18.47	35.12	397.90
13	203.4	0.085	0.090	17.25	18.31	35.55	433.45
14	201.6	0.089	0.090	17.86	18.14	36.01	469.46
15	199.8	0.093	0.090	18.50	17.98	36.48	505.94
16	198.0	0.097	0.090	19.16	17.82	36.98	542.92
17	196.2	0.101	0.090	19.84	17.66	37.50	580.42
18	194.4	0.106	0.090	20.54	17.50	38.04	618.46
19	192.6	0.110	0.090	21.27	17.33	38.60	657.06
20	190.8	0.115	0.090	22.02	17.17	39.19	696.25
21	189.0	0.121	0.090	22.79	17.01	39.80	736.05
22	187.2	0.126	0.090	23.59	16.85	40.44	776.48
23	185.4	0.132	0.090	24.41	16.69	41.10	817.58
24	183.6	0.138	0.090	25.26	16.52	41.79	859.37
25	181.8	0.144	0.090	26.14	16.36	42.50	901.88
Total profit (in euro)				444.23	457.65	901.88	

Table Appendix 2.1: Overview of the profit a citizen makes when he/she buys one solar panel in Waternet's project without a correction for inflation.

2.2. Profit calculations with a correction for inflation

Table Appendix 2.2 shows the profit a citizen makes when he/she buys one solar panel in Waternet's citizen participation solar panel project with a correction for inflation. The inflation rate is assumed to be 2.0 per cent per year (based on Van der Meer, 2013g). By doing so, all profits are comparable to the purchasing power of the year of installation (assumed to be 2014). This means that although citizens in total receive €901.88 (see table Appendix 2.1) this has the purchasing power of €709.77 in the year of installation.

For the calculations this means the following. As the energy prices are expected to increase yearly by 4.5 per cent, but 2.0 per cent of this is inflation, the real increase of the energy price (when compensated for inflation) is only 2.5 per cent. Secondly, although citizens will receive €0.09 tax reduction for every kWh produced, this reduction will become less valuable every year (a 2.0 per

cent reduction in value per year). By adjusting for inflation, all values in table Appendix 2.2 are expressed in the purchasing power of the moment of installation (assumed to be 2014).

Year	kWh produced	Price per kWh (in euro)	Tax reduction per kWh (in euro)	Profit of the sold electricity (in euro)	Tax reduction profit (in euro)	Total profit per year (in euro)	Cumulative profit (in euro)
1	225.0	0.050	0.090	11.25	20.25	31.50	31.50
2	223.2	0.051	0.088	11.44	19.69	31.13	62.63
3	221.4	0.053	0.086	11.63	19.14	30.77	93.39
4	219.6	0.054	0.085	11.82	18.60	30.43	123.82
5	217.8	0.055	0.083	12.02	18.08	30.10	153.92
6	216.0	0.057	0.081	12.22	17.57	29.79	183.71
7	214.2	0.058	0.080	12.42	17.08	29.50	213.21
8	212.4	0.059	0.078	12.62	16.60	29.22	242.43
9	210.6	0.061	0.077	12.83	16.13	28.96	271.38
10	208.8	0.062	0.075	13.04	15.67	28.71	300.09
11	207.0	0.064	0.074	13.25	15.22	28.47	328.56
12	205.2	0.066	0.072	13.46	14.79	28.25	356.81
13	203.4	0.067	0.071	13.68	14.37	28.04	384.85
14	201.6	0.069	0.069	13.90	13.95	27.85	412.70
15	199.8	0.071	0.068	14.12	13.55	27.67	440.37
16	198.0	0.072	0.066	14.34	13.16	27.50	467.87
17	196.2	0.074	0.065	14.56	12.78	27.34	495.21
18	194.4	0.076	0.064	14.79	12.41	27.20	522.41
19	192.6	0.078	0.063	15.02	12.05	27.07	549.48
20	190.8	0.080	0.061	15.25	11.70	26.95	576.43
21	189.0	0.082	0.060	15.48	11.36	26.84	603.27
22	187.2	0.084	0.059	15.72	11.02	26.74	630.01
23	185.4	0.086	0.058	15.96	10.70	26.66	656.67
24	183.6	0.088	0.057	16.20	10.38	26.58	683.25
25	181.8	0.090	0.055	16.44	10.08	26.52	709.77
Total profit (in euro)				343.46	366.31	709.77	

Table Appendix 2.2: Overview of the profit a citizen makes when he/she buys one solar panel in Waternet's project with a correction for inflation of 2.0 per cent per year.

Appendix 3. Interviews

The following questions were used to guide the interviews¹⁹⁴. The list of questions in appendix section 3.1, used for the interviews with Ingrid Heemskerk, Jos van der Meer and Enna Klaversma, were not all used in all interviews. As only Van der Meer was involved in the citizen participation project, questions related to the citizen participation project were not used in the interviews with Heemskerk and Klaversma. The list of questions in appendix section 3.2 was used for the interviews with Stefan Mol and Erik Kessler.

Based on previous interviews extra questions were added to the lists of questions used for the interviews (the lists below show the final lists after adding all questions). Furthermore, all lists present the general structure that was used to guide the interviews. The questions were not necessarily asked as formulated, nor in this order. The interviews were relatively open, and the author allowed the interviewees to speak freely while asking more in-depth questions based on their statements.

3.1. Interviews with Ingrid Heemskerk, Jos van der Meer and Enna Klaversma

- What was your exact task in the Zon op Waternet project?
- In how far are you involved in the expansion of this project towards the citizens of Amsterdam?
- What do you think are the reasons of Waternet to create Zon op Waternet? In a number of documents I found the following reasons, but I am curious what you think is missing.
 - o A step towards CO₂ neutrality for Waternet in 2020
 - o Present employees without (suitable) roofs the opportunity to invest in solar panels
 - o Create more sustainable awareness among employees
 - o Improve Waternet's image
 - o Create knowledge about PV projects for future PV projects (e.g. one with citizens)
 - o Strengthen/create horizontal connections between employees (one of the six themes of Waternet for 2014)
 - o The innovativeness of the project (the first PV cooperative in the Netherlands consisting entirely of employees)
 - o Personal development of the project team
- What, in your opinion, is the most important reason to start this project?
- What are the reasons to start a similar (possibly bigger) project with citizens?
- What is the most important goal of the citizen participation project?
- What do you think happens with the project if the CO₂ reduction cannot be subtracted by Waternet?
- Waternet used a number of means and methods to invite employees in the project. I found the following. Are there any other means/methods used?
 - o The sustainability contest of Jong Waternet
 - o Posts on the intranet
 - o A lunch-meeting
 - o A poster to announce the lunch-meeting
 - o An article in Waterdruk and in Helder
 - o People to contact in case of questions

¹⁹⁴ The interviews were conducted in Dutch. These questions are therefore a translation of the originally Dutch questions.

- Personal contacts via the network of the project team
- Little information is available about what Waternet is willing/not willing to do to invite citizens in the project. Do you know what Waternet will do? If so, what? If not, what do you think Waternet will do, or could do?
- Who else do you think I should talk to?

3.2. Interviews with Stefan Mol & Erik Kessler

- What were the reasons why you decided to participate in this project (Zon op Waternet)?
- How did you hear about the project for the first time?
- Waternet used a number of means to invite employees in the project. What was the most important method used by Waternet to involve you in the project?
 - The sustainability contest of Jong Waternet
 - Posts on the intranet
 - A lunch-meeting
 - A poster to announce the lunch-meeting
 - An article in Waterdruk and in Helder
 - People to contact in case of questions
 - Personal contacts via the network of the project team
- What is your opinion about the information provided about the project? Too much, too little, or exactly right?
- What would you have liked to be different concerning the project? Both for the project itself as well as the organisation and the methods used to involve you in it?

Appendix 4. Questionnaire

4.1. Dutch



Universiteit Utrecht

Enquête nr. **Enquête: onderzoek naar de interesse van burgers in zonnepanelen op daken van Waternet**

Voor mijn afstudeerscriptie aan de Universiteit Utrecht doe ik onderzoek voor Waternet. Waternet is de organisatie die uw drinkwater produceert, uw afvalwater zuivert en het oppervlaktewater schoon en op peil houdt in uw omgeving. Waternet wil duurzamer worden en ontwikkelt daarom diverse projecten om minder vervuiling uit te stoten en meer groene energie op te wekken.

Waternet onderzoekt op dit moment de mogelijkheden voor een zonnepanelenproject. In dit project zou Waternet graag willen samenwerken met burgers zoals u. Waternet zou terrein beschikbaar stellen voor zonnepanelen van burgers. U zou dan de mogelijkheid krijgen om een zonnepaneel te kopen welke op een dak van Waternet wordt gelegd.

U krijgt voor de elektriciteit die door uw zonnepanelen op het terrein van Waternet wordt opgewekt een vergoeding. Als u mee wilt doen met dit project heeft u eenmalig kosten van €400 om een zonnepaneel aan te schaffen. Het project loopt 25 jaar. Elk jaar krijgt u een vergoeding voor de elektriciteit die uw zonnepaneel opwekt. In totaal verdient u uw inleg van €400 terug en daar bovenop nog ongeveer €500 winst. De exacte winst is uiteraard afhankelijk van de zon. Indien gewenst kunt u meerdere zonnepanelen kopen. Dat levert u ook meer winst op. Waternet zorgt voor installatie en onderhoud van de zonnepanelen. Het project werkt op buurtniveau. U en uw buurtgenoten worden uitgenodigd om mee te doen.

Waternet is benieuwd of u interesse heeft in dit project indien het uitgevoerd wordt. Ik doe onderzoek hiernaar voor mijn afstudeerscriptie. Ik zou het zeer waarderen als u de enquête invult. Dit duurt ongeveer 10 minuten.

Voor het invullen van de enquête wil ik u vragen de volgende instructies in acht te nemen:

- Graag elke vraag beantwoorden en het antwoord dat voor u van toepassing is aankruisen.
- Graag bij elke vraag slechts één antwoord geven, tenzij uitdrukkelijk anders staat aangegeven.
- Er zijn geen goede of foute antwoorden. Vult u alstublieft de enquête eerlijk in. Indien geen van de antwoorden exact voldoet kiest u dan het antwoord dat het dichtst bij uw keuze ligt.

Het gaat hier slechts om een enquête over uw interesse. Uw antwoorden verplichten u tot niets. Waternet heeft nog geen definitief besluit genomen over het wel of niet uitvoeren van dit project. Kosten en opbrengsten die besproken zijn in deze enquête zijn niet definitief.

Ingevulde enquêtes worden volledig anoniem verwerkt.

Hartelijk dank voor uw medewerking aan dit onderzoek.
Imre Perenboom

Stagiair bij Waternet & student Sustainable Development aan de Universiteit Utrecht

In het eerste deel van de enquête worden u enkele algemene vragen gesteld.

1. Wat is uw geslacht?

- Man
- Vrouw

2. Wat is uw leeftijd? jaar

3. Wat is de hoogste opleiding die u heeft afgemaakt?

- Geen
- Basisonderwijs/lagere school
- VMBO (LBO/VBO, MAVO/MULO)
- Middelbaar Beroeps Onderwijs (MEAO, MTS etc.)
- HAVO, VWO, HBS, Atheneum, Gymnasium
- Hogeschool, Universiteit of Hoger Beroeps Onderwijs (HTS, Kweekschool etc.)
- Anders, namelijk:.....

4. Wat zijn de vier cijfers van uw postcode?

In het tweede gedeelte van de enquête worden u enkele vragen over het zonnepanelenproject gesteld.

5. Hoe groot schat u de kans dat u (op basis van de informatie gegeven op de voorpagina van deze enquête) mee wilt doen met het zonnepanelenproject op het terrein van Waternet?

- Zeer groot
- Groot
- Gemiddeld
- Klein
- Zeer klein

6. Op dit moment heeft u uiteraard nog maar een klein deel van de informatie over dit project gekregen. Hoe lang denkt u nodig te hebben om tot een definitief besluit te komen om wel of niet mee te doen met dit zonnepanelenproject, nadat u alle informatie over dit project heeft gekregen?

- Minder dan een week
- Een week tot een maand
- Meer dan een maand maar minder dan twee maanden
- Meer dan twee maanden maar minder dan zes maanden
- Meer dan zes maanden

Deel drie van de enquête gaat over zonnepanelen en het milieu. Deze vragen gaan niet over het project beschreven op de voorkant, maar over zonnepanelen en het milieu in het algemeen.

7. Hoeveel interesse heeft u in energieproblemen, zoals klimaatverandering en het opraken van olie en gas in de toekomst?

- Zeer veel
- Veel
- Gemiddeld
- Weinig
- Zeer weinig

8. Hoe goed bent u naar uw mening op de hoogte van de voor- en nadelen van zonnepanelen?

- Zeer goed
- Goed
- Gemiddeld
- Slecht
- Zeer slecht

Geef bij de volgende stellingen aan in hoeverre u het er mee (on)eens bent, ook als u momenteel geen interesse in het kopen van zonnepanelen heeft (graag voor alle stellingen invullen).

	Zeer oneens	Oneens	Niet eens/niet oneens	Eens	Zeer eens
9. Als ik zonnepanelen koop is het belangrijk dat ik daardoor minder milieuvriendelijke elektriciteit gebruik (bijv. kolen, gas of kernenergie).	0	0	0	0	0
10. Als ik zonnepanelen koop is het belangrijk dat ik daarmee geld verdien of bespaar.	0	0	0	0	0
11. Een belangrijke reden voor mij om zonnepanelen te kopen is het milieu.	0	0	0	0	0
12. Als ik zonnepanelen koop vind ik het belangrijk dat mijn buurtgenoten kunnen zien dat ik zonnepanelen heb.	0	0	0	0	0
13. Ik wil graag zonnepanelen, maar mijn dak is niet geschikt voor zonnepanelen/ik heb geen eigen dak.	0	0	0	0	0
14. Ik vind het moeilijk/vervelend om een geschikte locatie te zoeken en ik koop daarom geen zonnepanelen.	0	0	0	0	0
15. Ik vind het moeilijk/vervelend om een betrouwbare installateur te zoeken en koop daarom geen zonnepanelen	0	0	0	0	0
16. Ik vind het moeilijk/vervelend om toestemming bij de gemeente te regelen en koop daarom geen zonnepanelen.	0	0	0	0	0
17. Ik ben bang dat als ik zonnepanelen op mijn dak heb ik negatieve reacties van burens krijg.	0	0	0	0	0
18. Omdat de opbrengsten van een zonnepaneel niet vaststaan (maar afhangen van de zon) koop ik ze niet.	0	0	0	0	0
19. Ik ben bang dat zonnepanelen niet genoeg stroom zullen opwekken om er (genoeg) aan te verdienen.	0	0	0	0	0
20. Ik vind zonnepanelen nog een te nieuwe techniek om vertrouwen in te hebben.	0	0	0	0	0

Deel vier van de enquête gaat specifiek over het zonnepanelenproject van Waternet beschreven op de voorpagina van deze enquête.

Waternet kan op verschillende manieren informatie over dit zonnepanelenproject aan u verstrekken. Geef bij de volgende methoden aan hoe (on)belangrijk u het vindt om op die manier informatie over dit project te ontvangen (graag voor alle methoden invullen).

	Zeer onbelangrijk	Onbelangrijk	Niet belangrijk/ niet onbelangrijk	Belangrijk	Zeer belangrijk
21. Per brief	0	0	0	0	0
22. Presentaties gevolgd door vragenronden	0	0	0	0	0
23. Aankondigingsposters voor de presentaties (bijv. in bushokjes)	0	0	0	0	0
24. Een website	0	0	0	0	0
25. Papieren informatiefolders	0	0	0	0	0
26. Per email	0	0	0	0	0
27. Via een app (voor een smartphone/tablet)	0	0	0	0	0
28. De mogelijkheid tot vragen stellen per telefoon, email of website	0	0	0	0	0

Geef bij de volgende stellingen over het zonnepanelenproject aan in hoeverre u het er mee (on)eens bent, ook als u momenteel geen interesse in dit project heeft (graag voor alle stellingen invullen).

	Zeer oneens	Oneens	Niet eens/niet oneens	Eens	Zeer eens
29. Ik vind de aanschafkosten van een zonnepaneel voor dit project (€400) te hoog.	0	0	0	0	0
30. Ik heb niet genoeg geld beschikbaar om mee te doen met dit zonnepanelenproject.	0	0	0	0	0
31. De tijd tot ik mijn investering van €400 heb terugverdiend (ongeveer 13 jaar) vind ik te lang.	0	0	0	0	0
32. Als ik weet dat mijn buurtgenoten met dit project meedoen is de kans groot dat ik ook mee wil doen.	0	0	0	0	0
33. Ik vind het belangrijk om via dit zonnepanelenproject mijn banden met buurtgenoten te verbeteren.	0	0	0	0	0
34. Ik vind het belangrijk dat iedereen in de buurt van dit project profiteert (of ze nu meedoen of niet), bijv. door een deel van de winst te investeren in wijkverbeteringen.	0	0	0	0	0
35. Ik zou sneller meedoen aan dit project als een bekend persoon uit de gemeente mij uitnodigt (bijv. een wethouder of bekende buurtgenoot).	0	0	0	0	0
36. Ik overweeg alleen om mee te doen aan dit project als ik toegang tot alle informatie over het project heb.	0	0	0	0	0

	Zeer oneens	Oneens	Niet eens/niet oneens	Eens	Zeer eens
37. Als ik meedoe met dit project vind ik het belangrijk om betrokken te zijn bij de beslissingen over het project.	0	0	0	0	0
38. Als ik nieuwsberichten op internet zie over dit project zou ik waarschijnlijk sneller meedoen.	0	0	0	0	0
39. Ik heb geen tijd om de komende jaren betrokken te zijn bij dit project.	0	0	0	0	0
40. Ik heb al zonnepanelen en wil daarom niet meedoen aan dit project.	0	0	0	0	0
41. Ik weet te weinig van zonnepanelen om te kunnen beslissen of ik met dit project mee wil doen.	0	0	0	0	0

Het vijfde deel van deze enquête gaat over de betrokkenheid van Waternet bij dit project.

42. De hoeveelheid geld die u met een zonnepaneel verdient is afhankelijk van de zon. Vindt u het belangrijk dat Waternet garandeert dat u een minimale financiële opbrengst van de zonnepanelen krijgt? Indien de minimale opbrengst niet gehaald wordt zal Waternet de opbrengst aanvullen tot dit minimum.

- Zeer belangrijk
- Belangrijk
- Niet belangrijk/niet onbelangrijk
- Onbelangrijk
- Zeer onbelangrijk

Geef bij de volgende stellingen aan in hoeverre u het er mee (on)eens bent, ook als u momenteel geen interesse in dit project heeft (graag voor alle stellingen invullen).

	Zeer oneens	Oneens	Niet eens/niet oneens	Eens	Zeer eens
43. Als Waternet duidelijk zichtbaar bij dit project betrokken is ben ik sneller bereid om mee te doen.	0	0	0	0	0
44. Omdat experts van Waternet betrokken zijn bij dit project ben ik sneller bereid om mee te doen.	0	0	0	0	0
45. Ik ken Waternet niet goed en wil daarom niet aan dit project meedoen.	0	0	0	0	0
46. Ik wil met Waternet samenwerken in dit project.	0	0	0	0	0
47. Ik denk dat Waternet dit project goed kan organiseren.	0	0	0	0	0
48. Ik wil Waternet helpen om meer buurtgenoten bij dit project te betrekken.	0	0	0	0	0

Het laatste deel van deze enquête gaat over uw persoonlijke situatie.

49. Wat is het netto maandinkomen van uw huishouden?

- € 1500 of minder
- € 1501 - € 2000
- € 2001 - € 2500
- € 2501 - € 3000
- € 3001 - € 3500
- € 3501 - € 4000
- Meer dan € 4000
- Dit weet ik niet.
- Hier wil ik geen antwoord op geven.

Indien u op- of aanmerkingen heeft naar aanleiding van deze enquête kunt u deze hieronder vermelden:

.....
.....
.....
.....
.....
.....
.....
.....
.....

Dit is het einde van de enquête. Hartelijk dank voor uw medewerking.

4.2. English (translation)

Below the translation of the survey into English can be found. It should be kept in mind that the citizens were asked to fill out the Dutch survey (see appendix section 4.1). As some questions could not literally be translated they have been translated in a way that is as close to the original Dutch version as possible. Furthermore, the lay-out of the questionnaire was based on the Dutch version. As the length of words and sentences differs between English and Dutch the layout of the English version may differ from the Dutch version.



Universiteit Utrecht



Questionnaire nr.

Survey: research into the interest of citizens in solar panels on roofs of Waternet

For my master thesis at Utrecht University I conduct a research for Waternet. Waternet is the organisation which produces your drinking water, purifies your wastewater and cleans and maintains the surface water in your surroundings. Waternet would like to become more sustainable and therefore develops a number of projects to reduce their waste and produce more green energy.

Waternet currently researches the possibilities of a solar panel project. In this project Waternet would like to cooperate with citizens like you. Waternet would make terrain available for solar panels of citizens. You would be given the opportunity to buy a solar panel which is placed on a roof of Waternet.

You will be given a compensation for the electricity that is produced by your solar panels on the terrain of Waternet. If you would like to participate in this project you will have a one-time cost of €400 to buy a solar panel. The project runs for 25 years. Every year you will receive a compensation for the electricity produced by your solar panel. In total you will earn your original investment of €400 back and in addition to this a profit of about €500. The exact profit is of course dependent on the sun. In case you would like to you can buy multiple solar panels. This will increase your profit. Waternet will install the solar panels and maintain them. The project is aimed at the neighbourhood level. You and your neighbours will be invited to participate.

Waternet is curious whether you are interested in this project if it is carried out. I conduct a research into this for my master's thesis. I would appreciate it if you would fill out the questionnaire. This will take about 10 minutes.

When filling out the questionnaire I would like to ask you to take the following instructions in mind:

- Please answer all questions and tick your answer.
- Please only tick one box for every question, unless specifically stated otherwise.
- There are no right and wrong answers. Please fill out the questionnaire honestly. In case none of the answers exactly matches with your answer please choose the answer closest to your choice.

**This questionnaire is about your interest. Your answers do not obligate you to do or buy anything.
Waternet has not yet made a final decision whether to carry out this project or not.
Costs and benefits discussed in this questionnaire are not final.**

Filled out questionnaires will be processed anonymously.

Thank you very much for your cooperation in this research.
Imre Perenboom

Intern at Waternet & student Sustainable Development at Utrecht University

In the first part of this questionnaire you will be asked a number of general questions.

1. What is your gender?

- Male
- Female

2. What is your age? year

3. What is the highest level of education you have finished?

- Geen (*none*)
- Basisonderwijs/lagere school (*elementary school*)
- VMBO (LBO/VBO, MAVO/MULO)
- Middelbaar Beroeps Onderwijs (MEAO, MTS etc.)
- HAVO, VWO, HBS, Atheneum, Gymnasium
- Hogeschool, Universiteit of Hoger Beroeps Onderwijs (HTS, Kweekschool etc.) (*comparable to university of applied sciences and university*)
- Anders, namelijk:.....
(*other*)

4. What are the four numbers of your postal code?

In the second part of the survey you will be asked a number of questions about the solar panel project.

5. How high is the chance that you (based on the information provided on the front page of this questionnaire) will be willing to participate in the solar panel project on terrain of Waternet?

- Very high
- High
- Average
- Low
- Very low

6. At this moment you have only received a small part of the information concerning this project. How long do you think you will need to make a final decision to either participate or not participate in this solar panel project, after receiving all the information concerning this project?

- Less than one week
- At least one week but maximally one month
- More than one month, but less than two months
- More than two months, but less than six months
- More than six months

Part three of the questionnaire concerns solar panels and the environment. These questions are not about the project described on the front page, but about solar panels and the environment in general.

7. How much interest do you have for energy problems, such as climate change and the world running out of oil and gas in the future?

- Very much
- Much
- Average
- Little
- Very little

8. How well aware are you in your opinion of the advantages and disadvantages of solar panels?

- Very well aware
- Well aware
- Average
- Unaware
- Very unaware

Please indicate for the following statements in how far you (dis)agree with them, even if you have no interest in buying solar panels at the moment (please fill out for all statements).

	Totally disagree	Disagree	Do not agree/do not disagree	Agree	Totally agree
9. If I buy solar panels I find it important that this reduces the amount of environmentally polluting electricity I use (e.g. coal, gas or nuclear energy).	0	0	0	0	0
10. If I buy solar panels it is important that I will earn or save money with them.	0	0	0	0	0
11. An important reason for me to buy solar panels is the environment.	0	0	0	0	0
12. If I buy solar panels I find it important that my neighbours can see that I have solar panels.	0	0	0	0	0

13. I would like to have solar panels, but my roof is not suitable for solar panels/I have no roof of my own.	0	0	0	0	0
14. I find it difficult/annoying to find a suitable location and therefore I do not buy solar panels.	0	0	0	0	0
15. I find it difficult/annoying to find a trustworthy installer and therefore I do not buy solar panels.	0	0	0	0	0
16. I find it difficult/annoying to gain permission from the municipality and therefore I do not buy solar panels.	0	0	0	0	0
17. I am afraid that when I place solar panels on my roof I will receive negative feedback from my neighbours.	0	0	0	0	0
18. Because the revenues of solar panels are not fixed (but are dependent on the sun) I do not buy them.	0	0	0	0	0
19. I am afraid that solar panels will not produce enough electricity in order to earn (enough) from them.	0	0	0	0	0
20. I think solar panels are a technique that is too new to trust.	0	0	0	0	0

Part four of the questionnaire specifically concerns the solar panel project of Waternet described on the front page of this questionnaire.

Waternet can use different methods to bring you information about this project. Please indicate for the following methods how (un)important you find them to receive information about this project (please fill out for all methods).

	Very unimportant	Unimportant	Not important/not unimportant	Important	Very important
21. By letter	0	0	0	0	0
22. Presentations followed by the option to ask questions.	0	0	0	0	0
23. Posters to announce the presentation (for example at bus stops)	0	0	0	0	0
24. A website	0	0	0	0	0
25. Paper information flyers	0	0	0	0	0
26. By email	0	0	0	0	0
27. Via an app (for a smartphone/tablet)	0	0	0	0	0
28. The option to ask questions via telephone, email or website.	0	0	0	0	0

Please indicate for the following statements about the solar panel project in how far you (dis)agree with them, even if you are currently not interested in this project (please fill out for all statements).

	Totally disagree	Disagree	Do not agree/do not disagree	Agree	Totally agree
29. I find the price of €400 to buy a solar panel for this project too high.	0	0	0	0	0
30. I do not have enough money available to participate in this solar panel project.	0	0	0	0	0
31. The time needed to earn my original investment of €400 back (about 13 years) is too long.	0	0	0	0	0
32. If I know my neighbours participate in this project it is likely I will also participate.	0	0	0	0	0
33. I find it important to strengthen my relations with my neighbours via this solar panel project.	0	0	0	0	0
34. I find it important that everyone in the neighbourhood can profit from this project (whether they participate or not), for example by investing a part of the profit in neighbourhood improvements.	0	0	0	0	0
35. I would be more willing to join this project if a famous person from the municipality/neighbourhood would invite me (for example an alderman or a famous neighbour).	0	0	0	0	0
36. I will only consider participating in this project if I have access to all information about the project.	0	0	0	0	0
37. If I participate in this project I find it important to be involved in the decision-making process of the project.	0	0	0	0	0
38. If I see news articles about this project on the internet I would most likely be more willing to participate.	0	0	0	0	0
39. I do not have the time to be involved in this project the next years.	0	0	0	0	0
40. I already have solar panels and therefore do not want to participate in this project.	0	0	0	0	0
41. I do not have enough knowledge about solar panels to decide whether I want to participate in this project or not.	0	0	0	0	0

The fifth part of this questionnaire concerns the involvement of Waternet in this project.

42. The amount of money which you earn with a solar panel is dependent on the sun. Do you find it important that Waternet guarantees a minimum financial return of the solar panels? In case the minimum return is not reached Waternet will compensate the difference.

- 0 Very important
- 0 Important
- 0 Not important/not unimportant
- 0 Unimportant
- 0 Very unimportant

Appendix 5. Maps of the survey areas

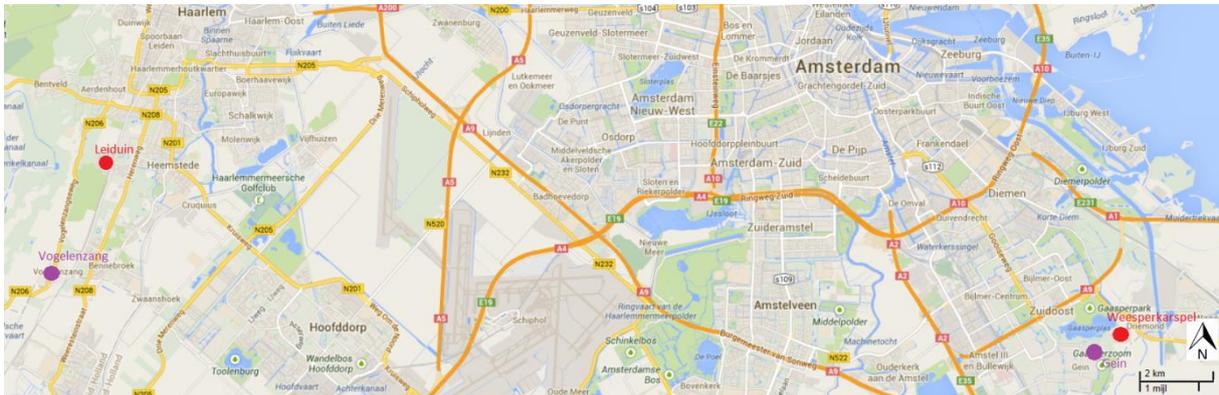


Figure Appendix 5.1: Overview of the locations of the two survey areas. The red dots indicate the locations of Waternet, the purple dots indicate the locations of the survey areas. Source: Googlemaps (2014a).

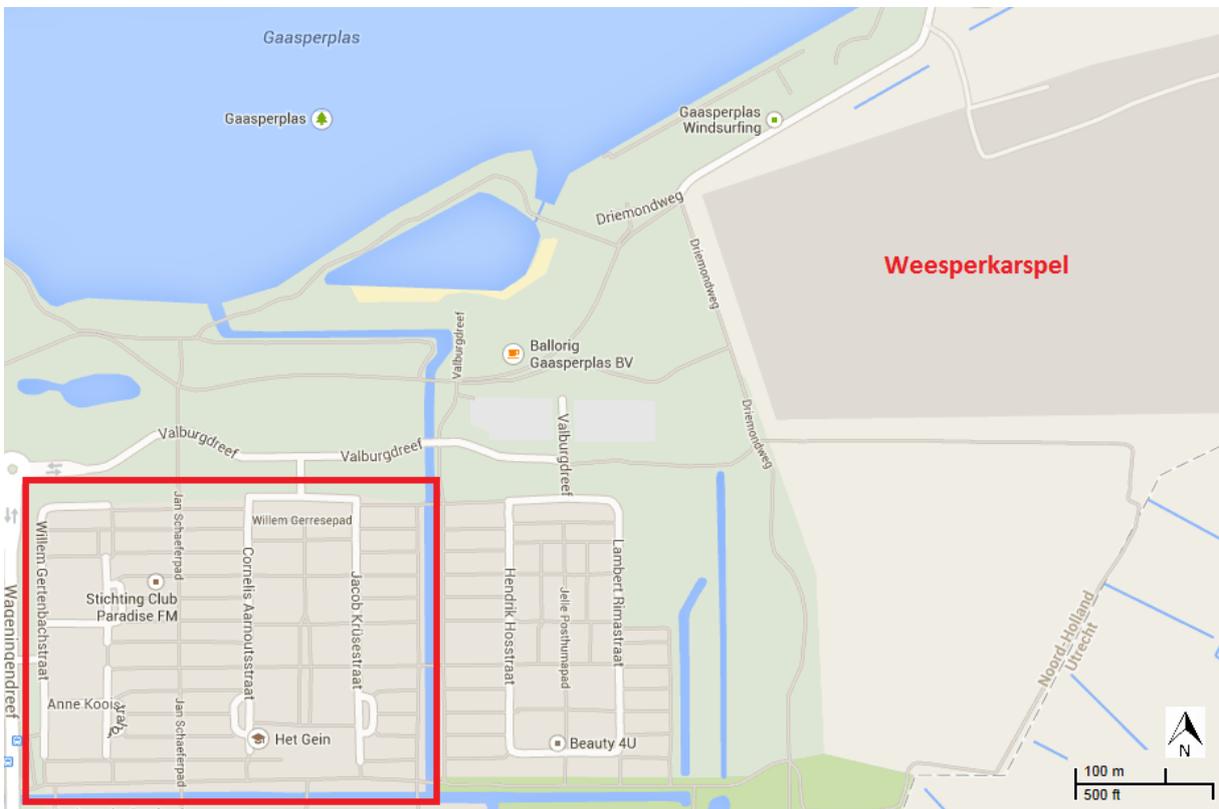


Figure Appendix 5.2: Overview of the area of Gein (near Weesperkarspel) in which the survey was conducted (the survey area is surrounded by red lines). Weesperkarspel is indicated on the map. Source: Googlemaps (2014a).



Figure Appendix 5.3: Overview of the area of Vogelenzang (near Leiduin) in which the survey was conducted (the survey area is surrounded by red lines). Leiduin lies north of the area (not indicated on the map). Although some areas with houses lie closer to Leiduin, they are not part of the postal code circle of Leiduin. Source: Googlemaps (2014b).

Appendix 6. Survey announcement letter

Techniek, Onderzoek & Projecten



Postbus 94370, 1090 GJ Amsterdam

Onderwerp

Enquête scriptie

Geachte mevrouw/heer,

Voor mijn afstudeerscriptie aan de Universiteit Utrecht doe ik onderzoek voor Waternet naar zonnepanelen. Waternet is de organisatie die uw drinkwater produceert, uw afvalwater zuivert en het oppervlaktewater schoon en op peil houdt in uw omgeving.

Waternet ontwikkelt diverse projecten om minder vervuiling uit te stoten en meer groene energie op te wekken. Ik onderzoek op dit moment de mogelijkheden voor het plaatsen van zonnepanelen in samenwerking met bewoners uit de omgeving. Binnen enkele weken zal ik bij u aan de deur komen met een enquête. Ik zou het zeer waarderen als u deze enquête invult. Het invullen duurt ongeveer 10 minuten. De enquête wordt volledig anoniem verwerkt.

Mocht u naar aanleiding van deze brief of de enquête vragen of opmerkingen hebben dan kunt u mij e-mailen op imre.perenboom@waternet.nl.

Medewerkers van Waternet tonen hun legitimatie als ze bij u langskomen. Bij twijfel bel 0900 9394.

Met vriendelijke groet,

Imre Perenboom

Stagiair bij Waternet & student Sustainable Development: Environmental Governance aan de Universiteit Utrecht

Datum

17 maart 2014

Contactpersoon

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*Waternet is de gemeenschappelijke organisatie van Waterschap Amstel, Gooi en Vecht
en de gemeente Amsterdam*