Influence of Trust Concerns and Benefits of Visibility on Participation in Green Electricity Programs: a Case-Study of Residential Solar-PV Systems in Ontario

by

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Andrzej Chlobowski

Abstract

This study examines two of the reasons that prevent people from taking part in green electricity programs: trust concerns that these programs may raise, and lack of benefits that come with visibility of participants' involvement. While the current literature takes notice of their influence, in this study it was decided to investigate both factors in more detail. In particular, with the help of a survey, the study focused on the reactions of electricity consumers to the proposition of participation in green electricity programs in a controlled setting, in which levels of trust concerns raised and benefits of visibility provided by the programs could be varied. The study was conducted in Oakville, an affluent southern Ontario (Canada) suburb. The results are based on 160 received responses to 500 questionnaires that were sent out by mail.

While the results of this study point towards the conclusion that both factors have an influence on participation in green electricity programs, their relative strength cannot be estimated by these results. One can, however, claim that the combined influence of trust concerns and benefits of visibility is quite strong. This research shows that at a 95% confidence level, willingness to participate in a program that proposes paying a premium for electricity from solar panels installed on a participant's roof (low trust concerns, high benefits of visibility) is 30% $\pm$ 19.3% higher than willingness to participate in a program that proposes paying a premium for electricity from undisclosed solar farms (high trust concerns, low benefits of visibility).

Additional data about trust concerns, appreciation of benefits of visibility, and concerns about installation of solar panels on one's own roof, provided by the survey, are also presented in the text.

In conclusion, it is recommended that future research should more clearly separate the strength of influence of trust concerns from the influence of benefits of visibility on green electricity program participation. It is also important to study which features of these programs make them more trustworthy and visible. An important implication of this study for policy makers and green electricity proponents is to concentrate on allaying trust concerns, and enhancing benefits of visibility when designing policies or drafting plans for green electricity programs. The creation of an independent green electricity program certification system and a greater emphasis on the local presence of such programs is suggested.

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Chapter 1: Introduction

1.1 Background

Global climate change, which is caused to a large extent by the burning of fossil fuels, can be considered the most pressing problem facing humanity today. At the same time, the prospect of exhausting the easily accessible oil and gas deposits may lead to a deep disturbance of modern societies. Electricity generation accounts for a considerable part of the fossil fuel usage, and for this reason is related to both of these problems.

The conventional approach to solving the problem of depleting the easily accessible supplies of oil and gas includes recarbonization of the world economy; the resurgence of coal utilization - a much more carbon intensive fuel. Unfortunately, this would contribute even more to global climate change. Alternatively, further exploration and exploitation of less accessible oil and gas deposits is proposed, which optimistically assumes their availability and reasonable accessibility, while refusing to take the reality of climate issues seriously.

There are several approaches to solving the above-mentioned combination of these two pressing problems. Some are more concerned with an immediate solution, hoping to buy time until a longer lasting one is found. Other solutions aim towards the goal of sustainability, which is a long-term maintenance of life conditions on Earth favourable to humans, which includes the use of existing resources in a way that does not diminish their availability for future generations.

In the first “stop-gap measures” category, one can put together all of the proposals, which combine a more intense exploitation of gas, oil and coal deposits with carbon sequestration technologies. The proposed resurgence in the use of nuclear fission as a source of energy should also be placed in this category, as the known uranium reserves will last even less time than the reserves of coal. In addition, nuclear fission has the undesired side effect of nuclear weapon proliferation (including the threat of terrorism), and a problem of how to safely dispose spent nuclear fuel.

Nuclear fusion is the hope of many, as it would provide a seemingly inexhaustible source of energy, without causing a serious waste problem. This could be a sustainable solution to the energy supply problem, but thus far the associated immense technological problems have not been successfully solved. Additionally, if implemented this technology would at least initially be very expensive, and would favour centralized energy distribution systems, which is not a desired option from the sustainability point of view.

Besides the issues already discussed, the unsustainability of fossil fuel or nuclear electricity production also comes from the environmental degradation it causes either during its generation, or mining for fuels, or both. This includes air pollution from fossil fuel burning, pollution and land destruction resulting from mountain top removal, open pit mining, and oil production, and air pollution resulting from natural gas extraction. Large hydro-electric projects also face unsustainability issues. Flooding resulting from reservoir construction destroys natural and human habitats, causing both environmental and social problems. There are also concerns related to structure aging, which include reservoir silting and dangers of catastrophic flooding in the event of dam failure.

Another more sustainable approach to electricity generation results from the soft energy path, a model proposed by Amory Lovins (Lovins, 1976). In this model, energy efficiency and renewable energy sources are matched to end-use in terms of scale and quality, and progressively replace the centralized energy supply system that is based on fossil fuels and nuclear fission. Renewable energy sources refer to wind, solar, micro hydro, ocean tide and wave, biomass, ground heat pump and geothermal.

Renewable (green) electricity generation is naturally a part of the soft energy path, and most of the mentioned renewable energy sources can be used for electricity production. In most markets, the price of green electricity is currently higher than the price of electricity from non-renewable sources, due to the entrenched business interests and the high cost of renewable technology, especially photovoltaic panels. In addition, renewable electricity sources face the problem of intermittency; a challenge that has not yet been successfully solved. All of this creates the common reluctance in switching to a green electricity supply.

In support of the development of renewable energy sources, central and local governments are pursuing various policies that include mandatory measures, financial incentives, and providing an arena for voluntary contributions by residential and business electricity consumers. Green electricity programs are an example of such voluntary contributions.

1.2 Green Electricity Programs

In order to support use of the existing capacity, and increase the amount of funds available for the development of green electricity generation, various voluntary financial commitments are solicited from the consumers of electric power, by both public and private electricity providers. These commitments can come in the form of purchasing blocks of green electricity to be supplied to the grid (green tags), or in the form of premiums paid on the electricity used by the volunteering consumer (green supply). So far, voluntary green electricity purchases have not spread widely in most jurisdictions (e.g. Wiser, 1998; Bird et al., 2002; Nomura et al., 2004; Diaz-Rainey and Ashton, 2008; Ek and Soderholm, 2008; Hansla et al., 2008; Zoric and Hrovatin, 2012).

How to overcome this reluctance is of utmost importance for renewable energy diffusion. To ensure its success, conditions must be created in which the prospective energy producers and consumers naturally gravitate towards renewable energy sources (Faiers and Neame, 2006). Therefore, the motivating factors in the adoption of renewable energy, and profiles of its potential users that could inform energy policy, are the focus of intense research. This research is part of a wider inquiry into consumer behaviour and decision-making, and as such is crucial in the exploration of sustainability issues.

In Ontario, green electricity programs are marketed in both forms, by green tags available from Ontario Power Generation through the local utility (Oakville Hydro, 2012)**,** and by green power supply through Bullfrog Power. In July 2012, the premium on the cost of electricity supplied by Bullfrog was 3.0 cents per kWh in Ontario and 2.0 cents in other Canadian provinces. (Bullfrog, 2012). According to a quote calculator available on the Bullfrog website, inhabitants of a detached house in Ontario, with square footage between 1500 and 2000, would pay on average $24.00 per month premium for the green electricity used.

1.3 Research Problem

In industrialized countries, the percentage of consumers stating that they are willing to pay a premium for green electricity is quite high (35-80%), as revealed by several studies (e.g. Farhar and Houston, 1996; Bird et al., 2002; Rundle-Thiele et al., 2008; Ek and Soderholm, 2008; Gerpott, T. J., & Mahmudova, I., 2010; Zoric, J., & Hrovatin, N., 2012). However, in most jurisdictions, the actual participation in such offered programs is very low (on average 1-3%) (e.g. Farhar and Houston, 1996; Bird et al., 2002; Ek and Soderholm, 2008; Zoric and Hrovatin, 2012). This thesis will explore some possible explanations of why the response to the green electricity offerings is so small.

Several barriers to consumers getting involved in green electricity programs are discussed in the literature, and will be presented in the next chapter. Here, the discussion will focus on one particular barrier-creating characteristic of the majority of those programs, which can be informally labelled their *opaqueness*. In most of the green electricity programs, the actual physical sources of green electricity are usually unknown to the purchaser, and the process of delivery to a power grid within which the purchaser lives is very opaque. One can even easily imagine that most of the consumers of electricity have a very vague concept of the power grid itself, and of a possible geographical location of green electricity generation facilities.

Trust concerns are the first barrier created by opaqueness of the programs. They come from the feeling of lack of control and oversight by the average citizen, of the usually large and removed entities that promote green electricity programs (e.g Farhar and Houston, 1996; Salmela and Varho, 2006; Diaz-Rainey and Ashton, 2008; Ek and Soderholm, 2008; Adaman et al., 2011; Ozaki, 2011). It is indeed very difficult for an average person to check if the promised green electricity was delivered to the grid, because one cannot see it, and one does not have the power and time to investigate the organizations involved. Three main areas of trust concerns are: a concern that the premium paid for the green electricity will not be spent wisely, a concern that undue profits will be made by the program provider, and a concern that cheating will take place, and cheaper 'dirty' electricity will be delivered instead of the promised green one. Investigating the influence of trust concerns raised by a green electricity program on participation in it, is the first task of this thesis.

The second barrier is the lack of benefits that a green electricity program may provide through the visual aspects of participation in it. These benefits will, from now on, be called *benefits of visibility* that a green electricity program can (or cannot) provide. Three main aspects of benefits of visibility are: an ability of the program participant to show off or brag about participation (statement making), an ability to influence others to take similar action, and an ability to witness modern technology at work. Lack of benefits of visibility can be considered a barrier to consumers getting involved with a green electricity program (Ek and Soderholm, 2008), or in a more straightforward way, one can look at benefits of visibility as an attractor for consumer involvement. Investigation of the influence of benefits of visibility on participation in a green electricity program is the second task of this thesis.

The reason both trust concerns and benefits of visibility are studied in this research project together is that they share a common origin, in the opaqueness of the majority of the existing green electricity programs. The two concepts will be more precisely defined in further chapters.

1.4 Other Methods of Public Support for Green Electricity Generation

Besides soliciting voluntary support for green electricity generation, governments in several jurisdictions provide financial incentives for green electricity generators. These financial incentives take the form of purchasing the generated electricity at preferred rates, providing tax incentives, and legislating mandatory green electricity content for local hydro providers.

The following sections concentrate on the aspects of financial incentives as they apply to solar energy. The discussion is limited to this area, because this study will involve solar electricity generation only.

1.4.1 Financial Incentives for Solar Electricity

Distributed electricity generation by photovoltaic panels located on the rooftops of private homes and businesses is considered one of the main sources of the future supply of sustainable electricity (Bradford, 2006). However, taking into consideration the total cost of capital investment divided by the amount of electricity produced, solar electricity is still very expensive in terms of price per kWh (see Example 1 in Appendix E – Detailed Examples). Consequently, jurisdictions worldwide have introduced various financial incentives for individuals and businesses who are willing to invest in solar technology. In many jurisdictions, grid-connected solar panels are installed on the consumer side of the meter, with the possibility of selling the unused power to a local utility through the net-metering arrangement. In some jurisdictions (e.g. Germany, Spain, France, some jurisdictions in the US, Ontario, (ren21, 2011, p52)), solar panels can be installed on the grid side of the meter, and all of their power is sold to the grid at the preferred rate (the Feed-in Tariff), making the owner a micro power generator.

Regardless of the details of the financial incentives, there is always a sizable capital investment required on the part of the prospective solar panel* owner (in the above mentioned Toronto example, it is $7/Wpeak for a residential scale system). Therefore, in the US, for example, third party financing models have been developed, in which the roof owners would either lease the panels from the leasing company, or buy the power at the established rate from the panels owned and operated from their roof by a third party (e.g. Bollinger, 2009; Coughlin et al., 2009). These financing models were designed for a situation in which solar panel systems were installed on the consumer side of the meter, a situation prevalent in US. In jurisdictions with the Feed-in Tariff, financing of the panels is provided by the banks on a basis similar to any business enterprise financing. In addition, in some jurisdictions, such as Ontario, roof owners can lease their roofs to companies that install their own panels and collect the Feed-in Tariff payments, instead of the roof owner.

1.4.1.1 Feed-in Tariff in Ontario

The Green Energy and Green Economy Act passed by the Ontario legislature in 2009, introduced the new Feed-in Tariff (FIT) program, which makes installations of rooftop solar panel systems more economically attractive. The original rate paid for electricity generated by solar panel systems smaller than 10kW was 80.2c per kWh, and guaranteed for 20 years (solartrader.ca, 2012). In 2012, the program was reviewed and this rate was lowered to 54.9c per kWh (OPA, 2012). Before the FIT program was introduced, Ontario supported the development of green electricity with the Standard Offer Program (SOP), which paid 42.0c per kWh of electricity generated by solar panels. Although they paid for the electricity as it is generated, neither of these programs solved the problem of the large initial capital investment that is required.

The creation of the FIT program in Ontario interfered somewhat with this research; this issue is discussed in chapter 5.

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*Note, in this thesis, photovoltaic panels will simply be called solar panels, since this thesis does not investigate solar thermal panels.

1.5 The Thesis Layout

After this introduction to the subject of the thesis, the following seven chapters describe the research conducted and its results. In the next chapter, the literature review is presented to place the broad ideas introduced in Chapter 1 in a proper research setting. In Chapter 3, two hypotheses tested in this research are formulated. Chapters 4 and 5 describe the methodological approach used, and the method – a mail survey - that resulted from this approach. In Chapter 6, results of the conducted survey are presented, which are then discussed in Chapter 7. Finally, Chapter 8 concludes the thesis with a summary of the research performed, and with recommendations for researchers, policy-makers, and green electricity proponents.

Chapter 2: Literature Review

As discussed in the previous chapter, this thesis investigates one barrier, lack of trust and one benefit, visibility, related to participation in green electricity programs. In the first part of this chapter, the reader's attention will be directed to the kinds of barriers to participation in green electricity programs that are examined in the research literature. Next, existing research about trust concerns related to green electricity programs will be analyzed to examine the gap in the literature that this study aims to fill.

In the second part of the chapter, green electricity will be discussed in the wider context of the private provision of public goods. It will be argued that the benefits of visibility are one of the private benefits enabling private provision of a public good through participation in a green electricity program. Finally, the contribution to research on participation in green electricity contracts of the second part of this study concerned with benefits of visibility, will be described.

2.1 Barriers to Participation in Green Electricity Programs

There is a rich area of research on consumers and green electricity. It covers inquiries regarding profiles of consumers interested in, or already supporting voluntary purchases of premium-priced green electricity, about the levels of willingness-to-pay for green electricity, and about the barriers to consumers' involvement. For this thesis, the research on barriers to consumers' involvement was thoroughly explored. In the course of the literature search on the subject, the following barriers to participation by consumers were found:

– Low levels of green electricity supply (Diaz-Rainey and Ashton, 2008). Even though this barrier is not the most often mentioned and does not apply to the consumer side *per se*, it is primarily listed here because it seems to be very basic.

- Lack of awareness and education about green electricity (e.g. Bird et al., 2002; Fuchs and Arentsen, 2002; Zarnikau, 2003; Gossling et al., 2005; Salmela and Varho, 2006; Diaz-Rainey and Ashton, 2008; Hite et al., 2008; Rundle-Thiele et al., 2008). This is by far the most often mentioned barrier. Since electricity and its distribution is an abstract issue, many consumers have trouble understanding what the effect of their voluntary contributions will be.

- Sensitivity to the high price of green electricity (e.g. Bird et al., 2002; Gossling et al., 2005; Salmela and Varho, 2006; Diaz-Rainey and Ashton, 2008; Zhang, et al., 2012).

- Scepticism about willingness of others to pay, because of the free-rider phenomenon (e.g. Salmela and Varho, 2006; Wiser, 2007; Diaz-Rainey and Ashton, 2008; Adaman et al., 2011).

- Negative attitude towards switching suppliers (e.g. Fuchs and Arentsen, 2002; Salmela and Varho, 2006; Brennan, 2007; Diaz-Rainey and Ashton, 2008; Gamble et al., 2009; Ozaki, 2011). Because consumers are accustomed to electricity supply monopolies, they have a certain degree of loyalty to former monopolists who are now still dominant market players. This, combined with hesitancy about making a choice and taking responsibility, creates a negative attitude towards switching suppliers (Fuchs and Arentsen, 2002).

- Effort (initiative and time) required to research and sign up for a program, which evidently adds to the negative attitude towards switching suppliers (e.g. Gossling et al., 2005; Salmela and Varho, 2006; Diaz-Rainey and Ashton, 2008; Ek and Soderholm, 2008; Gamble et al., 2009; Ozaki, 2011).

- Invisibility of green electricity programs (Ek and Soderholm, 2008).

- Lack of control of the household electricity account, when paid by a third party, e.g. landlord (Gossling et al., 2005).

- Trust concerns arising for various reasons, for example, about the intentions of the green electricity providers, or uncertainty regarding whether the green electricity actually comes from renewable sources (e.g. Farhar and Houston, 1996; Salmela and Varho, 2006; Diaz-Rainey and Ashton, 2008; Ek and Soderholm, 2008; Adaman et al., 2011; Ozaki, 2011).

On a side note, it looks as though it is not only individual consumers who have to overcome the above barriers on the way to their involvement with green electricity. Supposedly enlightened, higher educational institutions, seem to have the same problems. Dahle and Neumayer (2001) found the following barriers to the greening of energy and solid waste management for campuses of many such institutions in London, UK: lack of knowledge, budgetary constraints, and institutional reluctance to change.

2.2 Trust Concerns Barrier and the Significance of Proposed Research

In some European countries, providers of green electricity programs mix electricity generated from renewable sources with conventional electricity (including large hydro) (e.g. Bird et al., 2002; Diaz-Rainey and Ashton, 2008). As discussed below, such policies have a negative influence on consumers' trust in the green electricity providers.

Diaz-Rainey and Ashton (2008) write that the lack of an adequate green electricity supply in Britain, causes electricity providers to sell hybrid electricity products, that 'are linked only partially, if at all, to electricity generated form renewable energy'. Such a broadened green supply definition causes consumer confusion (Diaz-Rainey and Ashton, 2008). The same authors also report problems with green electricity certification systems. These issues, and the general opinion that corporations care only about shareholder profits, cause the expression of doubts in interviewed focus groups in Britain, as to whether the premiums paid for green electricity will contribute to the desired outcome. These warnings are echoed (with a tad of national pride) by Gerpott and Mahmudowa (2010) who write: "Specifically, policy makers could strengthen consumers' trust in the environmental qualities of the electricity they are purchasing by introducing a mandatory certification of green electricity offers by an independent agency. Such measures are likely to be necessary not only in Germany, but also in other countries (including outside Europe), because the general attitude toward environmental protection activities tends to be less positive in most other nations compared with Germany." In a similar tone, Paladino and Pandit (2012) suggest that renewable energy providers establish themselves as credible brands to provide assurance.

Similar doubts surface in interviews conducted in Finland (Salmela and Varho, 2006). A general lack of knowledge about electricity, however, can also create feelings of mistrust. As one interviewed person says: "Especially the idea that the electricity that I get when I pay for green electricity would actually not come by a different wire […] but instead it would actually be just the same electricity that everybody else is getting. Of course I feel like why would I pay more for the same electricity" (quoted in Salmela and Varho, 2006 p.3676).

A survey done in Sweden, while investigating perceived consumer effectiveness, reveals definite mistrust of green electricity's actual "greenness". In their article, Ek and Soderholm (2008) write that an overwhelming majority of respondents is either uncertain, partially agrees, or entirely agrees with the following four statements:

- In reality, "green" electricity is not more environmentally benign than electricity that is not labelled "green".
- It is difficult to know what environmental quality standards "green" electricity complies with.
- If I choose to purchase "green" electricity, this does not necessarily imply increased production from "green" electricity sources.
- I am not interested in "green" electricity because I cannot be sure that "green" electricity will be delivered to my household.

The high level of concerns about integrity of green electricity programs expressed in the survey indicates that perceived consumer effectiveness is very low in this case. This is naturally a problem, because as Rowlands et al. (2003) established, perceived consumer effectiveness is positively correlated with being a potential green electricity purchaser.

The problem of trust is not exclusive to Europe. Farhar and Houston (1996), analyzing green electricity issues in the U.S., found that consumers' trust in their utility company conduct plays a role in their inclination to sign on for a green electricity program. Adaman et al. (2011) write that consumers' willingness-to-pay for carbon dioxide reduction programs (including green electricity generation) in Turkey is, to a significant degree, hampered by a lack of trust in institutions that would promote it.

All the papers quoted here in regards to the trust concerns barrier treat it as one of many, and perhaps besides the Swedish study (Ek and Soderholm, 2008), do not commit substantial effort to its investigation. However, it seems that the issue of trust should occupy a more important position in the research on consumer support for green electricity. According to a theoretical model of green product marketing developed by Chen and Chang (2012), trust plays an important role in green purchase intentions. Therefore mitigating the consumers' doubts surrounding the intentions of green electricity providers, and the contents of the package sold as green power, is crucial to the success of the whole process of green electricity diffusion. Growing green electricity popularization efforts should diminish the lack of awareness barrier. At the same time, the maturing of retail electricity markets may lower the negative attitude towards switching suppliers, and the amount of effort required to sign up for a green electricity program. At that moment, the issue of trust in green electricity "greenness" may come to the forefront.

This research project aims at deepening the understanding of the trust concerns barrier by looking at it in a controlled setting, to find out if changes to the level of trust concerns by adjustments to the green electricity programs can influence participation in the programs, and if so, to what degree. It might be that the gap between the people already committed to green electricity programs and the next possible entrants is too wide to be affected by practically possible adjustment of the existing green electricity programs' trustworthiness.

2.3 Green Electricity as a Public Good

The use of renewable energy in general, and green electricity in particular, can be considered a public good as defined by the theory of public goods that is widely discussed in economics. Economic goods can essentially be divided into two categories: private goods and public goods. In the case of private goods, the producer unilaterally bears all the costs of production, and a single consumer or an exclusive group receives all the benefits of consumption. A public good has the defining qualities of non-rivalry and non-exclusivity. Non-rivalry means that one consumer's use of the good does not limit the capacity of other consumers to use it, and non-exclusivity means that it is not possible to prevent consumption of the good by those who fail to pay for it (Dowling and Chin-Fang, 2007).

In light of the dangers of global climate change and resource exhaustion, the use of green electricity that replaces current or future conventional generation can be treated as an example of public good (Wiser, 1998). It avoids carbon dioxide emissions and other environmental damage, and it supports the research and development of better and cheaper forms of renewable power generation that benefit all. It also provides security and price stability for the energy supply of the entire society, assuming that this renewable electricity is produced within the domain of the society. Finally, it may stimulate local economic development.

Public goods are often provided by the government and paid for by taxes. Private provision of public goods is possible as well, and is also known under the name of charity. Green electricity programs, voluntary in nature, are an example of a privately provided public good.

There has been a wide interest in the private provision of public goods in economics. Samuelson (1954) quoted in Wiser (1998), and Olson (1965) quoted in Cornes and Sandler (1984), provide mathematical proofs that as the group increases in size, private provision leads to sub-optimality of the public good, because of the free-riding phenomenon. Free-riding is the tendency of consumers to use the public good without their own voluntary contribution. The sub-optimality argument is the main support within neo-classical economics for a governmental role in an economy. Warr (1982), quoted in Dowling and Chin-Fang (2007), proves that in a large economy with few purely altruistic participants, the average amount of voluntary contribution approaches zero in the limit. Warr (1983), quoted in Bergstrom et al. (1986), also claims that a privately provided public good is not affected by income redistribution, and is therefore immune to public policy (related to income redistribution). However, Bergstrom et al. (1986) dispute this, because the decision of whether to contribute is as important as the decision regarding the amount of the contribution, and the former can be affected by income redistribution. Finally, the rule of Ricardian equivalence states that a dollar spent by the government on a particular public good will almost completely replace (crowd out) a dollar of private provision (e.g. Andreoni, 1988; Menges, 2003; Dowling and Chin-Fang, 2007).

As Dowling and Chin-Fang (2007) nicely state: “However interesting these results are, they do not square with reality”. In fact, private charities are strong, especially in the U.S. – the birth place and the stronghold of neo-classical economics – and green electricity voluntary contracts do generate some noticeable response. This response is small on average (1-3 %), but can be as high as 13 - 20% in different jurisdictions in the Netherlands (Bird et al., 2002).

In order to explain this contradiction, the idea of impure altruism was introduced by Andreoni (1988). Such a form of altruism arises when a private benefit is derived from the voluntary contribution to the public good, on top of the benefit that may come to the giver from the public good itself. This additional benefit may come from a “warm glow”, i.e. a good feeling that comes from the giving itself. But it can also arise from recognition by others, satisfaction of the pressure from society for self-sacrifice, and satisfaction of a special interest in a particular charity (Dowling and Chin-Fang, 2007). Other motives for impure altruism may be guilt, repentance, envy, sympathy and a taste for fairness (Andreoni, 1988). In fact, the motives of guilt and repentance find reflection in a theory developed by Jacobsen et al. (2012), which states that voluntary provision of an environmental public good is motivated by the desire to offset other behaviour that is environmentally harmful. This was tested on green electricity purchases of consumers in Memphis, Tennessee, and confirmed the prediction that after buying ‘indulgences’ in a form of green electricity blocks, many consumers actually increase their electricity use. Also, Menges et al. (2005) present evidence that voluntary payments for green electricity are indeed motivated by impure altruism. Finally, Dastrup et al. (2012) find that solar panel installations on California homes are not solely driven by investment motives, which in their opinion suggests that at least in some cases, owners install them because they derive pride from being green electricity producers.

There is another quite different mathematical approach within economics that considers impure public goods. Here, the consumer acquires a good that produces a private benefit for them and a public benefit for all. Such defined impure public goods are sensitive to income redistribution, and hence to public policy. They are also less vulnerable to free-riding (Cornes, 1994). Within this model, in the case of green electricity, the private benefit would be the use of the electricity itself and the public benefit would be the environmental repercussions of such a purchase, as motives for the purchase are not considered. Kotchen and Moore (2007) provide an interesting analysis of green electricity programs within this paradigm, arguing that the green tag program (which they call a voluntary contribution mechanism) behaves like pure public good provision, while the green supply program (which they call a green tariff mechanism) behaves like impure public good provision.

2.4 Issues of Benefits of Visibility and the Significance of Proposed Research

Determining which private benefit of private provision of public good compels consumers to contribute, and makes for impure altruism (or what mixture of those benefits) is one of the major debates in the discussion of private provision of public goods (e.g. Andreoni, 1988; Wiser, 1998; Menges, 2003; Dowling and Chin-Fang, 2007**)**. Benefits of visibility are certainly a good example of a private benefit coming from the private provision of public good through participation in a green electricity program, and a case can be made for its role as an attractor in these programs. There is a strong opinion expressed in the literature that better specified, more defined, and more visible green electricity voluntary support programs have a better chance of success. Wiser (1998) states that, as shown by existing programs, rooftop or community-based PV systems and local wind projects are more likely to induce customer participation. Farhar and Houston (1996) write that customers respond better to a more defined and specified program, rather than unspecified future actions. As an example, they describe a popular Sacramento Municipal Utility District (SMUD) PV Pioneers program, in which customers volunteered to pay a $4 monthly fee for 10 years to have a 4kW PV panel installed and operated on their roof by SMUD. Ek and Soderholm (2008) complain that the purchase of green electricity is invisible, as opposed to curbside recycling, and Nyborg et al. (2006) argue that "self-image effects are more likely to arise when the external benefits of a green product are easily envisioned". All of this points to the notion that visibility is important for voluntary green electricity support.

There is evidence in the existing literature of the significance of the first of the three aspects of benefits of visibility mentioned in Chapter 1 – statement making. Faiers et al. (2007) cite past research (BRESCU, 2001) showing that hot water solar systems offer an opportunity for consumers to make a statement about their interest in environmental issues. A study from California, on another visible environmental technology, hybrid electric vehicle (HEV), states in its conclusions that consumers' "HEV purchases were about constructing and communicating – through a widely recognized environmental symbol - that they are (for example) intelligent, moral people who care about others" (Heffner et al., 2007). Sexton (2011), studying the adoption of the same technology in Colorado and Washington, finds status signalling an important factor in purchases of the Toyota Prius HEV. This result confirms Griskevicius et al.'s (2010) findings that "status motives increase desire for green products when shopping in public (but not private), and when green products cost more (but not less) than non-green products." They suggest that status competition can be used to promote pro-environmental behaviour.

All of the above evidence strongly implies that similar effects should play an important role in voluntary green electricity support. Paradoxically, the Hartman and Apaolaza-Ibanez (2012) finding that Spanish consumers were not influenced by self-expression benefits in their choice of brand of green electricity provider, confirms the line of reasoning of this study, because all the proposed choices were not visible.

With regard to the second aspect of benefits of visibility mentioned in Chapter 1 – influencing others – some related research was encountered. Wiser (2007) finds a strong positive correlation between a stated willingness-to-pay for renewable energy, and the expectation of willingness-to-pay by others. Also, Nyborg et al. (2006) state that consumers must have some perception of the adoption rates of the green product in order to adopt it themselves, even though they cannot directly observe how effective the adoption by others is. For example, household recycling has been a great success in most communities, even though one usually cannot see how good the neighbours are at garbage sorting; it is sufficient to see that others put out the blue box on recycling collection day. Similarly then, visibility of the voluntary support for green electricity should reinforce its spread among electricity consumers. It can be reasoned that some people are aware of the influence of their visible actions on others, and are willing to get involved with green electricity programs just to do that. This line of argument is indirectly supported by the Rowlands et al. (2003) finding, that green consumers who would be willing to pay more for renewable electricity are more involved in their community.

No literature was found on the third aspect of benefits of visibility - an ability to witness modern technology at work.

From the analysis of the relevant literature, one can clearly see that benefits of visibility are one of the private benefits enabling private provision of a public good through participation in a green electricity program. While the existing research acknowledges the role of this factor as an attractor, it does not explore it much further. This research project enriches the understanding of this phenomenon by looking at it in a controlled setting to find out if changes to the attractor of benefits of visibility by adjustments to the green electricity programs can influence participation in the programs, and if so, to what degree. The controlled setting will provide a stronger confirmation of the phenomenon already described in the literature, and will make it possible to estimate the strength of influence of benefits of visibility.

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The literature search presented in this chapter showed that various trust concerns are a barrier to participation in green electricity programs. The significance of the benefits of visibility was also found widely reported in the research on green electricity programs. However, these are only general findings, and in-depth study of the influence of these two factors is missing. Such a study, involving more detail, was proposed as a research topic for this thesis. The discussion will now move to the next chapter, in which important definitions are provided, and the two hypotheses tested in this study are formulated.

Chapter 3: Hypotheses

3.1 Terminology

In this section, the definitions and conventions used throughout the following chapters will be clarified. First, concepts of trust concerns and benefits of visibility as related to green electricity program are defined.

3.1.1 Definition of Trust Concerns

As was mentioned previously, *trust concerns* are a result of the feeling of lack of control and oversight by the average citizen, of the usually large and removed entities that offer green electricity programs. In order to enunciate the major dimensions of trust concerns, the existing literature on the subject was consulted. Additionally, an anecdotal experience from the author's discussions about the issue with various members of the public was used. Based on this, the three following dimensions were specified:

1. A concern that corporations or governments administering the program will squander the collected money and do nothing (or not enough), while pretending that they fulfilled the promise. In other words, the concern that the money will be wasted.

2. A concern that the businesses involved will make unjustified, windfall profits.

3. A concern that corporations or governments administering the program will cheat to make it easy for themselves, and supply electricity that is not renewable (or for example not solar, if solar was promised).

3.1.2 Definition of Benefits of Visibility

Benefits of visibility were defined previously as the benefits that a green electricity program may provide through the visual aspects of experience of participation in it. Based on the literature search, the three following dimensions were specified:

1. Pride and good feelings coming from the fact that other people will think positively about the participants upon seeing proof that they support green electricity generation – in short, a *bragging* aspect.

2. Satisfaction coming from the act of influencing others to support green electricity generation by the way of a visual message; a good feeling coming from fulfillment of the duty to spread ideas one cares about to friends and strangers – in short, a *good influence* aspect.

3. Pleasure of watching modern and important technology at work. This dimension might seem a bit out of place, but only because of the current situation in which the majority of green electricity programs are very opaque. In some, one does not even know what kind of source provides the contracted electricity. If one imagines a situation in which the generation happens close to the participant and/or some of its aspects can be accessed remotely, for example with the help of the internet, then inclusion of this dimension becomes clear. This dimension is, in short, a *fascination with technology* aspect.

3.1.3 Relations of the Defined Concepts to Green Electricity Programs and Participants

Now that crucial concepts of trust concerns and benefits of visibility have been defined, their relations to green electricity programs and participants in the programs will be clarified.

One can say that (participation in) a green electricity program gives rise to trust concerns. These concerns can be smaller or bigger, so one can say that the green electricity program gives rise to a certain level of trust concerns, or simply has a certain level of trust concerns. The participants have trust concerns about/caused by a green electricity program. They can have lower or higher (level of) trust concerns.

Following the same pattern one can say that (participation in) a green electricity program provides benefits of visibility. These benefits can be smaller or larger, so one can say that the green electricity program provides a certain level of benefits of visibility, or simply has a certain level of benefits of visibility. The participants appreciate benefits of visibility of (provided by) the green electricity program. They can have lower or higher (level of) appreciation of benefits of visibility.

Let's now clarify who is referred to as a participant in a green electricity program. Even though individual persons usually do the registration to participate in such programs, in an overwhelming majority of cases they represent households that have an account with a local electricity provider. Even though no research on this topic was found by the author, one can safely assume that in many cases the decision about participation is made jointly by the members of a household who are responsible for its finances. Therefore, households will be considered participants in the green electricity program.

3.2 A Formal Statement of the Hypotheses

At this point, with the terminology now clarified, the hypotheses to be tested in this research will be formulated.

Assume that two different green electricity programs are proposed separately as a single option, to two subgroups of the same population of households. The two subgroups have the same relevant characteristics. In such a situation it is predicted that:

H1. More households will participate in the green electricity program that gives rise to a lower level of *trust concerns*.

and

H2. More households will participate in the green electricity program that provides higher level of *benefits of visibility*.

Trust concerns and benefits of visibility of a green electricity program are independent controlled variables. The number of households participating in a green electricity program (participation) is the dependent variable.

This study uses contrasting green electricity programs that differ significantly in the trust concerns they may raise, but not in other aspects influencing participation. If the *hypothesis about trust concerns* is not rejected, it affirms the role of trust concerns as a barrier, and further reinforces the belief that the level of trust concerns can influence participation.

To test the second hypothesis, this study uses contrasting green electricity programs that differ significantly in levels of benefits of visibility, but not in other aspects influencing participation. Like in the previous case, if the *hypothesis about benefits of visibility* is not rejected, it further reinforces the belief the role of benefits of visibility is an attractor, and further reinforces the belief that level of benefits of visibility can influence participation.

Besides testing the hypotheses, this research project attempts to measure the strength of the two effects. This can be done by comparing the numbers of participants in the two green electricity programs, which differ either in level of trust concerns or in level of benefits of visibility. There is no golden standard of level of trust concerns or level of benefits of visibility, so it is therefore impossible to have an absolute measure of the differences. Instead, an attempt is made to find differences in participation between the programs that substantially differ in levels of trust concerns and benefits of visibility in a natural, easily implementable way. It is then assessed whether the differences in participation are significant from a practical point of view.

3.2.1 Levels of Measurement

As one can gather from the descriptions of trust concerns and benefits of visibility, none of the variables has a precise, numerical method of measurement. The best that can be done is to adopt an ordinal measure for them – for example, small level, moderate level, and high level of trust concerns (benefits of visibility).

Participation in a green electricity program, defined as a number of participating households, is a ratio measure*.

3.2.2 Unit of Analysis

A household is the unit of analysis in this study. However, not all kinds of dwellings are investigated; the study is limited to single detached or semi-detached houses. This choice is dictated by the kinds of green electricity programs that are used in the research, which will be described in the next chapter.

3.2.3 Other General Aspects of the Study

The research was conducted in Oakville, Ontario. The town is a part of the Greater Toronto Area and is located 40 km south-west of Toronto on the shores of Lake Ontario. According to a 2011 census, it has a population of 182,520. The town was chosen partially for practical reasons, since the author resides there. However, since Oakville is a rather typical affluent suburb of Toronto, it was also considered that it should be possible to extend the findings to

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*According to Babbie, (2008, p.151) a ratio measure is: 'A level of measurement describing a variable with attributes that have all the qualities of nominal, ordinal, and interval measures and in addition are based on a "true zero" point. Age is an example of a ratio measure.'

similar affluent suburbs of larger cities in southern Ontario, if not to other major Canadian and U.S. urban centres.

Subsets of the population of households defined by various characteristics like total household income, highest level of education, etc. are not studied in this research project. Due to limited funds available it was not expected that enough responses from the studied population would be collected to achieve any statistical significance for formal quantitative analysis of such subpopulations.

According to the definitions found, for example in Babbie (2008) or Palys (2003), it is clear at this point that this is an explanatory and quantitative research, which uses a nomothetic, deductive approach. The study is also cross-sectional, because the population is observed at one point in time only.

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In this chapter, research hypotheses were formulated and general methodological aspects of the study were briefly discussed. The following chapter will include the full methodology discussion that leads to the decision to use a survey as the research tool.

Chapter 4: Methodology

In the next two chapters, the process leading from hypotheses to a practical testing procedure is described. As one progresses through the details of implementation, several choices are made that restrict the generalizability of the hypotheses, which in turn affect the representativeness of the findings. Throughout these chapters, remarks about the restricting choices will be made as they occur.

4.1 Choice of Contrasting Green Electricity Programs

In order to test the hypotheses, one needs to decide on green electricity programs that will be used as choices with different levels of trust concerns and benefits of visibility.

4.1.1 Choice of a Renewable Resource

At the start of the test procedure design, the following general choice needs to be made: There are several different renewable energy resources that could be used to generate electricity delivered by a green electricity program - solar, wind, hydro, biomass, farm methane, and geothermal. As discussed in the literature review, however, consumers do not treat different resources for green electricity generation as equal (e.g. Rowlands et al., 2002; Borchers et al., 2007; Kim et al., 2012). Therefore, to avoid possible biases against any particular resource, it was decided to use the same energy resource - solar energy - for contrasting green electricity programs. There could be differences in the extent to which one can adjust levels of trust concerns and benefits of visibility for the different resources, but there is nothing peculiar about any of them to prevent generalization of findings about one of them to all the others.

4.1.2 Initial Intuition and Its Weaknesses

Consideration of the differences between the Bullfrog program, in which electricity is generated at an unknown, remote wind farm, and a solar panel generating electricity on a house owner's roof, led to the creation of this research project. Building on this insight, the decision was made to use the following two options as contrasting green electricity programs: one, Bullfrog-like, which delivers electricity generated at *undisclosed*, *remote large solar farms*, and one in which electricity is delivered by *solar panels located on the participant's own roof*. Note that in the second program the solar panels do not belong to the house owner; their installation and operation is subsidized by the premium paid by the owners. This second program is essentially identical to the Sacramento Municipal Utility District PV Pioneers program mentioned in chapter 2.

One can notice immediately, that the two investigated issues – namely, influence of trust concerns and influence of benefits of visibility – are difficult to separate in such a set-up. The first option – remote solar farms – has a high level of trust concerns and a low level of benefits of visibility, while the second has the opposite qualities. Participants' decisions to choose one over the other could be caused by a mixture of the two investigated factors.

Ideally, one should have two pairs of contrasting programs: one with different levels of trust concerns, but with the same levels of benefits of visibility, and the other with different levels of benefits of visibility, but with the same levels of trust concerns. The first kind of contrasting programs (for investigation of trust concerns) is easy to imagine. For example, for one of the solar farms, but not for the other, one could provide more information about the organization that generates contracted green electricity, and create a tighter relationship with its management, in order to lower the level of trust concerns.

However, in the case of benefits of visibility if, for example, one were to enhance the visibility of a remote solar farm by providing Internet monitoring of the generation accessible to participants, their friends, and even strangers, or by other similar creative solutions, one would lower trust concerns. The same would happen if, in order to enhance visibility, one located the source of contracted solar electricity close to the targeted community (e.g. put solar panels on participants' roofs). Entanglement seems difficult to avoid. One possible way to avoid it is to compare participation in two programs that raise low levels of trust concerns, but differ in visibility. A program that raises low levels of trust concerns, but lacks in benefits of visibility, could be the one described at the beginning of the previous paragraph: a particular remote solar farm about which the organizer provides detailed corporate and financial information, and creates a tighter relationship with its management. Solar panels located on a participant's roofs could be the other program.

4.1.3 Second Phase of the Study Design - the Set of Three Programs

In order to provide a solution to the above problem, a mixed set of green electricity programs, based on the 'solar farm – solar panels on own roof' dichotomy, was designed. Instead of comparing participation in two pairs of programs, one for trust concerns and one for benefits of visibility, participation in three programs is compared. The programs differ from each other in levels of trust concerns or benefits of visibility. They are constructed in such a way that program #2 raises a lower level of trust concerns than program #1, but both have a similar level of benefits of visibility. Further, while program #3 has a higher level of benefits of visibility than program #2, but both are intended to raise similar levels of trust concerns.

Program #1: Solar electricity delivered from undisclosed solar farms located far away from Oakville.

This program raises a *high level of trust concerns*. The chance of improper spending, undue profits and possibility of cheating is high. At the same time, it has a *low level of benefits of visibility*; there is a small opportunity for bragging, influencing others, and watching the technology at work.

Program #2: Solar electricity delivered from a particular solar farm located far away from Oakville. Prospective participants are introduced to its management and provided details of the business profile, history, etc.

This program raises a *low level of trust concerns*. The connection to the management and the information that is provided should allay many of the fears of the participants. The *level of benefits of visibility is as low* as in program #1.

Program #3: Solar electricity delivered from a set of solar panels installed on the roof of the participant's house.

This program raises a *low level of trust concerns*. Even though connection to the management and business details are not provided, it is relatively easy for a prospective participant to estimate costs and profits of the parties involved. The participant actually sees the panels being installed, so the issue of improper spending, and especially cheating, is not serious. It is debatable how trust concerns in this program compare with program #2. They may be lower here because of the more direct experience that panels provide. Since one cannot be sure that they are equal, the inaccuracy this will introduce must be taken into consideration. Further discussion of this issue takes place at the beginning of section 4.2.

The benefits of visibility are high for this program. Having panels on his or her own roof, one can brag, influence, and enjoy modern technology quite intensely.

There is one important note to recognise. The following discussions of the responses of the participants to the three proposed programs assume that they do not have any concerns about the installation of solar panels on their roofs required in program #3 (solar panels on own roof). For the sake of clarity of the argument, the discussion of a correction for this possibility will be introduced later in this chapter.

4.1.3.1 What Else Besides Trust Concerns and Benefits of Visibility Could Contribute to Differences in Preferences between the Programs?

Now that the three programs are described in some detail, one needs to consider if there are other factors contributing to differences in preferences between the programs, besides trust concerns and benefits of visibility.

First, one needs to check if other barriers to participation in green electricity programs, as mentioned in the literature, differ for the three selected programs. Not including trust and visibility issues, the following barriers were listed previously:

- low levels of green electricity supply,
- lack of awareness and education about green electricity,
- price sensitivity,
- scepticism about the willingness of others to pay, because of the free-rider phenomenon,
- negative attitude towards switching suppliers and effort (initiative and time) required to research and sign up for the program,
- lack of control of the household electricity account, when paid by a third party, e.g. landlord.

Assuming that each program has the same premium to pay, is offered by the same organization, and the subgroup of the population to which it is marketed has the same relevant characteristics, the factors listed above do not contribute to the differences in participation between the three selected programs.

There are, however, other differences between the three programs that must be considered:

- Solar farms could be located in the U.S., while solar panels would probably be installed by a Canadian business. Canadian patriotism and/or unwillingness to support a foreign economy could be a factor working in favour of program #3 (solar panels on own roof). This seems not to be very likely though, because organizers do not have to mention in the program description anything about the U.S., or they can explicitly limit program #1 (undisclosed solar farms) to unspecified Canadian solar farms. In program #2 (familiar solar farm), a Canadian solar farm should be used.

- Opinion among the researched population, that solar farms have bigger negative environmental impact than roof-mounted solar systems. This should not be a big factor, because it can be assumed that recognition of this issue would be high among environmentally educated and sensitive circles only. Even though the author does not have evidence for this, one would not expect the general public in Oakville to understand such issues very well.

- Opinion among the researched population, that delivery of power from remote solar farms to the Ontario grid means bigger losses of energy than delivery from solar panels distributed within the grid. An important point, but similar to the previous one, it can be assumed that the Oakville public would not understand this issue well enough for it to interfere with the proposed way of doing the research.

In summary, one can assume that trust concerns and benefits of visibility are the primary factors creating differences for the decision to participate in the three selected programs.

4.1.4 Practical Issues of Implementation of the Proposed Way of Research

When considering practical issues of implementation of the proposed research plan, one quickly realizes that it would require quite intense effort and financial resources to have the three programs organized and introduced to the researched population. The described programs are not readily available for introduction to three subpopulations of the same community. The logistics of organizing, marketing and running such programs would require a tremendous amount of human resources. The only reasonable way of conducting this research with real programs would be to find a situation in which similar programs are or were already marketed by some organization in three very similar communities. The probability of such an event is then, very low. It should not be a surprise, that this configuration of programs was not available at the time this research was conducted.

One could pretend that such programs are being offered and organize a fake recruitment action with smaller financial resources. However, this kind of deceit would probably be considered unethical (by the research community or the University of Waterloo Office of Research Ethics). Also, such fake action might be brought to the attention of the local media by some smart members of the community before the end of the research, and the entire effort would be wasted.

An inexpensive and easy way of doing a similar kind of research is to introduce the three programs described above as hypothetical programs, which are considered by some organization for implementation in the community. To reduce the required effort further, instead of asking three separate groups of households about possible participation in three different programs, one could conduct the inquiry with the same group, asking about all three programs at the same time. The *way* of asking questions about participation is important in this scenario. If one asked the research participants to choose among the three programs the one they would prefer to participate in the most, one could expect an overwhelming majority, if not all, to choose program #3 (solar panels on own roof). The slightest difference in trust concerns and benefits of visibility should bring everybody to the most trustworthy and visible option, that is to program #3.

What one must do is ask three separate questions, each of the following form:

"If it were the only option offered, would you participate in program #X?"

Differences in answers to such questions could then be analysed, in order to test the hypotheses.

There is however, a serious problem with this described way of doing the research. Instead of testing the actual participation in different green electricity programs, one tests the stated willingness to participate in these programs. This is an important limitation of this approach. No research was found to determine how the willingness to participate translates into actual participation. The only thing known is that the latter is much lower than the former. Logically, one would expect that a barrier to participation should be reflected somehow in both. For example, it is rather difficult to believe that trust concerns about a green electricity program would affect willingness to participate, but not the actual participation (or the opposite). However, they might affect them to a different degree. Therefore, the attempt at quantitative assessment of the influence of trust concerns and benefits of visibility on participation planned for this research project would certainly be affected.

In spite of the problems identified, for practical reasons, a method of inquiring among the households in Oakville about hypothetical programs was adopted for this study. Because one of the proposed programs involved placing solar panels on the roof of the participant's house, only single detached and semi-detached houses were considered. Townhouses often do not have enough space on their roof for a reasonable size of solar panel system. Also, many of the townhouse complexes are condominiums, restricting inhabitants' ability to place solar panels on their roofs. A similar problem exists for inhabitants of apartment buildings, even if they own their units.

4.1.5 Division of Prospective Program Participants into Groups Based on Program Participation Patterns

At this point, a division of the prospective program participants into groups based on participation patterns will be presented. It describes the kinds of participant responses, and motivation one can expect when proposing the green electricity programs described in section 4.1.3, to the researched population. Major groups of prospective participants who behave similarly are defined below.

First of all, there is probably a large group of households that are not willing to participate in any of the programs. They may not be willing to spend the amount of money required to take part in a program, they may not be interested in support for green electricity at all, they may not like the organizers of the proposed programs (whoever they might think they are), or they may have any other reason not to participate. They will be called *the Naysayers*.

Then there is a second group, households for which the amount required to participate in the program is not prohibitive, and which are willing to support solar electricity financially on principle, because they see it as a good thing to do. They will be called *the Good Citizens*. For them, visibility issues are secondary, but trust issues play an important role. They participate in all programs that maintain a level of trust concerns that is acceptable for them. Those trusting enough to participate in all three offered programs will be called *the Trusting Good Citizens (abbreviated as TGC)*. And those less trusting, who only participate in programs that have low level of trust concerns, that is in program #2 (familiar solar farm) and program #3 (solar panels on own roof), will be called *the Not Trusting Good Citizens (abbreviated as NTGC)*. Since the definition of both Trusting Good Citizens and Not Trusting Good Citizens does not include their attitude towards benefits of visibility, for members of both groups, levels of appreciation of benefits of visibility can range between low and high values.

There should be one more major group of households. They have the resources required to spend on the program, they are supportive of green electricity in general, but they are not willing to participate in a green electricity program just on principle, just because it is a good thing to do. They need an additional push and the benefits of visibility provide that push for them. Therefore, they only consider participation in program #3 (solar panels on own roof), because it has a high level of visibility. Whether they are more or less trusting is not important, because programs with a high level of benefits of visibility are assumed to raise a low level of trust concerns. But even if a program raised a low level of trust concerns, but also had a low level of benefits of visibility (program #2), they would not participate in it. Since they show a high level of appreciation for benefits of visibility, they will be called *the Visibility Junkies (abbreviated as VJ)*.

Besides these main groups defined above by their choices of programs, one can imagine some counterintuitive patterns. Households that declare participation in program #1 (undisclosed solar farms), but not in program #2 (familiar solar farm), regardless of their choice for program #3 (solar panels on own roof), seem to be making a very unusual decision. Such responses should be removed from the analysis and marked as *odd ones*. This is a reasonable choice, because both programs are fundamentally the same from all points of view besides levels of trust concerns. Choosing a program with a higher level of trust concerns over a program with a lower level may be a result of sloppy or irresponsible attitude of the research participant. Only after receiving substantial amount of such responses one should look into explaining their existence.

The pattern when a household declares participation in program #1 (undisclosed solar farms) and in program #2 (familiar solar farm), but does not declare participation in program #3 (solar panels on own roof) is also a bit counterintuitive. However, since there is a substantial difference in form between programs #1 and #2 on the one hand, and program #3 on the other, it is easier to accept this choice as reasonable. For example, such a person might have strong aesthetic reservations about solar panels. Households displaying this pattern of answers will be called *Trusting Odd Participants (abbreviated as TOP)*.

Households displaying a similar pattern of answers, declining participation in program #1 (undisclosed solar farms), declaring participation in program #2 (familiar solar farm), and declining participation in program #3 (solar panels on own roof), will be called *Not Trusting Odd Participants (abbreviated as NTOP)*.

Table 4.1 provides the summary of the definitions of various groups when the set of three programs described in section 4.1.3 is used.

Table 4.1 – Definitions of Household Groups According to Patterns of Participation in the Set of Three Programs

	Participation in:		
Group name	**Program #1**	**Program #2**	**Program #3**
Naysayers	No	No	No
Visibility Junkies	No	No	Yes
Trusting Good Citizens	Yes	Yes	Yes
Not Trusting Good Citizens	No	Yes	Yes
Trusting Odd Participants	Yes	Yes	No
Not Trusting Odd Participants	No	Yes	No
Not accepted odd cases	Yes	No	Any answer

With the above definitions in mind, one can clearly describe how to test the hypotheses with the set of three programs.

4.1.5.1 A Note on the Choice of Names

The names of groups of prospective program participants (Good Citizens, etc.), were not meant to be any kind of value judgement on households who decided not to participate in any program, or who decided to participate for various reasons. These are playful names based on some common stereotypes, handy terms created to simplify discussion about the researched topic. They should not create any bias for the research. The names were not used in any communication with the research participants.

4.1.6 How to Test the Hypotheses with the Set of Three Programs

Answers to the questions proposed in section 4.1.4 that reveal willingness to participate in a program or lack of willingness, are the material used to test the hypotheses.

4.1.6.1 Testing the First Hypothesis

Finding households that declare participation in program #2 (familiar solar farm) but not in program #1 (undisclosed solar farms) would confirm the first hypothesis. Both programs have a low level of visibility, so any difference in participation should be due to significantly different levels of trust concerns that they raise. The group that one must find consists of Not Trusting Good Citizens and Not Trusting Odd Participants, as defined previously. The fact that someone did not chose to participate in programs involving solar panels on local roofs does not influence the test of the first hypothesis.

To measure the strength of the effect, one needs to compare the number of Not Trusting Good Citizens and Not Trusting Odd Participants, to the number of Trusting Good Citizens and Trusting Odd Participants.

4.1.6.2 Testing the Second Hypothesis

Finding households which declare participation in program #3 (solar panels on own roof) but not in program #2 (familiar solar farm), that is, Visibility Junkies, would confirm the second hypothesis. Both programs raise a low level of trust concerns, so this pattern of participation should be due to significantly different levels of benefits of visibility that they have.

To measure the strength of the effect, one needs to compare the number of Visibility Junkies to the number of Trusting and Not Trusting Good Citizens.

4.1.7 Final Phase of the Study Design - the Set of Four Programs

Questions about the three previously presented green electricity programs were not the final structure of the inquiry conducted among Oakville households. There was an additional problem that had to be handled – installation of solar panels on someone's roof can be a source of concerns on its own. It is not possible on every roof, and it might not be welcomed on every roof.

4.1.7.1 Concerns about Solar Panel Installation on Own Roof

Six particular concerns were identified:

- Concern that the roof does not have enough sun exposure.
- Concern that the roof structure does not have enough strength to support solar panels.
- Concern that the construction work required to install the solar panels on the roof could cause damage to the house or its landscaping.
- Concern that the roof might leak after the solar panels are installed on it.
- Concern that the solar panels would affect the appearance of the property negatively.
- Concern that the neighbours might not like the solar panel installed on one's roof.

If these concerns were not corrected for, one could end up with some Trusting and Not Trusting Good Citizens not choosing program #3 (solar panels on own roof) because of the concerns, and being misclassified as Odd Participants. At the same time, some Visibility Junkies would not choose program #3 because of the above concerns, and would be misclassified as Naysayers.

4.1.7.2 Final Set of Programs Used in the Study

To solve the problem posed by concerns related to installation of solar panels on the participant's roof, in addition to the three already described programs, a fourth program was introduced. A fourth question about participation in this program, analogous to the questions described in section 4.1.4, was added to the previous three.

The additional program has the following description:

Program #4: Solar electricity delivered from a set of solar panels installed on a municipal or community building roof in Oakville.

Similar to program #3 (solar panels on own roof), this program has a *low level of trust concerns*. Even though connection to the management and business details are not provided, it is relatively easy for a prospective participant to estimate costs and profits of parties involved. If they choose so, participants can go and see the panels being installed; therefore the issue of improper spending and especially cheating, is not serious. The issue of how close the levels of trust concerns are for this program and program #2 (familiar solar farm) raises the same kinds of problems as the ones mentioned in section 4.1.3 for program #3 (solar panels on own roof). Further discussion of this issue can be found at the beginning of section 4.2.

Benefits of visibility for this program are high, but not as high as for program #3 (solar panels on own roof). In order to enhance them, the program includes the option of placement of a customized, aesthetically-pleasing and visible lawn sign in front of the participant's house, informing the public about participation. Additionally, the participants would be able to have a plaque with their names placed on the building where the panels would be located, to further mark their contribution. These two options should enhance the bragging and influence aspects of benefits of visibility. To enhance the fascination with technology aspect, the current power output of the sponsored system and other interesting statistics would be made available for the participant to view on a dedicated website. To increase the bragging and influence aspects, at the participant's request the website could be made accessible for family and friends.

4.1.7.3 Groups of Households According to Patterns of Participation in the Set of Four Programs

For clarity reasons, the detailed discussion of the working model of behaviour and the division into groups of households was conducted with the set of three proposed programs. Introducing program #4 (solar panels on roof in community) does not change the situation very much. Table 4.2 provides an update of the definitions of various groups in which the set of four programs is used. These are the final definitions which will be used throughout the rest of this text.

Table 4.2 – Definitions of Household Groups According to Patterns of Participation in the Set of Four Programs

	Participation in:		
Group name	**Program #1**	**Program #2**	**Programs #3,#4**
Naysayers	No	No	'No' to both
Visibility Junkies	No	No	'Yes' to at least one
Trusting Good Citizens	Yes	Yes	'Yes' to at least one
Not Trusting Good Citizens	No	Yes	'Yes' to at least one
Trusting Odd Participants	Yes	Yes	'No' to both
Not Trusting Odd Participants	No	Yes	'No' to both
Not accepted odd cases	Yes	No	Any answer

4.1.8 Test of the Hypotheses with the Help of the Participation Numbers in the Four Proposed Programs

Answers to the four questions in the form proposed in section 4.1.4:

"If it were the only option offered, would you participate in program #X?"

which reveal willingness to participate in each of four programs or lack of it, are to be the material used to test the hypotheses in the final version of this survey.

4.1.8.1 Testing the First Hypothesis

As in the case of the three programs, finding households that declare participation in program #2 (familiar solar farm) but not in program #1 (undisclosed solar farms) would confirm the first hypothesis. The group that one must find consists of Not Trusting Good Citizens and Not Trusting Odd Participants.

To measure the strength of the effect, one needs to compare the number of Not Trusting Good Citizens and Not Trusting Odd Participants, to the number of Trusting Good Citizens and Trusting Odd Participants.

$$\text{Strength of influence of level of trust concerns} = \frac{\text{Not Trusting Good Citizens} + \text{Not Trusting Odd Participants}}{\text{Trusting Good Citizens} + \text{Trusting Odd Participants}}$$

4.1.8.2 Testing the Second Hypothesis

Also, as it was in the case of the three programs, finding the existence of Visibility Junkies, would confirm the second hypothesis.

To measure the strength of the effect, one needs to compare the number of Visibility Junkies to the number of Trusting and Not Trusting Good Citizens. All the reasons why not to include Trusting and Not Trusting Odd Participants in the analysis are as valid now as they were in case of the three programs.

$$\text{Strength of influence of level of benefits of visibility} = \frac{\text{Visibility Junkies}}{\text{Trusting Good Citizens} + \text{Not Trusting Good Citizens}}$$

4.2 Additional Inquiries about Trust Concerns, Benefits of Visibility, and Concerns Related to the Installation of Solar Panels on Participant's Roof

The proposed way of testing the hypotheses through the participation numbers in the set of four programs is not an exact science. The levels of trust concerns for programs #3 (solar panels on own roof) and #4 (solar panels on roof in community) might be lower than for program #2 (familiar solar farm). The difference may be significant enough to cause some of the people who refuse participation in program #2 because of trust concerns, to declare participation in at least one of the two 'visible' programs, just because of their low level of trust concerns, and not because of the benefits of visibility. They would however, be defined as Visibility Junkies, and count towards the combined participation in 'visible' programs, exaggerating the effect of visibility.

There is no further way to correct for this effect by analysis of the participation numbers in the four proposed programs. However, a declared participation pattern assumes possession of certain opinions with regards to levels of trust concerns and benefits of visibility of the proposed programs. A Trusting Good Citizen should be rather trusting in the good intentions of the green electricity program providers. A Not Trusting Good Citizen should be not trusting (or trusting to a lesser degree than the members of the previous group). By the same token, a Visibility Junkie should have a high level of appreciation for benefits of visibility of the green electricity program to be considered a true Visibility Junkie. There are limits to this kind of data analysis as well, but they could give important insights into the results of the analysis based on declared participation in the four proposed programs. It therefore makes sense to ask questions about research participants' general opinions of the trustworthiness of the green electricity programs providers, and about research participants' levels of appreciation for the benefits of visibility of the green electricity programs.

Besides helping to clarify the results of the research, these questions can also be used to confirm general correspondence between participants' membership in one of the groups defined by a participation pattern, and their actual expressed opinions on the topics of trust concerns and appreciation of benefits of visibility. While this correspondence does not have to be present for every member of the group, it is rather natural to expect that on average, Trusting Good Citizens should report more trust in the good intentions of the green electricity program providers than Not Trusting Good Citizens, or that on average Visibility Junkies should report more appreciation for benefits of visibility than any of the other groups. Seeing this correspondence is an additional confirmation of the consistency of the results of this study.

In addition, since the questions will be asked of all research participants, they could provide additional benefit, gathering information about trust concerns and appreciation for benefits of visibility related to green electricity programs, for the investigated population as a whole.

From the same perspective, it makes sense to ask additional questions about concerns related to the installation of solar panels on one's roof. Even though answers do not confirm or refute the hypotheses, they can indicate if those who chose program #4 (solar panels on a roof in the community), but not program #3 (solar panels on own roof), had more intense concerns about the installation of solar panels on their own roof. To be consistent with the expected behaviour, those concerns should be more intense.

In addition, by asking these questions one can learn about the intensity of concerns related to the installation of solar panels on one's roof in the entire studied population. As this subject is not well researched, this becomes an additional benefit of the study for understanding the barriers to the diffusion of the solar electricity generation.

Thus, in the final version of the study design, it was decided to include an additional set of questions about trust concerns and appreciation for benefits of visibility related to green electricity programs, and about concerns related to the installation of solar panels on one's roof. The additional cost of doing so was minimal.

4.3 Choice of a Method of the Study

As discussed in this chapter, there are two ways of conducting this study. Either a real life situation can be encountered or created, in which participants actually decide whether to sign up for the real program, or a hypothetical situation is presented to participants, and questions are asked about their willingness to sign up.

If one were able to find a real life situation, in which the four described programs were offered in four very similar communities, an unobtrusive study could be performed by analysing program providers' data. Since only the participation data would be analysed and no direct behaviour observations would be necessary, quantitative observational study would not be needed here.

If one had enough means and time to arrange the four programs and introduce them to a certain population, and then measure the response in the form of number of participants, one could consider such study an experimental research, as "at the most basic level, experiments involve (1) taking action and (2) observing the consequences of that action." (Babbie, 2008, p.245).

However, for practical reasons, the choice was made to present four hypothetical programs to a selected sample of the population, and test the hypotheses by asking a standard set of questions with short, standardized answers, that make the results uniform and easy to analyse quantitatively. In order to be able to draw any valid conclusions from such analysis, it is important to have a random sample from the studied population.

Because one needs to ask questions, this research setup requires an interactive method of inquiry. In general, one could consider a survey, an in-depth interview, or a focus group. Only the first method – a survey – seems to fulfil the needs of this study. An in-depth interview, applicable rather to qualitative research, would be too extensive for the simple purposes of this study. Secondly, "qualitative interview is an interaction between an interviewer and a respondent in which the interviewer has a general plan of inquiry ... but not a set of questions that must be asked" (Babbie, 2008, p.335). This contradicts the requirement of standardized questions and answers needed for hypothesis testing. Focus groups, also more applicable to qualitative research, run the risk that "participants ... are not likely to be chosen through rigorous, probability sampling methods." (Babbie, 2008, p.338)

It is clear then, that it is the survey research method that should be employed in this study. It allows asking a standardized set of questions in a uniform and efficient way, making it possible to draw statistically valid conclusions about a population as large as Oakville. Babbie (2008, p.270) states that "survey research is probably the best method available to the social scientist interested in collecting original data for describing a population too large to observe directly." He further remarks: "surveys are also excellent vehicles for measuring attitudes and orientations in a large population."

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The methodology discussion conducted in this chapter led from the issue of choice of suitable contrasting green electricity programs, through the study implementation options, to the choice of the survey as a research method. In the next chapter, implementation of this research method will be presented.

Chapter 5: Method

As discussed in chapter 4, it was decided that this study should use a survey as a research method to test the proposed hypotheses. This chapter presents all the details of how the implemented version was created. First, the discussion centres on the choice of the survey mode. Next, the questionnaire design is described. Finally, the survey implementation procedures are discussed.

Before deciding on one of the four basic modes of survey: face-to-face interview, telephone interview, mail survey, and internet survey (or even mixed-mode survey in which several of those basic approaches are used simultaneously), various sources of total survey error were considered. This analysis, combined with the assessment of general difficulties in conducting surveys and assessment of resources available to this particular research project, informed the decision of which mode to choose.

5.1 Total Survey Error

Dillman et al. (2009, pp. 16-17) nicely summarize the job of conducting a reliable survey in one sentence: "Reducing survey error means selecting the survey mode or combination of modes that provides accurate coverage of the entire population (low coverage error) and from which a large enough random sample of the desired population can be drawn (minimizes sampling error), designing an implementation system that encourages most people in the sample to respond (reduces nonresponse error), and approaching respondents in the contacts and the questionnaire itself in a way that encourages and enables them to provide thoughtful and honest answers (decreases measurement error)." The process that can be described in this one sentence is not an easy task, however. Just interviewing randomly met people, or calling a random sample from the telephone book, or mailing (e-mailing) a questionnaire to a large list of addresses with the hope that the small percent who do answer will satisfy the requirements of statistical analysis, is not the right way to conduct a survey. As mentioned above, four kinds of survey error must be considered in all aspects of the survey design and execution.

5.1.1 Coverage Error

All members of the targeted population should have a known, nonzero chance of being selected in the sample drawn for the survey, unless those who are excluded are not different from the rest on measures that are significant to the study. Failing to do so creates coverage error. Two of the most common situations in which coverage error arises are when the chosen survey mode does not cover the population adequately, or when the list from which the sample is selected does not contain all members of the population.

5.1.2 Sampling Error

Sampling error arises from the simple fact that in an overwhelming majority of surveys, not every person in the population is selected. The fact that one has to sample only a small portion of the targeted population is the most important advantage of a properly executed survey. This, however, brings unavoidable statistical error, which can be minimized only to a certain degree by drawing a random sample that is large enough for the given population. If the sample is not fully random, the sampling error increases and in extreme cases becomes totally unknowable, making results invalid.

5.1.3 Nonresponse Error

The fact that not everybody from the selected sample decides to take part in the survey is the source of nonresponse error. This happens because respondents who decided to take part might differ in significant ways from those who did not, and in this way bias the resulting response.

5.1.4 Measurement Error

In order for the results of the survey to be correct, survey questions must be properly understood, and true answers must be given. This is especially difficult to achieve in self-administered surveys (mail, internet). Poorly worded questions, unclear directions about answers, and improperly designed questionnaires can cause a measurement error, which may be difficult to estimate.

5.2 The Choice of the Survey Mode for This Study

All four modes of conducting a survey were considered before reaching the final decision to use a mail survey.

Compared to the face-to-face interview and telephone modes, surveys by mail offer large time savings for the person conducting it. The immense time investment of being with each respondent during the interview is dramatically cut, and only partially counterbalanced by the time required to prepare the questionnaires and other survey materials. Also, this mode offers substantial monetary savings, compared to if one were to hire paid help for the face-to-face or telephone interviews. If, however, the two previously discussed modes were to be conducted with voluntary help or by the organizer alone, then the mail survey is the more expensive option. The costs of designing and printing survey materials, plus mailing costs, can add up to a substantial amount. This is exacerbated by the low response rates of mail surveys, which not only cause larger nonresponse error, but create the need for larger mailings to avoid unacceptable sampling error.

An internet survey could reduce some of the costs of a mail survey, such as the costs of questionnaire printing, but the mailing costs of invitations to the survey could not be avoided. E-mailing such invitations is not a viable option, since there is no existence of a complete list of Oakville residents' e-mail addresses.

There is, however, a basic problem with internet surveys that causes coverage error: not everybody has access to internet, and even if they do, not everybody is inclined to use it. Lower income, older age, and lower level of education significantly reduce the probability of internet usage (Dillman et al., 2009, p.8), and would affect the outcome of the survey conducted for this study.

Finally, a seeming advantage of the ease of response to the internet based questionnaire over the mailed one is brought into question by the research done by Don Dillman and his associates. In their mixed mode survey conducted in 2007 in a small metropolitan region of northern Idaho and eastern Washington, they found the mail response to be significantly higher than the web response. (Dillman et al.,2009, pp.234-236).

To reduce the costs of the mail survey, door-to-door delivery of the survey materials, and their pick up from the survey participants was briefly considered. However, finally financing for this research was secured from a lucky lottery winner, and a proper mail survey routine with postal mailings and stamped return envelopes was implemented.

In the following sections, all the implementation details of this mail survey are explained. While Babbie (2008) and Palys (2003) offer extensive treatment of survey techniques, the majority of the information presented in this chapter comes from Dillman et al. (2009). Their book provides very thorough and up to date knowledge on mail surveys, and Don Dillman was strongly recommended by the University of Waterloo Survey Research Centre as the best source of survey advice.

5.3 The Tailored Design Method

Dillman et al. (2009) ground their survey practice in what they call the *tailored design method*, based on social exchange theory. Social exchange theory puts forward the hypothesis that motivation for a person's voluntary actions comes from the expected return those actions bring or might bring from others (Blau, 1964 as quoted in Dillman et al., 2009). There are three elements involved in a social exchange: rewards one expects to gain, costs one expects to suffer, and trust one has that the other side will deliver the promised reward. Unlike economic exchange, the social one does not necessarily involve an exchange of money and exact terms of delivery. Rewards and costs can be of various kinds, and the time when rewards are provided can be vague.

Social exchange can be used in the survey design to motivate the participants to respond. This technique is not only powerful in the survey application, but also very efficient, because the rewards that need to be provided are small (from the monetary point of view). Dillman et al. (2009) provide detailed information on the tailored design method. The survey design for this research project followed this advice in two crucial areas: questionnaire design and interactions with the participants.

5.4 General Overview of the Questionnaire Design for This Thesis Survey

The questionnaire design process for the survey conducted as part of this thesis went through several stages. It co-evolved with the development of insights on methodology, described in chapter 4. Its final version, implements four program mode and related set of questions about participation to test the hypotheses, as discussed in sections 4.1.7 and 4.1.8. In addition, the questionnaire asks about trust concerns, appreciation of benefits of visibility, and concerns about installation of panels on one's roof in accordance with the analysis performed in section 4.2.

The questionnaire consists of three distinct segments. The first introductory segment provides thorough descriptions of the green electricity programs used for comparison of willingness to participate. Such thorough description is provided because the participants are asked questions about their reactions to certain imaginary situations, and they need to be properly familiarized with these situations in order to be able to give informed answers. The second segment contains questions about participation in the programs described in the first segment. Finally, the third segment contains questions about trust concerns, appreciation of benefits of visibility, and concerns related to installation of solar panels on the participant's roof.

The final version of the questionnaire is presented in Appendix A – Questionnaire and Communications with the Participants.

5.4.1 The Initial Segment of the Questionnaire that Provides Information about Proposed Green Electricity Programs

The introductory segment is two pages long. The first page contains general information that relates to all of the programs. The second page contains descriptions of the three (of four) green electricity generation support programs chosen for the research. As discussed in chapter 4, this study presents participants with four such programs. However, the descriptions of two of them are quite similar – supporting delivery of solar electricity from (1) remote solar farms and (2) from a particular solar farm, of which senior management is personally known by the participant (program *with* personal connection). In order to avoid repetitiveness, the description of the solar farms program *with* personal connection is placed within the second segment of the questionnaire, as part of one of the questions about willingness to participate (question A1).

5.4.1.1 General Terms of the Proposed Programs

For all of the proposed programs, it was decided that the required monthly payment would be 25 dollars. By providing this amount of financial support, the participant would enable the delivery (on average) of 370 kWh of solar electricity per month to the Ontario power grid. The participant would be asked to remain committed for a minimum of two years, with the requirement of one year's notice to withdraw from the program at any time following that initial two year period.

The amount of solar electricity provided to the grid (370 kWh per month) was estimated for a 4kW solar panel system with the help of RETScreen software, provided by the Canadian government. It was decided that a solar panel system of this size would be used by programs proposing the installation of solar panels on participants' roofs, or on roofs in the community. Naturally, to be equivalent, the same amount of electricity would go into the grid if the participant had chosen a solar farm program.

The payment of $25 per month was, for the sake of equivalency, made identical to the average monthly household payment in the Bullfrog Power program, according to the claims from their website (www.bullfrogpower.com). It is difficult to calculate what the real costs of the program for the organizer would be. One attempt is presented in Appendix E – Example 2. However (as the author realized after the fact), for the 370 kW of electricity supplied by remote solar farms, a payment of $25 per might be too small. Aside from the practicalities of finding solar farm generated electricity available for delivery to Ontario grid in year 2011, its cost would probably be much higher than Bullfrog rates, because Bullfrog Power delivers wind generated electricity, which is cheaper than solar.

It is important to understand however, that the terms of the proposed programs do not have to be very close to realistic conditions. Since survey participants are asked questions about hypothetical situations, which do not lead to a real contract, details of the programs must only roughly represent the economic reality, just enough to maintain credibility and to fulfill the research purposes.

5.4.1.2 FIT Program Interference with the Study

As mentioned in chapter 1, the creation of the FIT program in Ontario interfered somewhat with this research. It seemed on the surface, that if the government of Ontario was prepared to pay quite generous rates for the electricity generated by solar panel systems installed on private or business roofs, then the studied green energy support programs did not make sense any more.

The majority of the survey participants probably would not be aware of the FIT program and its benefits, but the study could not assume this. Fortunately (for the study), there are at least four major limitations to participation in the FIT program that apply to the research setting considered for this study:

- Lack of own capital to invest in the installation of a solar panel system.
- Inability to commit for a period of time long enough to realize FIT benefits.
- Low rate of return for small systems fitting average residential roofs, which does not justify costs of borrowing the capital.
- Not owning, but renting one's residence.

All of these reasons were explained in the cover letter sent with the questionnaire, and on the first page of the introductory segment of the questionnaire used in this research.

5.4.1.3 Program Descriptions

The second page of the introduction to the questionnaire contains descriptions of the solar electricity generation support programs that the respondent is to consider.

Program 1 is an implementation of a green electricity program characterized by high levels of trust concerns and low levels of benefits of visibility. Program 2 is an implementation of a green electricity program characterized by low levels of trust concerns and high levels of benefits of visibility. Lastly, program 3 is an implementation of the second option of the green electricity programs, characterized by low levels of trust concerns and high levels of benefits of visibility. This second option is an alternative for respondents with a high level of concerns about the installation of solar panels on their own roofs.

The program descriptions that were used in the research can be found in Appendix A.

5.4.2 The segment of the Questionnaire Titled “Part 1” that Contains Questions about Participation in Proposed Programs

Pages three and four of the questionnaire contain questions about participation in the proposed programs (see Appendix A). The four questions A, A1, B, and C are the core of the questionnaire. The answers to those questions are used to divide the respondents into the categories described in the Methodology chapter.

Before the proper questions start, an introductory question determines if the respondents should be answering those questions at all. It was decided that it does not make sense to ask the questions about participation to people:

- Who already take part in programs of voluntary financial support for the green electricity generation (for example, Bullfrog Power program), because their decision would be affected by their already existing involvement; not too many people can be expected to take part in two such programs at the same time.

- Who have solar panels installed on their roofs already, because they simply might not have space on their roof. Also, their decision to take part in the proposed programs could be negatively affected by the fact that they have already invested a sizable amount of money in the existing panels.

- Who already entered into a contract to have panels installed on their roofs (for example, to take part in the FIT program), because of the same reasons as above.

Respondents who fall into any of the above categories are asked to skip questions about participation in the proposed programs contained in the questionnaire segment titled “Part 1”, and go directly to the segment titled “Part 2”. Their answers about issues from Part 2 do not contribute to testing the hypotheses of this study, but nevertheless are a valuable research material.

5.4.3 The Segment of the Questionnaire Titled "Part 2", which Contains Questions about Trust Concerns, Appreciation of the Benefits of Visibility, and Concerns about Installation of Solar Panels on One's Roof

Pages five, six, and seven of the questionnaire contain questions about trust concerns, appreciation of the benefits of visibility, and concerns about the installation of solar panels on one's roof. They are marked as Part 2 of the questions in the questionnaire.

As discussed in the Methodology chapter, questions about trust concerns, appreciation of the benefits of visibility, and concerns related to the installation of solar panels on one's roof give another perspective on the classification of the respondents, according to their responses to the questions from Part 1. The function of these questions is to help check the consistency of classification of respondents by answers to questions from Part 1, with expected characteristics of the classification groups.

5.5 Testing the Questionnaire

A preliminary version of the questionnaire was tested in November 2010, by presenting it to several friends of the author and witnessing them going through the process of reading the explanations and answering the questions. Altogether, seven people took part in the testing phase – three couples and a single parent. All of them were Oakville homeowners with various outlooks on environmental issues.

All test participants were asked to comment on the questionnaire as they were going through it, and their remarks were immediately recorded. After the completion of the forms they were asked for more comments. The following important insights were gained from those remarks:

- The fact that the programs are about voluntary financial support and bring no monetary benefits to the participants had to be stressed much stronger.

- The need to replace some of the language that might be too technical for the general public including the word photovoltaic, which was replaced with word solar.

- The need to exclude from the set of questions about participation in proposed programs: the households already subscribing to the Bullfrog program or taking part in FIT program or having solar panels installed on their roof.

- The need for explicit informative statements that this survey also applies to participants who rent their homes.

5.6 The Office of Research Ethics (ORE) Clearance

In April 2011, all the materials to be used while conducting the survey were submitted to the Office of Research Ethics at the University of Waterloo for an ethics review, and were accepted. However, before that process officially started, consultations were held with Julie Joza, ORE Manager. From those consultations came the following changes to the questionnaire and the communication materials:

- The original version of the questionnaire was worded in such a way as to leave an impression that the described programs were truly considered for implementation in Oakville. This was done so that the research conditions more closely mimic the situation in which households in Oakville would be approached to take part in such programs for real. However, ORE considered it deceitful, and suggested that there is no strong justification for such an approach. Both sides agreed that informing participants about the fact that these are hypothetical programs would not jeopardize the goals of this research.

- Proper wording of the necessary disclaimer clauses for the cover letter and all other communication materials was worked out.

- A clearer and easier to comprehend layout of the first page of the questionnaire was suggested and implemented. This was not a research ethics issue, but rather a kind act of help on the part of Julie Joza, for which the author is very grateful.

5.7 Implementation of the General Design Guidelines for Questions and for Questionnaires

The discussion so far has concerned itself mostly with the issue of how the questionnaire implemented the research objectives. However, after this was finally settled, a rich list of guidelines included in Dillman et al. (2009) was consulted in order to create effective questions, and an effective questionnaire.

Since the advice in Dillman et al. (2009) is very thorough – it covers 170 pages of the book - it is only possible to highlight its main points in this text. As well, some of the guidelines did not apply to the questionnaire from this study. Below, some of the more interesting issues that arose at the implementation of guidelines are presented.

5.7.1. Using Specific and Concrete Words to Specify the Concepts Clearly

This guideline was applied with some notable exceptions. In Part 1, question A1 speaks about 'personally knowing a senior manager'. This statement is quite vague, as 'personally' and 'senior' might mean many things. It was felt however, that the exact meaning of the statement is not necessary, as long as it distinguishes this version of the solar farm program sufficiently enough.

In Part 2, question #1 includes a vague statement 'to waste the money', and question #2, a vague statement 'to make excessive profits'. It was considered however, that these are the statements commonly used when people criticize situations similar to the one described. Reaction to such statements could then be treated as a measure of trust concerns.

On the other hand, in question #3, cheating was clearly defined, not to leave any doubts that one might, for example, think about cheating as cheating on a spouse or cheating on taxes.

5.7.2 Using Design Properties with Consistency and Regularity

All questions from Part 1 start with a bold letter marking the sequence, and all questions in Part 2 start with bold number that has the same function. For all the closed-ended questions (and the partially closed question D), answer spaces are marked by identical ovals. For all open-ended questions (and the final comment section on page 7), the answer space is always a blank area without any graphic elements that would differ from one to the other.

The initial question that comes before Part 1 is purposely designed to look different. Its function as a radical disruptor of flow at the very beginning of the questionnaire is completely different from the rest of the questions.

5.7.3 Choosing Direct or Construct-Specific Labels to Improve Cognition

Construct specific labels require construct-specific questions. Such questions directly ask about the issue of interest, instead adding a layer that requires the respondent to 'unwrap' the question. For example, in this questionnaire, question #1 - *Are organizers of solar electricity programs, like the ones described above, likely to waste the money paid by people like you?* – is construct-specific and has a construct-specific scale as an answer ('Not at all likely to waste money' to 'Very likely to waste money'). If however, it was decided to ask the question – *Do you agree or disagree that the organizers of solar electricity programs, like the ones described above, are likely to waste the money paid by people like you?* – and then use the scale 'Strongly disagree' to 'Strongly agree', the respondents would be forced to first judge how likely it is that the money would be wasted, and then translate it into the agree/disagree scale.

5.7.4 Considering How Verbally Labelling and Visually Displaying All Response Categories May Influence Answers

After giving it some thought, it was decided to label all the response categories in closed-ended questions. In Part 1, there was no other choice, because designation as a positive or negative answer depended heavily on the choice of response categories. Not labelling the two middle choices would leave too much to the respondents' interpretation. As to Part 2, it was decided to heed the following warning from Dillman et al. (2009): "One difficulty with polar-point-labeled scales is that the meaning of the unlabeled categories is open to respondents' interpretation, and different respondents can interpret the middle categories differently, often increasing measurement error."

5.7.5 Grouping Related Questions that Cover Similar Topics

For obvious reasons, questions about program participation were separated from other questions, by grouping them into Part 1. Also questions in Part 2 were grouped into three different categories by the sequence in which they were asked. All three questions about trust concerns were asked first, all three questions about appreciation of benefits of visibility were asked next, and all questions about concerns related to the installation of the solar panels on one's roof were asked last.

5.7.6 Establishing Consistency in the Visual Presentation of Questions across Pages

In the questionnaire, all text directly related to the questions (i.e. information about the proposed programs, question stems and answer options) are printed in the same font of the same size (besides a few words in italics to stress important points). All the directions to the respondent about what they are required to do are printed in italics. The instructions about the flow of the questionnaire in Part 1 after question A are printed in smaller size italics, to make them look like an internal element of Part 1, and to maintain the understanding that the respondent is still going through this part.

5.8 Survey Implementation Procedures

All of the effort committed to proper questionnaire design would go to waste if sloppy procedures were followed during the survey implementation. The way communications with the survey participants are handled is as important as the creation of the questionnaire. The tailored design method provides several guidelines, which were consulted during the implementation of this survey. This process will be described here, based on and in the sequence presented in Dillman et al. (2009).

5.8.1 Personalization of All Contacts to Survey Participants

Personalization of contacts to participants is important from two points of view. First, it contributes to establishing trust by creating the feeling of authenticity of the survey organizer. It also helps to draw the participant out of the group, and make them feel that it is them who are called to the duty of answering the survey.

In the case of this survey, since the names of the participants were not known, the degree of personalization was limited. Still, there were important steps that were taken. Since the survey was conducted in Oakville, in all communications the participant was addressed as Oakville Resident – on the envelope, in the address at the top of all letters, and as a salutation. On the envelopes, under the participant address, the message “Re: Solar Electricity for Oakville” was placed. Lastly, in the texts of all the communications, the word Oakville was used at least once.

All communications were signed in blue ink by the author, and high quality water mark paper was used, to add a personal touch to the computer generated materials. Finally, to convey the feeling that this survey came from a real human being, the author introduced himself as a graduate student in the Department of Environment and Resource Studies at the University of Waterloo, supervised by Dr. Ian Rowlands.

5.8.2 Token of Appreciation Sent with the Survey Request

According to Dillman et al. (2009), prepaid, token financial incentives, are the second largest contributor (after multiple contacts) to improved response rates. Of all of them, cash included with the mailed questionnaire is the most effective. Not only does this strategy have a strong influence on response rates, but research is starting to show that it reduces nonresponse error by attracting participants who would not be interested in completing the questionnaire otherwise (Miller, 1996 as quoted in Dillman et al., 2009).

Token incentives use the mechanism of social exchange to encourage reciprocation by the participants. In addition, as a novel and unusual feature, they make a survey participation request stand out, and more difficult to ignore.

For this survey, a two dollar coin was used as a token incentive. The coin was attached with tape to the return envelope included in the mailed questionnaire. Initial doubts about the token incentive idea were dispelled, when a survey request from the Royal Bank of Canada came to the author's house with a toonie inside.

5.8.3 Use of Multiple Contacts

According to Dillman et al. (2009), 'multiple contacts are essential for maximizing response to mail surveys'. Each mailing is created differently, because under social exchange theory, stimuli different from previous ones receive a stronger response.

Dillman's book presents a five element contact system, but for this survey, only the first three steps were followed. Originally, a fourth step - replacement questionnaire - was planned as well, but when the first three contacts provided a response rate that was considered large enough for the purposes of this study, the idea was abandoned. The next sections describe the performed mailings.

5.8.4 The Prenotice Letter

The function of the prenotice letter is to provide a positive notice about the coming questionnaire. It is not supposed to go into much detail about the survey, but rather, by using a positive tone, aims at creating enthusiasm and anticipation. Wide research quoted in Dillman et al. (2009) shows that a prenotice letter improves response rates to mail surveys by three to six percent.

The full text of the prenotice letter can be found in Appendix A.

5.8.5 The Questionnaire Mailing

The next step is the questionnaire mailing. Besides the questionnaire itself, a standard questionnaire mailing includes a cover letter, postage-paid return envelope, and a token incentive (if provided).

5.8.5.1 The Cover Letter

The function of the cover letter is to inform the participants of job they are asked to do, why they are supposed to do it, the steps they should take, and what benefit their action will bring. The letter should be written as if communicating with a particular person in mind, in order to avoid an impersonal tone.

Below a few important fragments of the cover letter, which was used in the study, are discussed.

In the very first paragraph, the letter stresses that the participant is one of a very small number of Oakville residents who were selected for this task. This is done to increase the benefits of participation, by creating the impression of scarcity of opportunity to take part in such a survey. Also, by dispelling the illusion that there are multitudes of other people who can respond to the survey instead of the participant, this statement creates an additional pressure to act.

A request is made that the questionnaire be completed by the person or persons responsible for the financial decisions in the household. This very specific demand is important from a research point of view. If, for example, one asked for an adult who has had the most recent birthday to complete the form, as is often done in surveys, it could mean the choice of a person who would not have anything to do with the household decision to participate in one of proposed programs, if they were actually proposed. Adult children of the family, or live-in retired seniors, usually do not sign the household up for a program to have solar panels installed on the house roof. It might not even be one person, but rather the couple living in the house, who would make the decision in the real situation.

The participant is asked to return the completed questionnaire in the self-addressed, stamped envelope, "as soon as possible". The vague time limit is put here purposely. At first, the idea was entertained that a short deadline to send the questionnaire back prevents participants from procrastinating. However, a request to send the questionnaire back within a short period of time (for example, two weeks) would be contradicted by the fact that a replacement questionnaire would arrive between three and four weeks after the first mailing. The solution to include a longer, for example five or six week, deadline, would not work as procrastination prevention. Having a concrete deadline also means that some people might open the envelope after the requested date, and come to the conclusion that it is too late to answer the survey (as was witnessed by the author when the earlier mentioned Royal Bank questionnaire mailing was opened by his son, to whom it was addressed, two days after the requested deadline). Since this research did not have a tight deadline and responses could be received even four or five months after the questionnaire mailing, it was decided to put a vague "as soon as possible" deadline in the cover letter.

The letter further explains that each questionnaire is numbered on the back, and that this is done so that the organizer can check participants' addresses off the mailing list when their questionnaire is received, and therefore, no reminder would be sent. This refers to the replacement questionnaire mailing that was initially planned for this survey. The disclosure is necessary to create the impression that no tricks are played behind the participants' backs, with the help of a strange number that appears on the blank eighth page of the questionnaire. However, to build trust further, the participant is assured that the list of addresses will be destroyed at the completion of the study, and no one other than the researchers has access to this list.

It might seem trivial, but the presence and nature of the 'small token of appreciation' is briefly explained, so that the participant is not confused by the quite unusual presence of a two dollar coin in the mailing.

The full text of the cover letter can be found in Appendix A.

5.8.5.2 Stamped Return Envelope

Social exchange theory suggests three functions of a stamped return envelope. It reduces the financial and time burden of participation to the respondent. It creates the impression that the survey is important. And finally, attaching a real postage stamp is a gesture akin to a token incentive, because the participant could possibly use the stamped envelope to mail something else.

Dillman et al. (2009) argue that the use of real stamps is superior to business reply envelopes, and improves response rates by a few percent. Not can only stamps play a role similar to a token incentive, but also for many people, a cultural barrier exists against throwing out something of a monetary value. For these reasons, it was decided to use real stamps on return envelopes for this survey, even though using University of Waterloo business reply envelopes might have reduced the costs.

5.8.6 Thank You Postcard

The function of a thank you postcard is to jog the participants' memory, rather than try to overcome their reservations about completing the questionnaire. It is supposed to reach the participant about a week after the questionnaire mailing, when the memory of receiving the questionnaire is still fresh, and it is still easy to locate the survey (if it has not been mailed back already).

There is a reason why the first sentence of the postcard sent as a part of this survey informs the participant that a questionnaire was mailed. It seems like a waste of space, but some participants might not have received the previous mailing yet, or somebody else in the household might have opened the letter but did not give it to the proper person.

The next two sentences carry the main message, thanking those who already responded and repeating the main instruction about responding to those who have not. This twofold message is necessary, because the postcards are sent to every survey participant. Just one week after the questionnaire mailing, it is likely that none of the responses would have arrived yet.

The full text of the thank you postcard can be found in Appendix A.

5.8.7 Reminder Letter with Replacement Questionnaire

According to Dillman et al. (2009), two to four weeks after the thank you postcard mailing, the next reminder should be sent to the participants who have not yet responded. Together with the reminder letter, a replacement questionnaire and a postage-paid return envelope should be sent. As was mentioned previously, this survey stopped at the thank you postcard reminder. However, a reminder letter, which is part of replacement questionnaire mailing, was prepared and went through the ORE approval, together with a slightly altered replacement questionnaire. The full text of the reminder letter and the first altered part of the replacement questionnaire can be found in Appendix A.

5.8.8 Timing of Mailings

The timing of all the mailings is an important matter. The questionnaire mailing should be done about one week after the prenotice letter, when the event of receiving it is still in the memory of the participant. Similarly, the thank you postcard sent to all participants should follow the questionnaire mailing within about a week, so that receipt of the questionnaire is still in a fresh memory, and the letter can be easily located in the house. Its twofold message (thank you if you did answer, please respond if you did not) should not be annoying to those who already sent the questionnaire back.

The reminder letter with a replacement questionnaire should be sent after a period long enough to collect the first, and always the biggest wave of responses. The mailing should be sent only to those whose responses have not been received. This way the danger of annoying the participants who already answered is minimised. In order to be able to cross off those who sent a reply from the mailing list, one must assign an individual number to each questionnaire to identify participants.

Since the reminder letter mailing was originally planned, unique numbers were assigned to each questionnaire. These were placed on the last (eighth) page, which was otherwise left blank. Numbers ranged from 1 to 100 and were written in five different colours, to uniquely mark the 500 questionnaires that were sent. It was reasoned that if the participant would see, for example, number 450 on the questionnaire, they would come to the conclusion that there are at least 450 participants, and possibly more. Seeing, for example, number 85 on the questionnaire, would give a much weaker basis for assuming such a large number of participants, and left the possibility open that the number of participants was perhaps just a hundred. The smaller the imagined group was, the bigger the motivation to respond was expected.

Although the reminder letter mailing was not performed, the assigned numbers were useful in the analysis of how well different parts of Oakville were represented within the group of participants who decided to respond.

The period in which the mailings were sent was carefully considered. The survey was ready for implementation at the beginning of July 2011. The decision had to be made if the mailings should happen in summer or in the fall. On one hand, it was considered that summer was the time when kids were out of school and families might be away on vacation. Therefore, waiting until September would be advisable. On the other hand, it was considered that while kids have their summer off, parents usually work and do not take more than two weeks of vacation at a time. Sooner or later then, they would be present when one of the mailings came. Further, summer might be a more relaxed period in people's lives, so they would actually have more time to complete a questionnaire. In addition, many retired residents of Oakville who live in its wealthier neighbourhoods could already be away in Florida during a colder part of the year. The final decision was to start the mailings on July 21, 2011, so that the reminder letter mailing, which was to be sent on August 30, 2011, could target those who were away with kids in the summer for a longer period of time.

5.8.9 Making Sure Mailings not Mistaken for Junk Mail

One of the biggest mail survey problems is to avoid having its mailings treated like junk mail, i.e. to have them end up unopened in a recycle box. In order to stand out, but still look business like, the letter mailings were sent in white #10 business envelopes, with participant and return address, and university logo printed in plain black ink on a jet ink printer. This gave the envelopes a certain austere look, which avoided the slickness of typical junk mail. The overall goal was to make the letter look serious, but not too professional. In addition, the University of Waterloo logo was made very visible by the large font used to print it. Finally, a regular postage stamp was used, which was another element distinguishing the letter from the majority of junk mail.

5.8.10 Decision on a Number of Survey Participants

During the budgeting conducted before the start of the survey implementation, it was realized that a maximum of about 500 complete mailings could be afforded. The question remained if it was necessary to contact this many participants. In order to acquire a better judgement, a table from Dillman et al. (2009, p.57), of completed sample sizes (i.e. numbers of completed questionnaires received) needed for various population sizes at three confidence intervals for the 95% confidence level was consulted.

To use the table, the surveyed population size had to first be estimated. The surveyed population in this study consists of Oakville households that occupy detached and semi-detached houses. According to (city-data.com, 2012), in 2006 Oakville had 56,528 private occupied dwellings. 64.5% of them were single detached houses and 4.3% were semi-detached houses. All together, in 2006 the number of households targeted in this survey was 38,890. Since Oakville is a fast growing town, in 2011 that number must have been noticeably larger, but a quick look at the consulted completed sample sizes table revealed that for a confidence interval down to ± 5%, a survey population size above 2000 did not significantly change the completed sample size required. For a confidence interval of ± 3%, the completed sample size stabilized above survey population size of 20,000. Therefore, it was decided that 39,000 can be assumed as low estimate of the surveyed population size, without any negative consequences. Data from Dillman et al.'s (2009, p.57) table for population of 40,000 were used to make a decision about the number of survey participants (see table 5.1).

Further research conducted in 2012 revealed that according to a 2011 census, Oakville had 39,455 detached houses and 2570 semi-detached houses – together 42,025 dwellings of interest to this study (Stats Canada, 2012b).

Table 5.1 – Completed Sample Sizes (i.e. Numbers of Completed Questionnaires Received) Needed for a Population Size of 40,000, and at Three Confidence Intervals, for the 95% Confidence Level. Based on Dillman et al. (2009, p.57)

	Confidence interval		
Split	± 10%	± 5%	± 3%
50/50	96	383	1040
80/20	61	245	672

‘Split’ in table 5.1 means the expected division of the surveyed population based on a given answer to a question. For example, if one expects responses of a particular population to be evenly divided between two answer options to a question (which is the most conservative assumption), then the assumed split is 50/50. If, however, one has reasons to expect that only a small part of the population will choose one of the answer options, an 80/20 (or some other) split can be chosen. This decision influences the size of a required sample.

Looking at table 5.1, one can see that to reach a + 10% confidence interval, one needs to have between 61 and 96 completed questionnaires, which is quite a low number. Actually, since the surveyed population is to be divided into at least four groups (Trusting Good Citizens etc.), and one expects Naysayers to be a dominating group comprising close to 80% of the respondents, an 80/20 split is more applicable, with its requirement for 61 completed questionnaires. Hoping for at least a 30% response rate, one can calculate that only about 200 participants need to be contacted.

However, with a more optimistic result of a 49% response rate and 500 participants contacted, one could reach a much better confidence interval of ± 5%. Alternatively, with 500 participants and a quite low response rate of 12%, one could at least achieve a still reasonable ± 10% confidence interval.

Ultimately, the decision was reached to contact 500 participants, hoping for a good response rate, but hedging the possibility of a dismal one.

5.8.11 Selection of Participants

After the theoretical and preparatory work had been done, in July 2011 the mailings of the survey began. In order to do that, one had to create a mailing list that would contain 500 Oakville addresses selected at random, in such a way that all single detached and semi-detached homes in Oakville had an equal chance of being selected, while other kinds of dwellings would be completely excluded.

In the ideal situation, one would use a list of all addresses in Oakville, with types of dwellings marked on it. One would perform a random walk down such a list until one would select 500 addresses of the desired kind. If types of dwellings were not marked on such an ideal Oakville address list, one could check the selected addresses with the help of a GIS tool that shows an aerial image of Oakville streets, with enough magnification that single detached and semi-detached housed are distinguishable. For example, one could use Google maps in their 'satellite' mode.

However, the above mentioned Oakville address list was not available to the author. Instead, a complete list of Oakville streets was used. It was located on the back of an "Oakville Community Map 2011", distributed free of charge by the Town of Oakville. Theoretically, one could use this list to create a list of all Oakville addresses of single detached and semi-detached houses, by checking street house after street house with the help of Google maps, but that would be an enormous job. The more practical way, which was actually followed, is to choose 500 streets at random from the list of Oakville streets, and then choose a dwelling on each street randomly, while making sure that it is of the desired type.

The following procedure was then established:

- Go by random intervals down the list of Oakville streets.
- Focus a GIS tool on the selected street.
- Select a dwelling on the street at random.
- Check if it is a single detached or semi-detached house.
- If it is not, make another random selection.
- If it is, find the postal code, place the address on the mailing list, and go back to the list of streets to do the next step of the random walk.
- Finish when the mailing list is 500 addresses long.

5.8.11.1 Selection of a Street

Before the random selection, the original list of Oakville streets from the "Oakville Community Map 2011" was modified, by removing from it streets that were known (by the author) not to have any residential dwellings. Then, long streets that traverse the whole town were divided into four equal sections, and the streets that traverse about three quarters of the town's width or length were divided into three sections, and the streets that traverse about half of the town's width or length were divided into two sections. Each of these created sections were added to the list where the sole name of the street was previously located. The list had an alphabetic order, and included close to 1300 streets or street sections.

When preparatory work was complete, starting from the top of the list, the first street was chosen by throwing a die and counting the rolled number down the list. Then the die was rolled again, and a jump was made according to the rolled number. This was continued until 500 addresses were found. Instead of choosing subsequent streets by die roll, one could do a systematic sampling by traversing the list at equal intervals after the initial random choice (Babbie, 2008, p.224). This can be done, because one can safely assume that the Oakville streets listed in alphabetic order do not follow any internal pattern from the point of view of geographical location of the street in Oakville (i.e. naming of the streets in Oakville is not done in such a way that, for example, every third street from the alphabetic list is in the south-western part of the town). By adjustment of the stepping interval, in theory, systematic sampling could traverse the whole list just once, but in our case, the interval would have to be 2.6 (1300 divided by 500), which was not practical and would require some variation of a step. On the other hand, since a step rolled by die had an average length of 3.5, it provided almost two full traverses of the street list (1300 divided by 3.5 is 371 of streets per one full traverse). The die rolling method was selected, because it made a tedious task of street choosing less boring. As expected, it took almost two traverses of the whole list to select 500 addresses. The streets that were selected during the first traverse were removed from the list before the second one.

5.8.11.2 Selection of an Address on the Street

To assist with the selection of a street address when the street name was chosen, a GIS tool provided by the Town of Oakville was used. Labelled "GIS – Explore Oakville" and available at http://explore.oakville.ca/maps/ , this interactive map is much better suited to the purpose of mailing list assembly than Google maps. Not only does it provide better picture resolution, because the aerial photographs are done from low altitude airplane fights instead of satellites, but it also has several search tools that help extract needed information.

The "Explore Oakville" search tool provides all the street addresses for a chosen street. When one selects an address, the map zooms in on the proper part of Oakville, and the property is marked by a big blue dot. One can zoom in further on the selected address, and quite easily judge if it is a single detached or semi-detached house. The main task is then to select an address randomly, in order to avoid a situation where, for example, corner houses or houses in the middle of the street are overrepresented.

The following system of random selection was applied to select the street address:

- For the first street, the die was rolled and the rolled number was counted down the street addresses list generated by "Explore Oakville".
- If the property was of a desired type, the address was placed on the mailing list and another street was chosen from the street list.
- If the selected property was not of desired type, the whole street was looked at, and if it turned out that it did not contain any properties of a desired type, another street was chosen from the street list.
- If however, the chosen street had properties of the desired type, the dice was rolled again, and the rolled number was counted further down the addresses list. This procedure was continued until a property of the desired type was selected, in which case the address was placed on the mailing list and another street was chosen from the street list.

- The rolled numbers were added as this process went forward, so that when address selection moved to another street, the random choice reached deeper into the street. Were one to travel down the street address list only to the extent of one die roll (maximum 6), the addresses selected would have always been close to the beginning of the street, and this would cause a bias. To avoid the counting becoming too long, the total was reset at 50. This way, some short streets had their address list traversed more than once, while long streets had a chance of address selection far away from the beginning of the street.

After the street address was selected with the help of "Explore Oakville", the Canada Post website was consulted to find a proper postal code. The complete address was entered into a Microsoft Word mailing list generator, in order to print addresses on envelopes and at the top of the correspondence. The entire job of mailing list assembly took two days to complete, and it generated a list of 500 addresses to which survey correspondence was mailed.

5.9 Particulars of Mailings

When the mailing list was ready, the mailing procedure started. As planned, on July 21, 2011, 500 prenotice letters were sent. This was followed by the mailing of 500 questionnaires on July 27, 2011. Finally, 500 thank you postcards were sent on August 2, 2011. The mailing of the reminder letter with the replacement questionnaire, which was planned for August 30, 2011, was not performed.

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This chapter discussed the methods used in this study, starting with the choice of survey mode and ending with the details of its implementation. The next chapter provides the description of the results of this research.

Chapter 6: Results

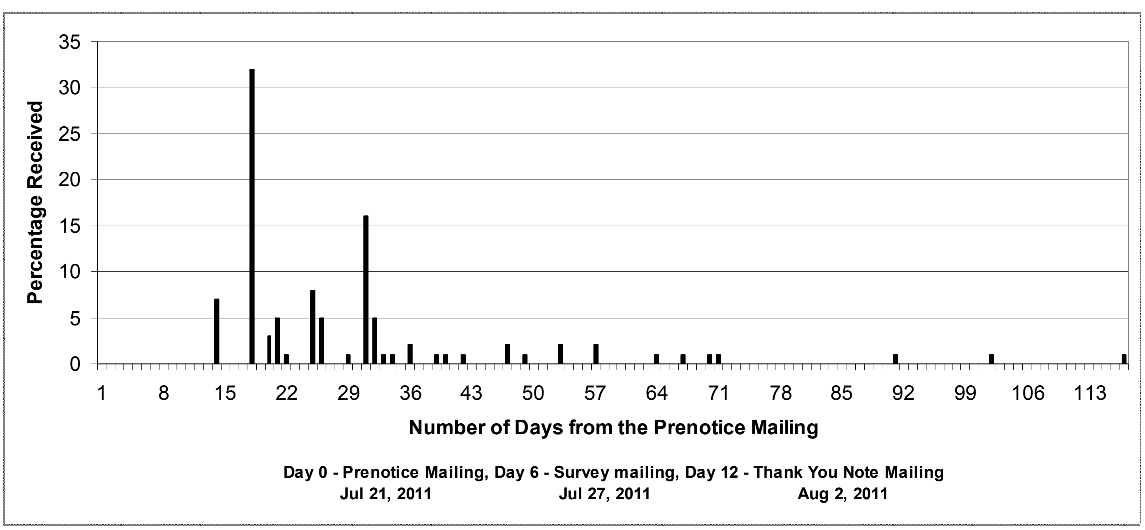
This chapter contains the description of the responses to the survey that was mailed out in the summer of 2011, according to the method described in chapter 5.

6.1 Response Timeline

As described in section 5.9, five hundred prenotice letters, questionnaire mailings, and thank you notes were sent. In response to that, 176 replies came to the University of Waterloo address, and were collected and marked with the date of arrival by my supervisor, Dr. Ian Rowlands.

All of the responses were received between August 4th, 2011 and November 15th, 2011 (inclusive), however, the bulk of the response (154, or 87.5%) came in August 2011, and most of the rest (19, or 10.8%) in September, 2011. There were only three letters (1.7%) received after the end of September, 2011. The distribution of the response in time is presented in Figure 6.1.

Figure 6.1 – Percent of Survey Responses Received Per Day



6.2 Response Rate

As mentioned above, 500 questionnaires were sent, and 176 responses came back. There were two additional questionnaire mailings that were received unopened as 'Return to Sender'/RTS by Canada Post, and one thank you postcard that was returned, 'RTS', from a different address than the other two. Since all of the letters and thank you cards were addressed under the general heading to 'Oakville Resident' at the given address, it is likely that the three 'RTS' addresses were from houses that were not occupied. Therefore, for the calculation of the response rate, the number of questionnaires sent was reduced by three, as the RTS letters should be treated as not sent at all. The reason for this is that nobody had a chance to even consider answering them. After this correction, the preliminary number of valid questionnaires sent out was then 497, however, this number received further adjustments later (elaborated below).

Of the 176 responses that were received, 12 arrived with the questionnaire not completed at all, and four arrived without the questionnaire inside. Altogether then, there were 16 'non response' letters. Interestingly, most of the respondents from this group felt the obligation to also send back the two-dollar financial incentive. Four responses (from the 16 'non response' letters) included a note justifying the choice to not participate. After the analysis of the comments attached to these responses, it was decided that these four households should be treated as unable to participate. Two of the four responses came back with comments that the respondents were seniors who were not able to participate, and the other two had a note stating that the homeowners were not able to participate (see questionnaires 164, 165, 168, and 175 in Appendix C – Answers to Open-ended Questions and Comments). Taking these statements at face value, the number of valid questionnaires distributed was therefore reduced again, this time by four, and the final corrected number of valid *sent* questionnaires was established as 493.

The other 12 responses from the above 'non-response' group were treated as if they were not sent *back* at all. This is because there is no meaningful difference, for this research, between an empty questionnaire sent back, and an empty questionnaire thrown into the blue box.

Therefore, the calculation of the response rate did not include these 12 as received. They were still counted as *sent out,* as they were clearly looked at by people able to respond.

All of the other 160 responses were treated as honest attempts to answer the survey questions, even though not all of them contained questionnaires that were fully completed, or had all questions answered correctly. By ‘incorrect answer’ to a question, it is understood that a response had more than one answer to a question which allows only one answer, or a response had a marking of the answer between the printed ovals provided for the answer. The extreme case of a not fully completed questionnaire was one with no answer to any of the questions at all, but with a large comment at the end of the survey, which stated that the respondent would not take part in any of the programs, followed by the reasons for this position (see questionnaire 120, in Appendix C). It was decided that this response would be considered valid, and answers ‘Definitely not participate’ were assigned to questions A, A1, B, and C (making this respondent a Naysayer). There were two other notable cases of not fully completed questionnaires, where respondents probably did not realize that they needed to turn the page over to continue. One of them (questionnaire 151, see Appendix B – Data) missed all of questions B to E and 7 to 12 (pages 4 and 6 of the questionnaire), which resulted in this response having to be removed from the analysis needed to test the hypothesis. The other respondent (questionnaire 22) missed only questions 7 to 12 (page 6 of the questionnaire). Both responses were still useful for different parts of the data analysis, and were therefore counted as valid.

In sum, this analysis implies that the response rate of the survey was 160 out of 493, equalling 32.5%. Note that this number is used only for the nonresponse error estimation. For the statistical analysis of particular questions, the number of valid responses might be lower than 160, due to the fact that some respondents did not answer all questions, or did not answer them correctly (as defined above).

6.3 Geographical Distribution of Questionnaires Sent and Responses Received

Oakville is divided into five Forward Sortation Areas (FSA) by Canada Post (Figure 6.2). These correspond to the first three characters of a postal code. Canada Post provides statistics about the mailing addresses in these areas, known as 'householder counts' (Canada Post, 2012). In order to have a rough idea of how well the devised random address selection system worked, the number of questionnaires sent to a particular FSA was compared to the number of houses in the FSA. As discussed in chapter 5, the questionnaires were sent to the inhabitants of single detached and semi-detached houses. Unfortunately, the number of houses from each FSA provided by Canada Post also includes townhouses, so the exact comparison of the number of questionnaires sent, to the number of a targeted kind of household is not possible. Looking at table 6.1, one can see a noticeable over-representation of the two FSAs from south-eastern and central Oakville – L6J and L6K. According to the thesis author's personal knowledge of Oakville (no statistics on townhouse addresses could be found), the two over-represented FSAs contain a much smaller number of townhouse complexes than the three other FSAs. This is the first suggested reason for the observed over-representation. Additionally, the lot sizes, and therefore the lengths of the front yards in the two over-represented FSAs, are larger (this is also based on author's personal knowledge of Oakville). This indicates that there are fewer houses on an average street in those two FSAs. Since the random address selection system chose one house per street, it caused an overrepresentation of households from the areas that have fewer houses per street. Unfortunately, this analysis was done after the survey was completed, and no corrective action is possible any more. However, since the exact number of single detached and semi detached houses per FSA is not readily available, such a correction would have been impossible to do accurately in any case.

Interestingly, looking again at table 6.1 ('Returned as % of sent' column), one can notice that the same two FSAs that are overrepresented have the highest response rates. This becomes even more visible when one divides the L6J FSA into two regions – the first called Clearview, a relatively new subdivision located in the immediate vicinity of the Oakville Ford plant and with smaller house lots, and the second being comprised of South East Oakville and Downtown, the oldest parts of Oakville with large property lots and many sizeable, expensive houses (see table 6.2). The income and lifestyle differences between L6J and L6K FSAs and the rest of Oakville might explain the difference in response rates, however, this issue was not pursued further in this study.

Table 6.1 – Distribution of Questionnaires Sent and Returned among Oakville FSAs

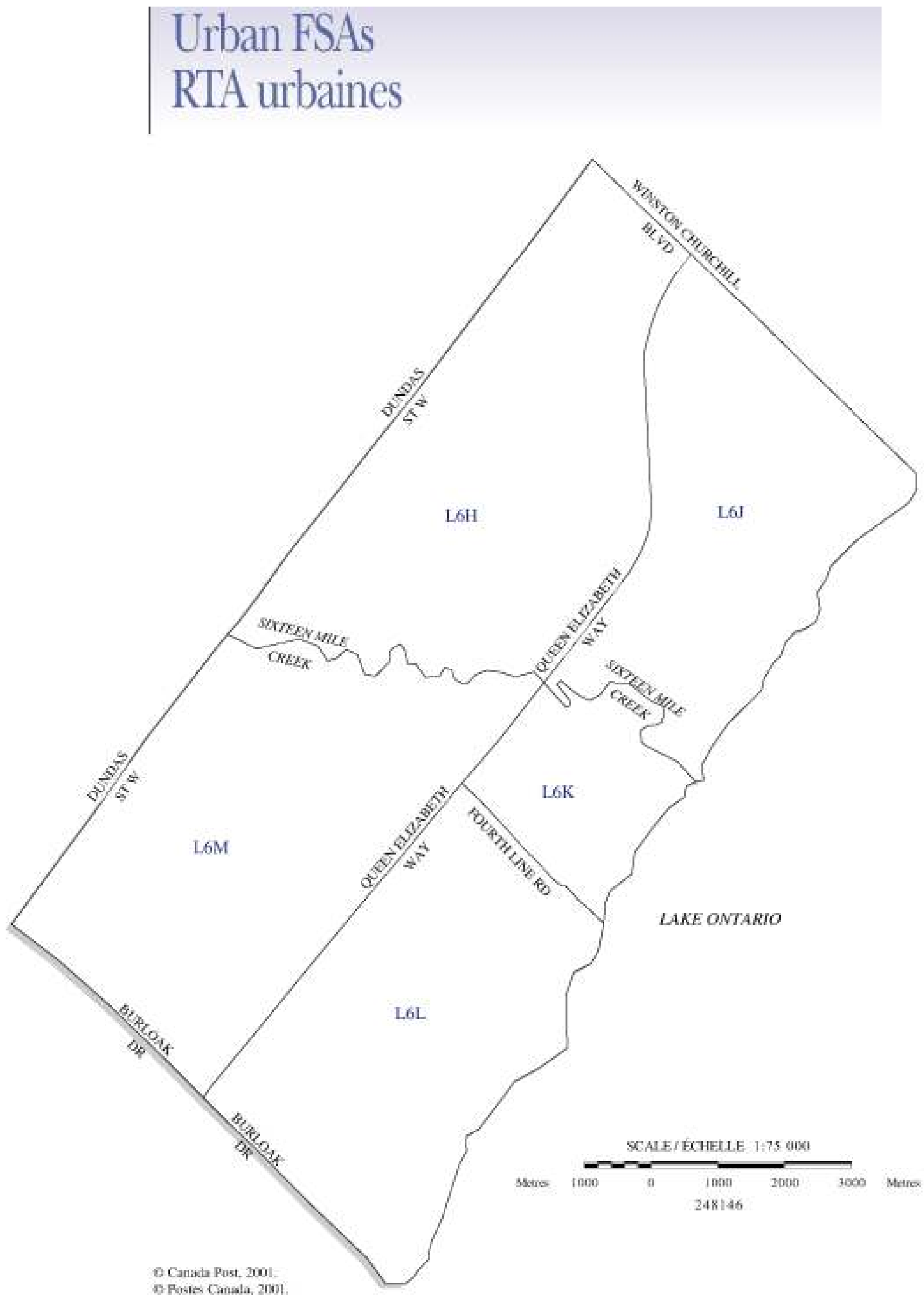
Postal code	Number of houses [1]	Number of questionnaires sent	Number of questionnaires returned	Sent as % of total houses in FSA	Returned as % of questionnaires sent
L6H	17,135	123	38	0.7	31
L6J	7410	132	47	1.8	36
L6K	2995	36	16	1.2	44
L6L	9021	81	27	0.9	33
L6M	16,746	128	30	0.8	23
Unknown	-	-	2	-	-
Total	53,307	500	160	0.9	32

[1] – Based on Canada Post data (Canada Post, 2012)

Table 6.2 – Questionnaires Sent and Returned in Different Parts of L6J FSA

Part of L6J FSA	Number of questionnaires sent	Number of questionnaires returned	Returned as % of questionnaires Sent
Clearview	27	6	22
SE Oakville & Downtown	105	41	39

Figure 6.2 – Forward Sortation Areas in Oakville



Copied with the permission of Canada Post.

6.4 Guidelines in Accepting the Responses as Valid

As mentioned above, it was quickly discovered that not all questionnaires received were completed fully or correctly (as defined in section 6.2). For the purpose of statistical analysis of the results, additional guidelines were established for the inclusion of questionnaires with: (1) *responses to one or more questions missing*, or (2) *incorrect responses to one or more questions.*

6.4.1 Analysis of a Particular Question

Most of the answers to the questions on the survey can be analysed on their own as opinions of the broad population on the particular issue. Additionally, responses to a particular question can be compared for two different subsets of the surveyed population (e.g. Visibility Junkies and Trusting Good Citizens). For such quantitative analysis of replies to a question, the questionnaire with the missing or incorrect answer to the question was removed, and the number of responses *n* was reduced by one.

6.4.2 Testing the Hypotheses

In order to prepare the data from the survey for testing the hypotheses of this research, the following two preparatory steps need to occur:

First, it must be checked whether the respondent provided a negative answer (box not marked) to the introductory question of the survey, located before the beginning of the Part 1. A negative answer to this question means that the respondent is not already involved with any kind of voluntary financial support for renewable electricity, nor has solar panels currently installed on their roof (and doesn't plan to have them in the near future). As discussed in section 5.4.2, to qualify for answering the questions from Part 1, the respondent cannot already be involved in this way with regards to renewable electricity. All of the responses with the introductory question answered positively (marked 'x' in the box) must be counted as members of group “Other”, even if they contain answers to the questions from Part 1, that would otherwise qualify them as members of the groups of interest for the hypotheses testing. These “Other” responses will, however, contribute to the number of valid responses, which is important in the margin of error calculations. These questionnaires will also be useful for the analysis of questions from Part 2.

Secondly, to group the remaining respondents into appropriate categories required for hypotheses testing, one needs to have a certain minimum number of answers to questions A through C. In line with the discussion in chapter 4, the following patterns of answers to questions A through C define groups of respondents important for hypotheses testing:

- Trusting Good Citizens – positive A, positive B and/or C.
- Trusting Odd Participants – positive A, negative B, negative C.
- Not Trusting Good Citizens – negative A, positive A1, positive B and/or C.
- Not Trusting Odd Participants – negative A, positive A1, negative B, negative C.
- Visibility Junkies – negative A, negative A1, positive B and/or C.
- Naysayers - negative A, negative A1, negative B, negative C.

To qualify for assignment to any of the above groups , the respondent must answer question A (about undisclosed solar farms) correctly (as defined in section 6.2), and if the answer to this question is negative (‘Probably not’ or ‘Definitely not participate’), then question A1 (about a familiar solar farm) also has to be answered correctly. In the case of questions B and C, a correct positive answer (‘Definitely participate’ or ‘Probably’) to only one of them is needed. The other question does not have to be correctly answered (or answered at all), because it is enough to declare participation in only one of the two programs – ‘Solar panels on own roof’ (question B) and ‘Solar panels on roof in community’ (question C) – to be classified as Not Trusting Good Citizen, Trusting Good Citizen, or Visibility Junkie. However, answering one of these questions *negatively* requires a correct answer (either positive or negative) to the other one. Otherwise, it would be impossible to classify the response. Not fulfilling all of the above conditions caused the response to be excluded from the hypothesis testing analysis, and from the number of valid responses.

6.4.3 Comparing Answers to Different Questions

Finally, there is an issue of preparing the data for the comparison of answers by the same group of respondents to two different questions. For a questionnaire to be included for such an analysis, answers to both compared questions must be answered correctly (as defined above). The questionnaires not fulfilling this condition will be removed from consideration.

6.5 Total Survey Error

As discussed in chapter 5, there are four types of survey error – coverage, sampling, nonresponse, and measurement error. Below is the analysis of how well this survey performed in these four areas.

6.5.1 Coverage Error

The method of random selection of houses, which was described in chapter 5, gave every member of the target population a nonzero chance of being selected. However, as discussed in section 6.3, the probability of being selected was different in different parts of Oakville. This is a problem, especially because those different parts have different socio-economical profiles. It is difficult to quantify this type of error, but one must be aware of its existence.

6.5.2 Sampling Error

Because of a reasonable response rate and large number of mailed questionnaires, the size of the response in comparison to the targeted population of about 40,000 households provides for levels of precision high enough to test the hypothesis. In-depth calculations and analyses of margins of error for different kinds of responses are done in chapter 7.

6.5.3 Nonresponse Error

There is no single agreed upon percentage number that the response rate should cross for the survey to be considered as having low nonresponse error. Babbie (2008) suggests that a response rate of 50% is adequate, 60% is good, and 70% very good. Dillman et al. (2009) in several places describe a rate of return below 25% as low, and in giving examples of properly conducted surveys mentions rates above 60% as very good. Thus, the rate achieved in this research – 32.5% – should be considered as lying in a grey zone, somewhere between low and adequate.

6.5.4 Measurement Error

The design of the questionnaire used in this research was carefully executed, and followed the advice from Dillman et al. (2009) closely. Pre-testing (as noted in chapter 5) was done to discover problems with both understanding of the questions, and the overall flow of the questionnaire. However, it is quite difficult to judge the measurement error when the process of actually filling out the mailed questionnaire cannot be observed.

One thing that can be done is to watch for the amount of noticeable mistakes made by respondents during the inspection of the returned questionnaires. By that measure, the design seems to be proper, because there were only few such mistakes. For example, out of 160 valid responses, only one had question A1 answered, when it should have been left blank. There were no cases of the opposite error, in which a negative answer to question A required an answer to question A1, but the subsequent necessary answer was not provided. Also, only two respondents did not turn the page to fill the questions on the other side. Finally, there was only one comment by one respondent about being confused by the question, while many respondents made several comments of a different nature left alongside the questions.

Descriptions of the programs and explanations related to them must have also been generally understood, because the respondents left no comments about such confusion, while many of them left various lengthy remarks in both sections that requested a comment.

Therefore, one can conclude that the probability of a significant measurement error in this survey is low.

6.6 Results for Each Question of the Survey

In November 2011, the data from all questionnaires received was entered into a Microsoft Excel spreadsheet. This was done by a person working alone. Afterwards, the data were checked by two people, one reading the answers to the other. In order to perform further analyses, statistical software SPSS 20 was used. Complete survey responses are presented in Appendix B – Data. Statistics of received answers to all the questions of the survey are presented below.

6.6.1 Initial Question

The Initial Question of the questionnaire (Appendix A) asked the participants the following:

" Attention, if you currently:

- *are taking part in a program in which you pay premium for green electricity generation, or*
- *have solar panels installed on your roof, or*
- *signed a contract to install solar panels in the near future,*

please mark 'x' in the box below and go directly to Part 2, skipping questions A to E in Part 1."

The number of valid responses (*n*) was 160. Four questionnaires had 'x' marked in the box, and 156 did not.

One of the 156 respondents did mention in a comment that they had a solar pool heating system installed on their roof already. This did not stop them from answering questions in the

Part 1 of the survey. They also did not mark the initial question answer box with 'x'. Since the intention of the initial question is to sort out all those respondents who already support green electricity by paying a premium for it, or who already (or plan to) take part in the FIT program, or who produce solar electricity to supply their own house (see discussion in section 5.4.2), it was decided to include this response in the analysis of questions from Part 1. For the purposes of this survey, a roof unfit for new solar panel installation due to an already existing solar thermal system does not differ significantly from the roof unfit for it due to day long shade from surrounding trees.

6.6.2 Questions from Part 1

Questions A to C from Part 1 have ordinal answers (so they are not numerical). Also the intention is to treat them as 'Yes/No' questions, where answers 'Definitely participate' and 'Probably' are treated as 'Yes', and answers 'Probably not' and 'Definitely not participate' are treated as 'No'. Therefore calculating mean, median, and variance is meaningless here, and those statistics are not provided. Thus, only frequency tables and frequency diagrams are presented for each of them. In the frequency tables, the number of responses marked as 'Missing' relates to the responses in which the question was not answered properly by a participant. The column titled 'Valid percent' contains percentages of valid responses, and the column titled 'Cumulative percent' also refers to valid responses.

Answers to question D are categorical, so only a frequency table is presented for this question. Question E was a request for a comment, and does not have any statistics provided.

6.6.2.1 Question A

Question A of the questionnaire (Appendix A) asked the participants the following:

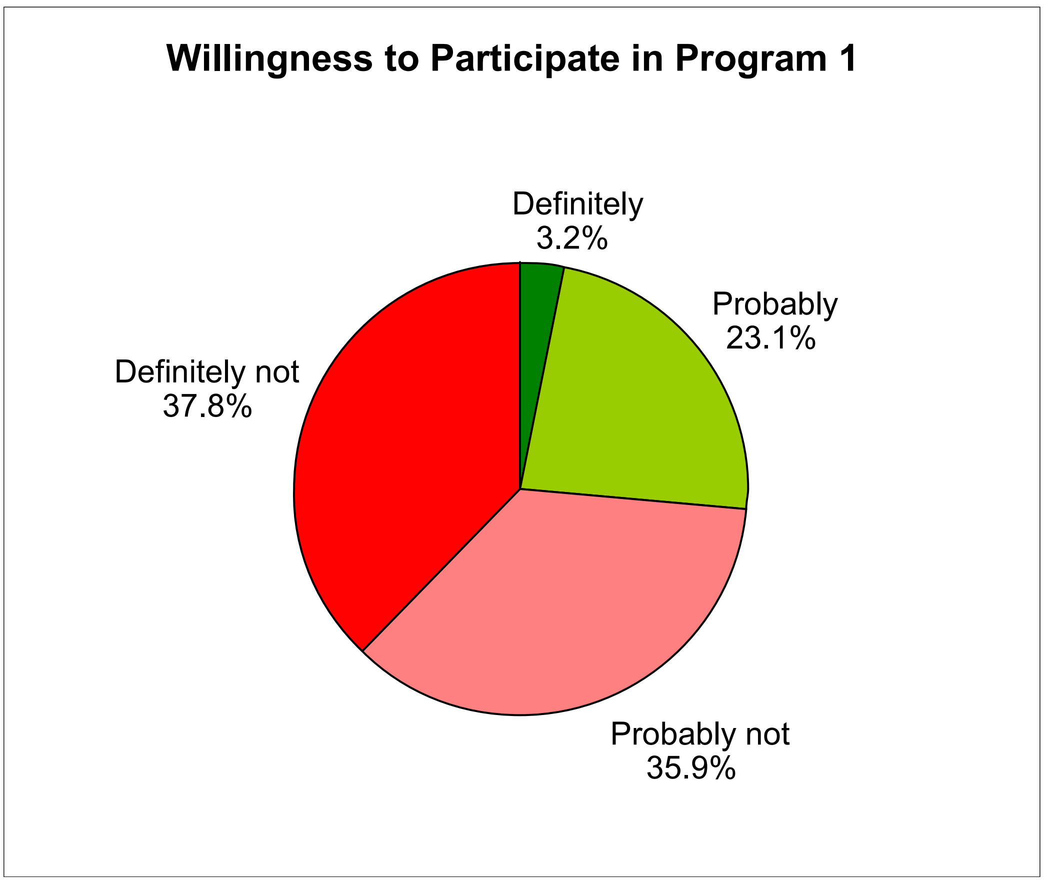
"Please indicate how likely you are to participate in program 1 (electricity from solar farms outside of Oakville) if this were the only program option offered to you?"

Responses are presented in table 6.3.

Table 6.3 – Frequency of Answers for Question A

Willingness to Participate in Program 1					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Definitely	5	3.1	3.2	3.2
	Probably	36	22.5	23.1	26.3
	Probably not	56	35.0	35.9	62.2
	Definitely not	59	36.9	37.8	100.0
	Total n	156	97.5	100.0	
Missing		4	2.5		
Total		160	100.0		

Figure 6.2 – Percentages of Answers to Question A



6.6.2.2 Question A1

Question A1 of the questionnaire (Appendix A) asked the participants the following:

"Please indicate how likely you are to participate in program 1 (electricity from solar farms outside of Oakville) if you personally knew a senior manager of the particular solar farm that was contracted to deliver the solar electricity?"

Responses are presented in table 6.4.

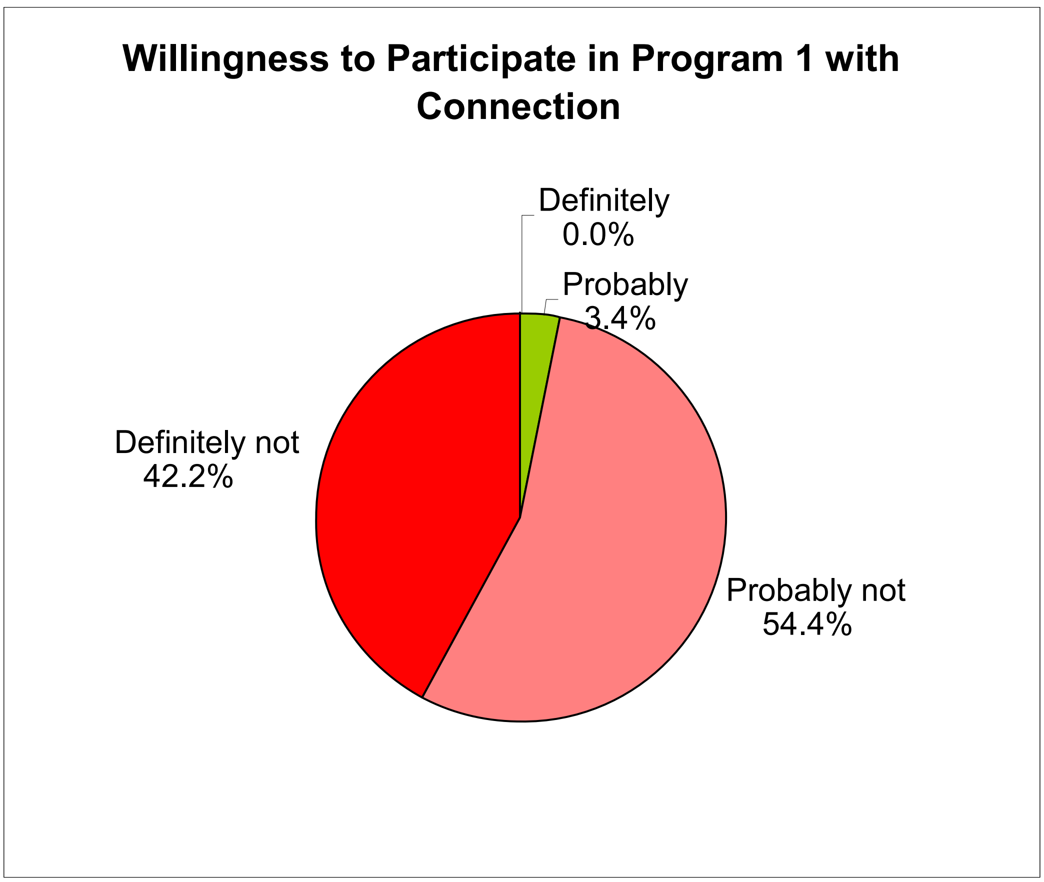
In this question, the large number in the 'Missing' category is caused by the fact that all of the respondents who answered 'definitely' or 'probably' to question A are supposed to skip question A1. All but one person followed the survey instructions properly, and did not answer question A1 when they gave a positive answer ('Definitely' or 'Probably') to question A. However, this one respondent answered question A1 positively, and therefore could be classified as either a Trusting Good Citizen or Trusting Odd Participant (see discussion in section 4.1.5). In fact, because of positive answers to questions B and C, this respondent was classified as a Trusting Good Citizen (see response #10 in Appendix B).

One respondent marked their answer as both 'Probably' and 'Probably not'. Against the general rule, it was decided to treat the answer as 'Probably', which is a weak positive. This decision was made because it could be understood from the comments written by this response that this respondent was on the edge of deciding to participate. (See questionnaire 5 in Appendix C.)

Table 6.4 – Frequency of Answers for Question A1

Willingness to Participate in Program 1 by Connection					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Definitely	0	0	0	0
	Probably	4	2.5	3.4	3.4
	Probably not	63	39.4	54.4	57.8
	Definitely not	49	30.6	42.2	100.0
	Total n	116	72.5	100.0	
Missing		44	27.5		
Total		160	100.0		

Figure 6.3 – Percentages of Answers to Question A1



6.6.2.3 Question B

Question B of the questionnaire (Appendix A) asked the participants the following:

"Please indicate how likely you are to participate in program 2 (electricity from solar panels on your roof) if this were the only program option offered to you?"

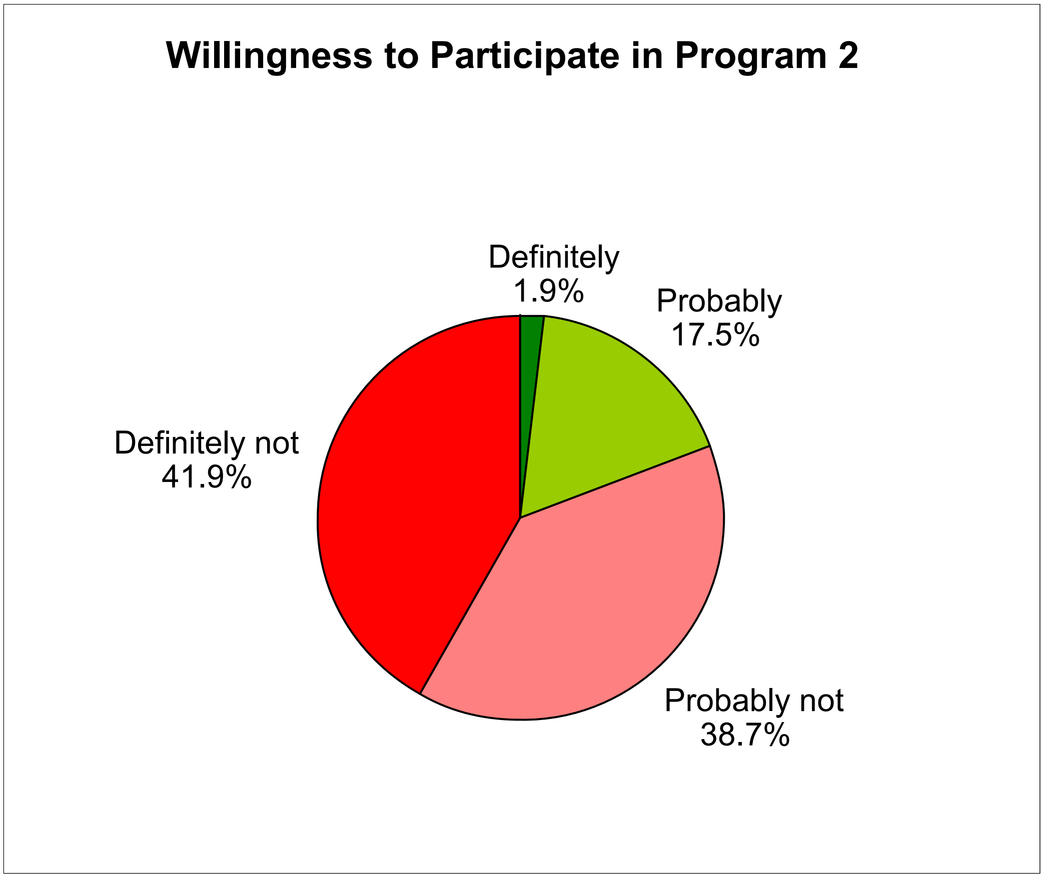
Responses are presented in table 6.5.

One respondent (the same one noted in the comment to question A1) marked the answer in an added oval between 'Probably' and 'Probably not'. Against the general rule, it was decided to treat the answer as 'Probably', which is a weak positive. Again, it could be understood from the comments written by their response that this respondent was on the edge of deciding to participate.

Table 6.5 – Frequency of Answers to Question B

Willingness to Participate in Program 2					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Definitely	3	1.9	1.9	1.9
	Probably	27	16.9	17.5	19.4
	Probably not	60	37.5	38.7	58.1
	Definitely not	65	40.6	41.9	100.0
	Total n	155	96.9	100.0	
Missing		5	3.1		
Total		160	100.0		

Figure 6.4 – Percentages of Answers to Question B



6.6.2.4 Question C

Question C of the questionnaire (Appendix A) asked the participants the following:

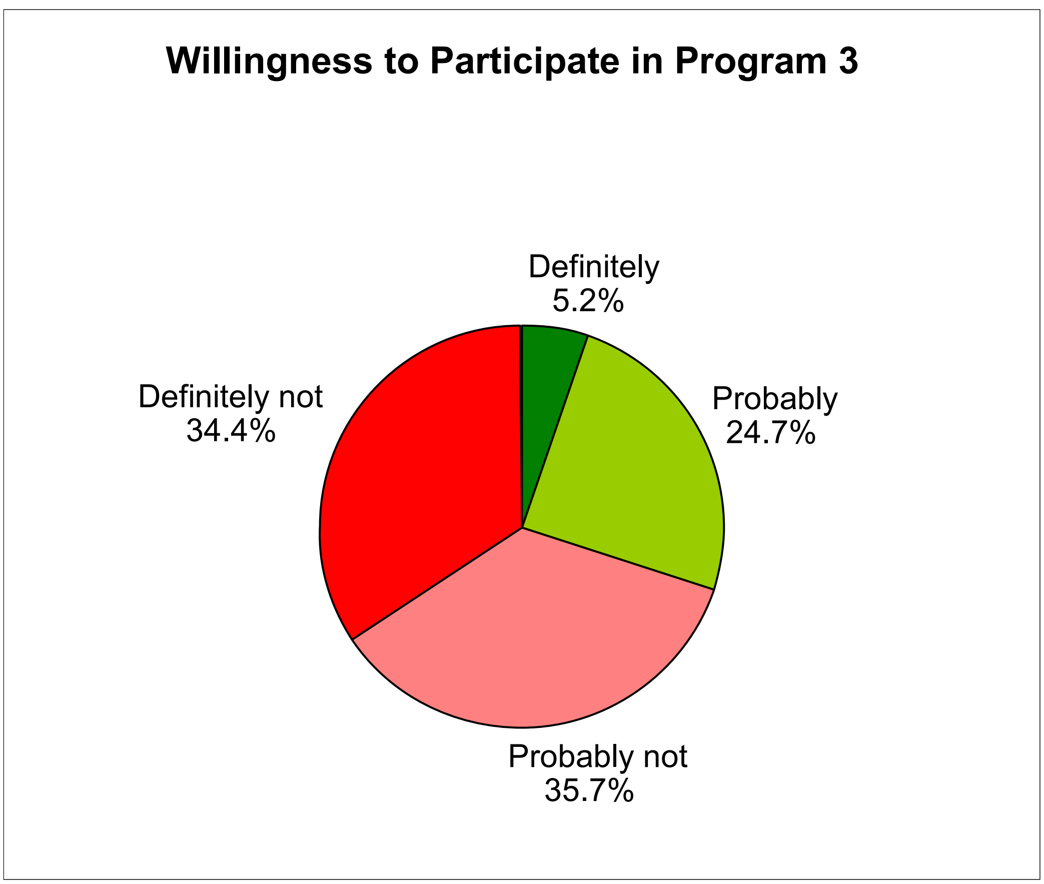
"Please indicate how likely you are to participate in program 3 (electricity from solar panels in Oakville, but not on your roof) if this were the only program option offered to you?"

Responses are presented in table 6.6.

Table 6.6 – Frequency of Answers to Question C

Willingness to Participate in Program 3					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Definitely	8	5.0	5.2	5.2
	Probably	38	23.8	24.7	29.9
	Probably not	55	34.4	35.7	65.6
	Definitely not	53	33.1	34.4	100.0
	Total n	154	96.3	100.0	
Missing		6	3.8		
Total		160	100.0		

Figure 6.5 – Percentages of Answers to Question C



6.6.2.5 Question D

Question D of the questionnaire (Appendix A) asked the participants the following:

"If you chose answers '<u>Definitely not participate</u>' or '<u>Probably not</u>' to all of the above four questions - <u>A</u>, <u>A1</u>, <u>B</u>, and <u>C</u>, - please state the main reason that is discouraging you from participating in any of these programs.

- ◯ *$25 per month is too much money for me to pay.*
- ◯ *Two years is too long of a commitment period for me.*
- ◯ *I do not think we need solar power.*
- ◯ *I would rather take part in the feed-in tariff program directly.*
- ◯ *Other - please elaborate in the space immediately below:"*

Responses are presented in table 6.7.

There were 108 questionnaires received that provided an answer to question D. Of those 108 responses, 98 came from respondents who were supposed to answer question D (who chose answers 'Definitely not participate' or 'Probably not' to all of the four questions, A, A1, B, and C), and these responses were considered valid. The other 10 responses came from the group that was not supposed to answer question D, because they chose a positive answer to at least one of the above mentioned four questions. Therefore, these other 10 responses were considered not valid. Of the 100 respondents who were supposed to answer question D, only two did not answer it (therefore, there were 98 valid responses). Twenty-one of the respondents who were supposed to answer question D chose more than one answer to question D. It was decided to consider these responses valid, and they are part of the above mentioned 98 valid responses. All respondents that marked 'Other' as their answer made a comment in the provided space. These comments are recorded in the Appendix C.

This thesis does not include any further analysis of answers to this question.

Table 6.7 – Frequency of Answers for Question D

Reason for non-participation	Frequency	Percentage
(1) $25 per month too much money	28	28.6
(2) Two years is too long	7	7.1
(3) We do not need solar power	9	9.2
(4) Take part in the FIT directly	9	9.2
(5) Other	24	24.5
(1) + (2)	7	7.1
(1) + (4)	1	1.0
(1) + (5)	6	6.1
(1) + (2) + (3)	2	2.0
(1) + (2) + (4)	2	2.0
(1) + (2) + (5)	2	2.0
(2) + (4) + (5)	1	1.0
Total	98	100

6.6.2.6 Question E

Question E of the questionnaire (Appendix A) asked the participants the following:

"Please feel free to elaborate upon any or all of your answers for questions A to D:"

Responses are recorded in Appendix C.

There were 62 questionnaires received that provided the invited comment in question E. An interesting observation is that respondents who answered all four questions A, A1, B, C negatively, had much more to say in this section (50 out of 100 responses with a comment – 50% of this group), compared to respondents who answered at least one of the above mentioned questions positively (12 out of 55 responses with a comment – 22% of this group).

This implies that those who decided not to take part in any of the programs felt that they had some explaining to do.

No further analysis of responses to question E is provided in this thesis.

6.6.3 Questions from Part 2

Questions 1 to 12 from Part 2 have ordinal answers. Since they are not numerical, even assigning values 1 to 5 to each answer, from the least intense expression of opinion to the most intense, does not make it proper for statistical analysis with the use of averages and variances. For example, the fact that someone answered 4 ('Probably') to question 1 does not mean that they are twice as certain that the organizers will waste money, than the person who answered 2 ('Probably not') to the same question. However, it was decided that statistics such as mean, median and mode provide a useful picture of the aggregate answer to a question, and are therefore included for each question. The calculations are based on the assignment of numbers from 1 to 5 to the answers to each question, starting with value 1 on the left side, and progressing towards higher values to the right.

In the statistics and frequency tables, the number of responses marked as 'Missing' relates to the responses for which the answer to the discussed question was either missing, or was not correct (as defined in section 6.2).

Question 13 was a request for a comment, and does not have any statistics provided.

6.6.3.1 Question 1

Question 1 of the questionnaire (Appendix A) asked the participants the following:

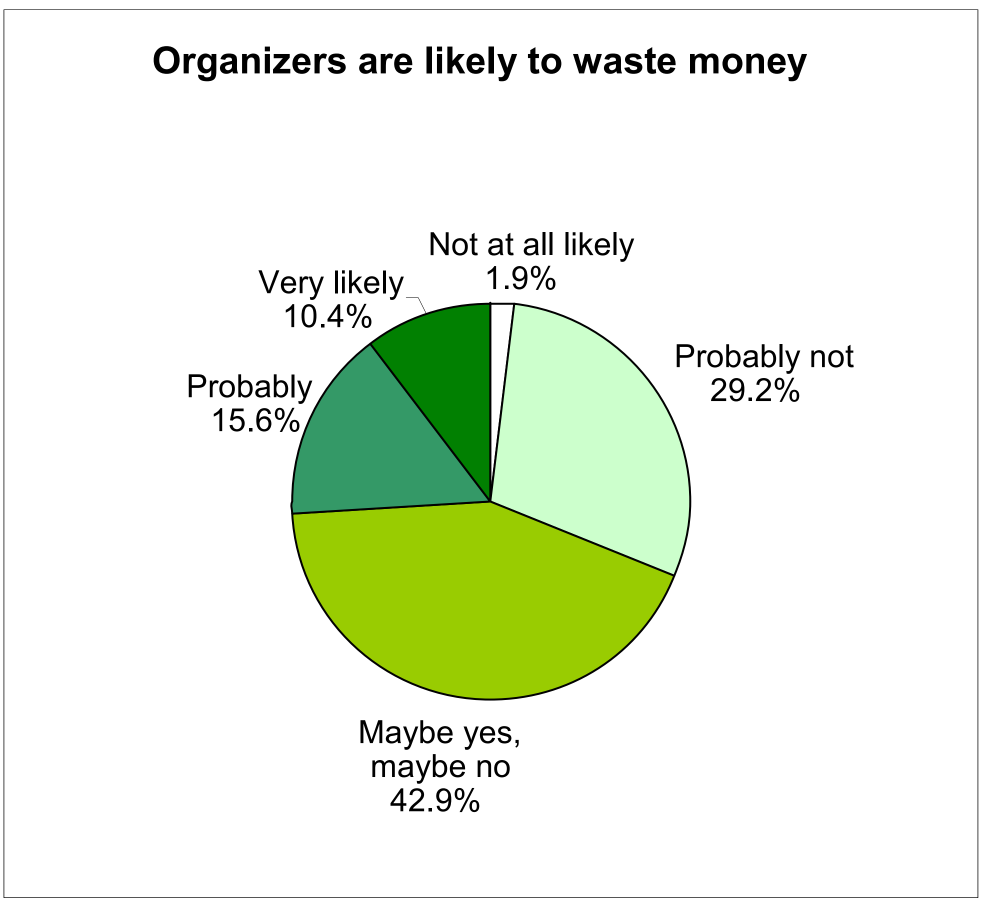
"Are organizers of solar electricity programs, like the ones described above, likely to waste the money paid by people like you?"

Responses are presented in table 6.8.

Table 6.8 – Statistics and Frequency of Answers for Question 1

Organizers are likely to waste the money						
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Not at all likely	3	1.9	1.9	1.9
	Probably not	45	28.1	29.2	31.2
	Maybe yes, maybe not	66	41.3	42.9	74.0
	Probably	24	15.0	15.6	89.6
	Very likely	16	10.0	10.4	100.0
	Total n	154	96.3	100.0	
Missing		6	3.8		
Total		160	100.0		
Mean:	3.03				
Median:	3				
Mode:	3				

Figure 6.6 – Percentages of Answers to Question 1



6.6.3.2 Question 2

Question 2 of the questionnaire (Appendix A) asked the participants the following:

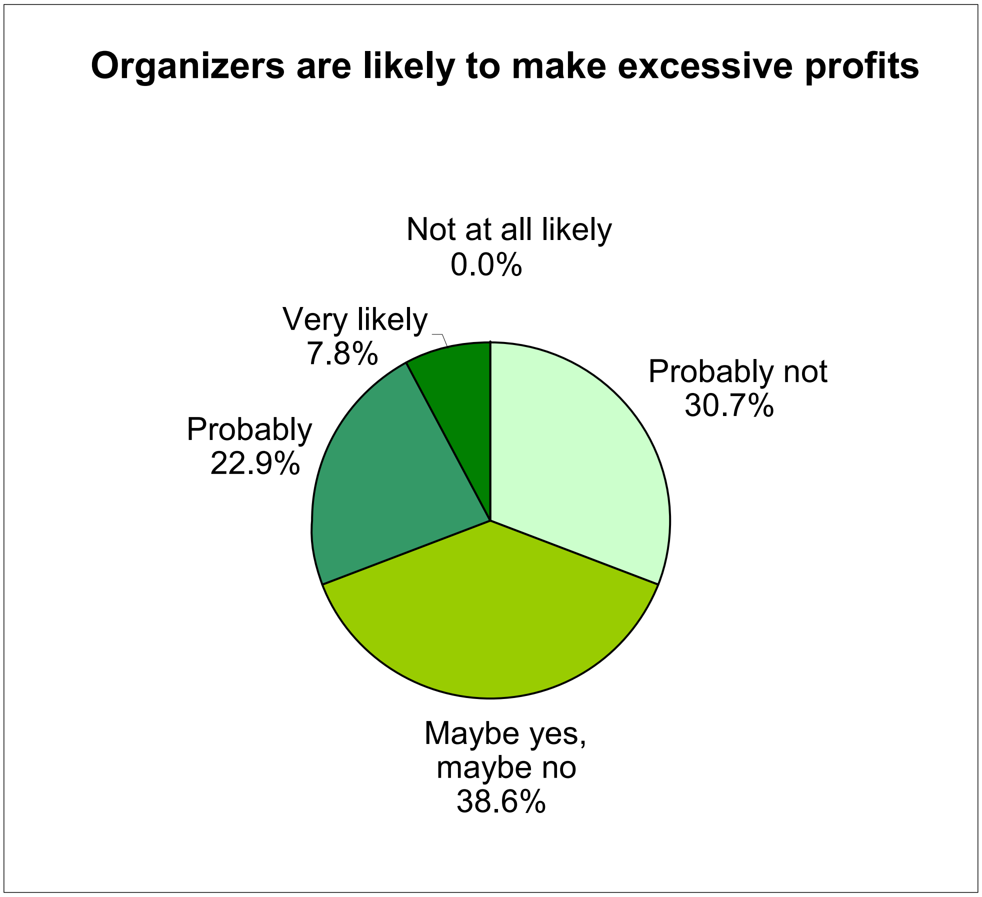
"Are organizers of solar electricity programs, like the ones described above, or businesses contracted by them, likely to make excessive profits from such programs?"

Responses are presented in table 6.9.

Table 6.9 – Statistics and Frequency of Answers for Question 2

Organizers are likely to make excessive profits						
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Not at all likely	0	0	0	0
	Probably not	47	29.4	30.7	30.7
	Maybe yes, maybe not	59	36.9	38.6	69.3
	Probably	35	21.9	22.9	92.2
	Very likely	12	7.5	7.8	100.0
	Total n	153	95.6	100.0	
Missing		7	4.4		
Total		160	100.0		
Mean:	3.08				
Median:	3				
Mode:	3				

Figure 6.7 – Percentages of Answers to Question 2



6.6.3.3 Question 3

Question 3 of the questionnaire (Appendix A) asked the participants the following:

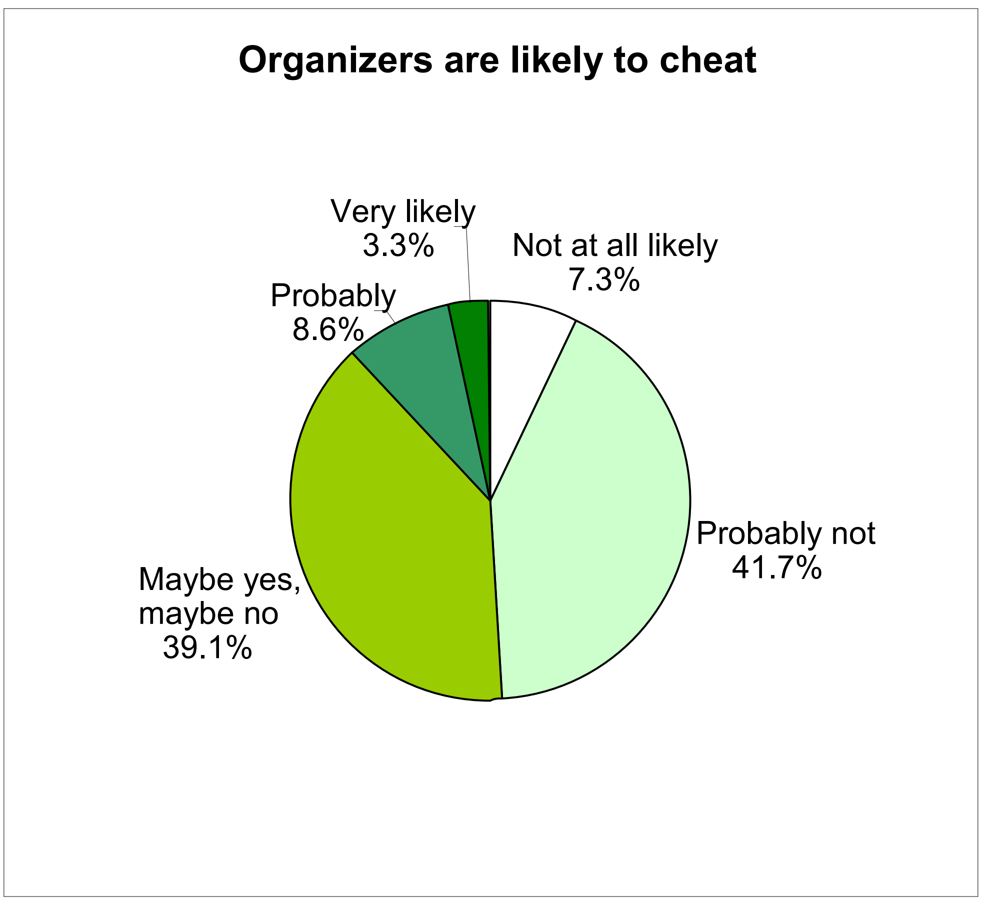
"Are the organizers of program 1 (electricity from solar farms outside of Oakville) likely to cheat by delivering electricity generated by other, less expensive methods, and not by the solar panels?"

Responses are presented in table 6.10.

Table 6.10 – Statistics and Frequency of Answers for Question 3

Organizers are likely to cheat					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Not at all likely	11	6.9	7.3	7.3
	Probably not	63	39.4	41.7	49.0
	Maybe yes, maybe not	59	36.9	39.1	88.1
	Probably	13	8.1	8.6	96.7
	Very likely	5	3.1	3.3	100.0
	Total n	151	94.4	100.0	
Missing		9	5.6		
Total		160	100.0		
Mean:	2.59				
Median:	3				
Mode:	2				

Figure 6.8 – Percentages of Answers to Question 3



6.6.3.4 Question 4

Question 4 of the questionnaire (Appendix A) asked the participants the following:

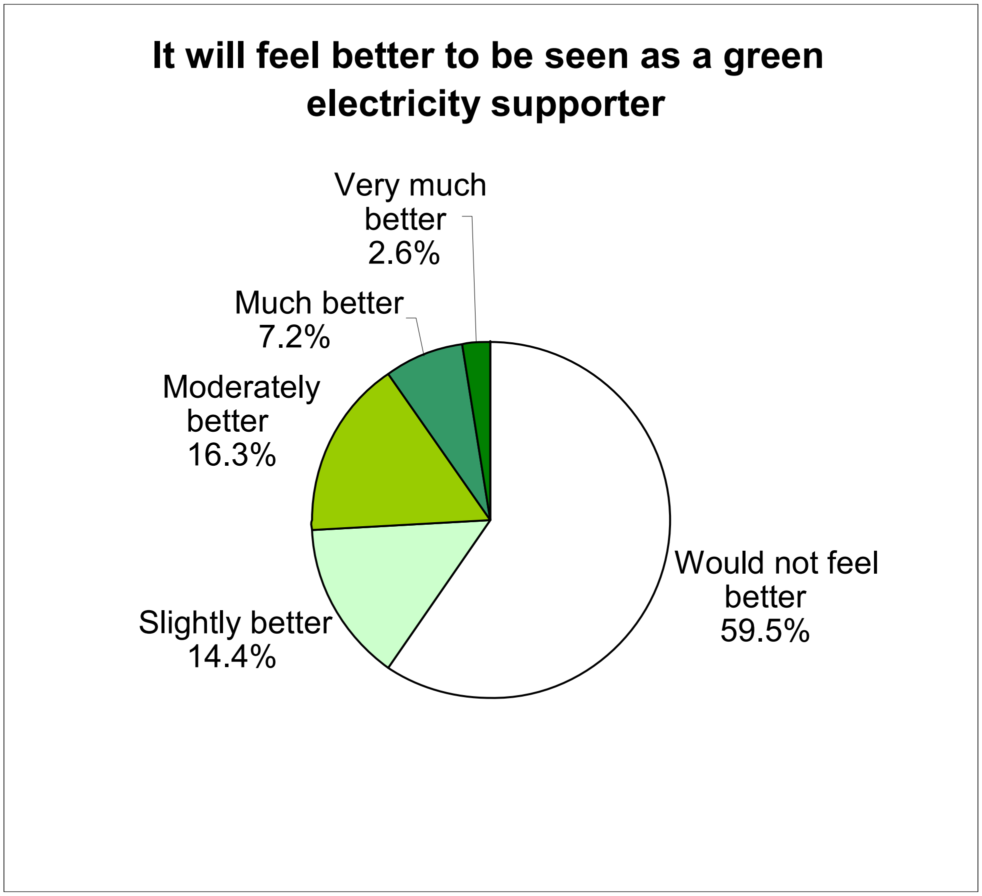
"Assume that the installation of solar panels on your roof was feasible and safe. Would you then feel better about yourself if other people could see the panels on your roof, and understand that you are supporting solar electricity?"

Responses are presented in table 6.11.

Table 6.11 – Statistics and Frequency of Answers for Question 4

It will feel better to be seen as a green electricity supporter					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Would not feel different	91	56.9	59.5	59.5
	Slightly better	22	13.8	14.4	73.9
	Moderately better	25	15.6	16.3	90.2
	Much better	11	6.9	7.2	97.4
	Very much better	4	2.5	2.6	100.0
	Total n	153	95.6	100.0	
Missing		7	4.4		
Total		160	100.0		
Mean:	1.79				
Median:	1				
Mode:	1				

Figure 6.9 – Percentages of Answers to Question 4



6.6.3.5 Question 5

Question 5 of the questionnaire (Appendix A) asked the participants the following:

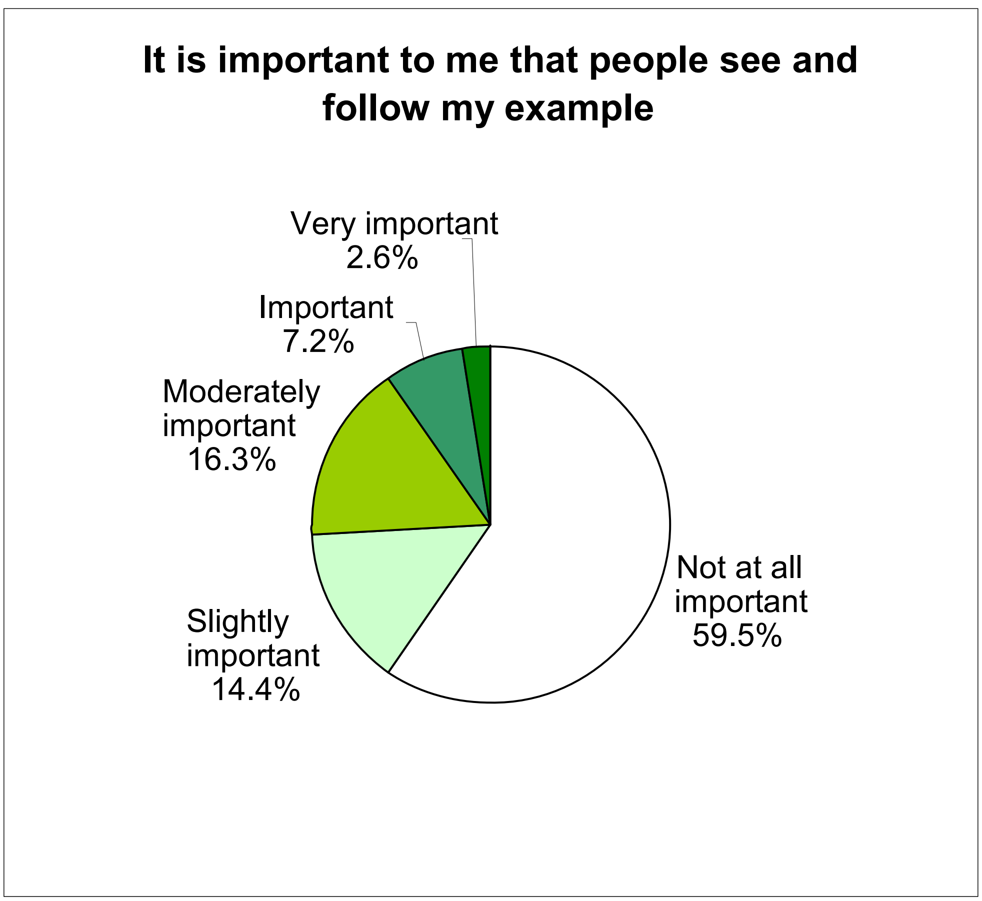
"How important is it to you that your decision to place solar panels on your roof, or on a visible roof in your community, can influence other people who see them to follow your example?"

Responses are presented in table 6.12.

Table 6.12 – Statistics and Frequency of Answers for Question 5

It is important to me that people see and follow my example						
			Frequency	Percent	Valid percent	Cumulative percent
Valid	Not at all important		64	40.0	41.8	41.8
	Slightly important		32	20.0	20.9	62.7
	Moderately important		33	20.6	21.6	84.3
	Important		21	13.1	13.7	98.0
	Very important		3	1.9	2.0	100.0
	Total n		153	95.6	100.0	
Missing			7	4.4		
Total			160	100.0		
Mean:	2.13					
Median:	2					
Mode:	1					

Figure 6.10 – Percentages of Answers to Question 5



6.6.3.6 Question 6

Question 6 of the questionnaire (Appendix A) asked the participants the following:

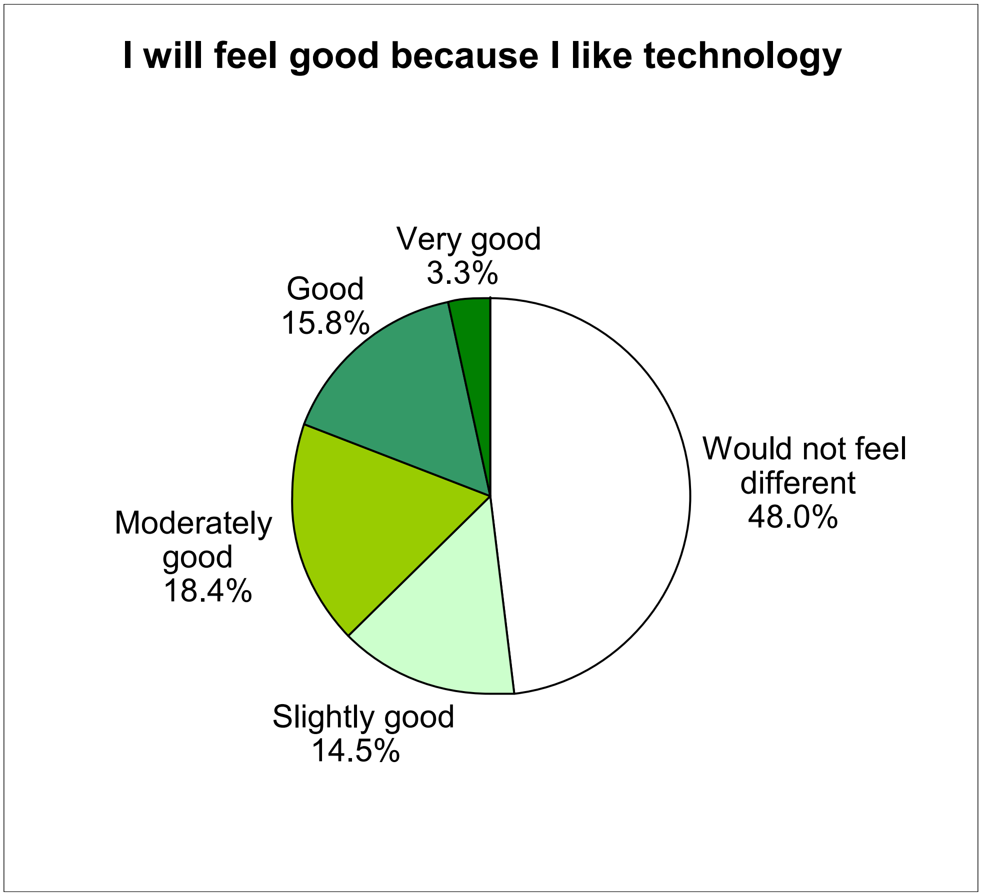
"Assume that the installation of solar panels on your roof was feasible and safe. Would placing solar panels on your roof then make you feel good because you like modern technology?"

Responses are presented in table 6.13.

Table 6.13 – Statistics and Frequency of Answers for Question 6

I will feel good because I like technology					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Would not feel different	73	45.6	48.0	48.0
	Slightly good	22	13.8	14.5	62.5
	Moderately good	28	17.5	18.4	80.9
	Good	24	15.0	15.8	96.7
	Very good	5	3.1	3.3	100.0
	Total n	152	95.0	100.0	
Missing		8	5.0		
Total		160	100.0		
Mean:	2.12				
Median:	2				
Mode:	1				

Figure 6.11 – Percentages of Answers to Question 6



6.6.3.7 Question 7

Question 7 of the questionnaire (Appendix A) asked the participants the following:

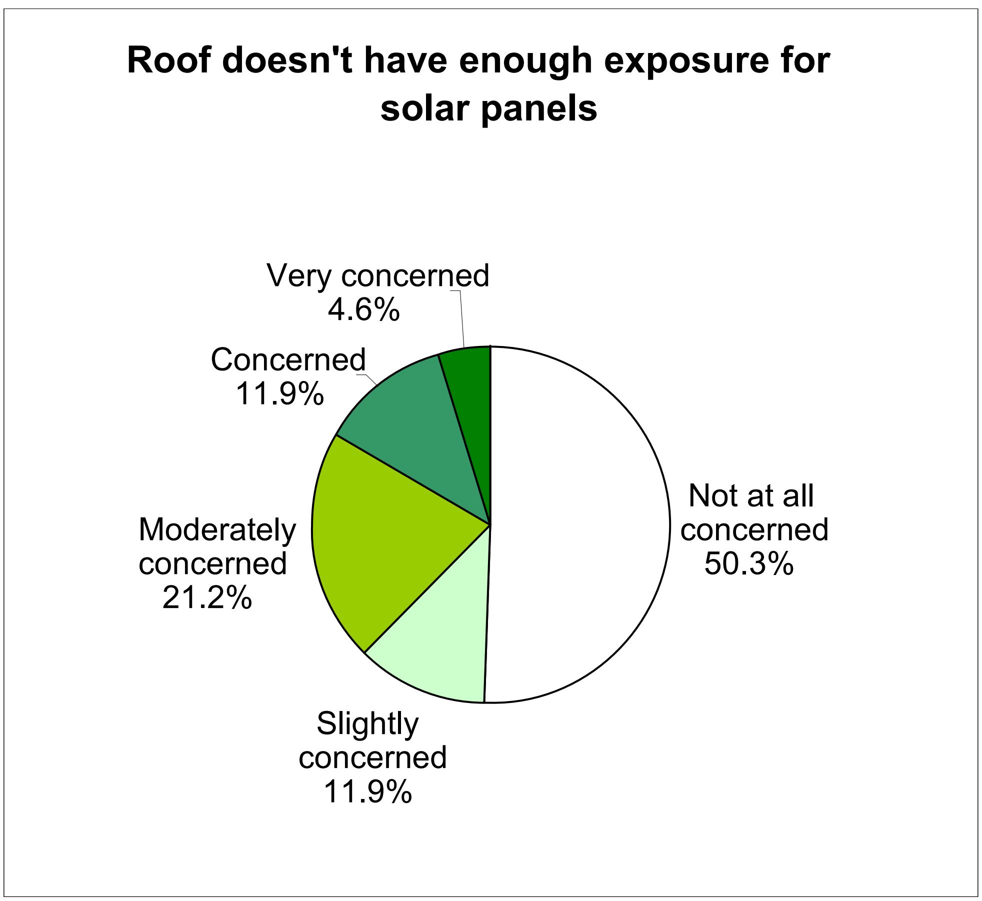
"Would you be concerned that your roof does not have enough solar exposure for solar panels to generate any significant amount of electricity?"

Responses are presented in table 6.14.

Table 6.14 – Statistics and Frequency of Answers for Question 7

Roof doesn't have enough exposure for solar panels						
			Frequency	Percent	Valid percent	Cumulative percent
Valid	Not at all concerned		76	47.5	50.3	50.3
	Slightly concerned		18	11.3	11.9	62.3
	Moderately concerned		32	20.0	21.2	83.4
	Concerned		18	11.3	11.9	95.4
	Very concerned		7	4.4	4.6	100.0
	Total n		151	94.4	100.0	
Missing			9	5.6		
Total			160	100.0		
Mean:	2.09					
Median:	1					
Mode:	1					

Figure 6.12 – Percentages of Answers to Question 7



6.6.3.8 Question 8

Question 8 of the questionnaire (Appendix A) asked the participants the following:

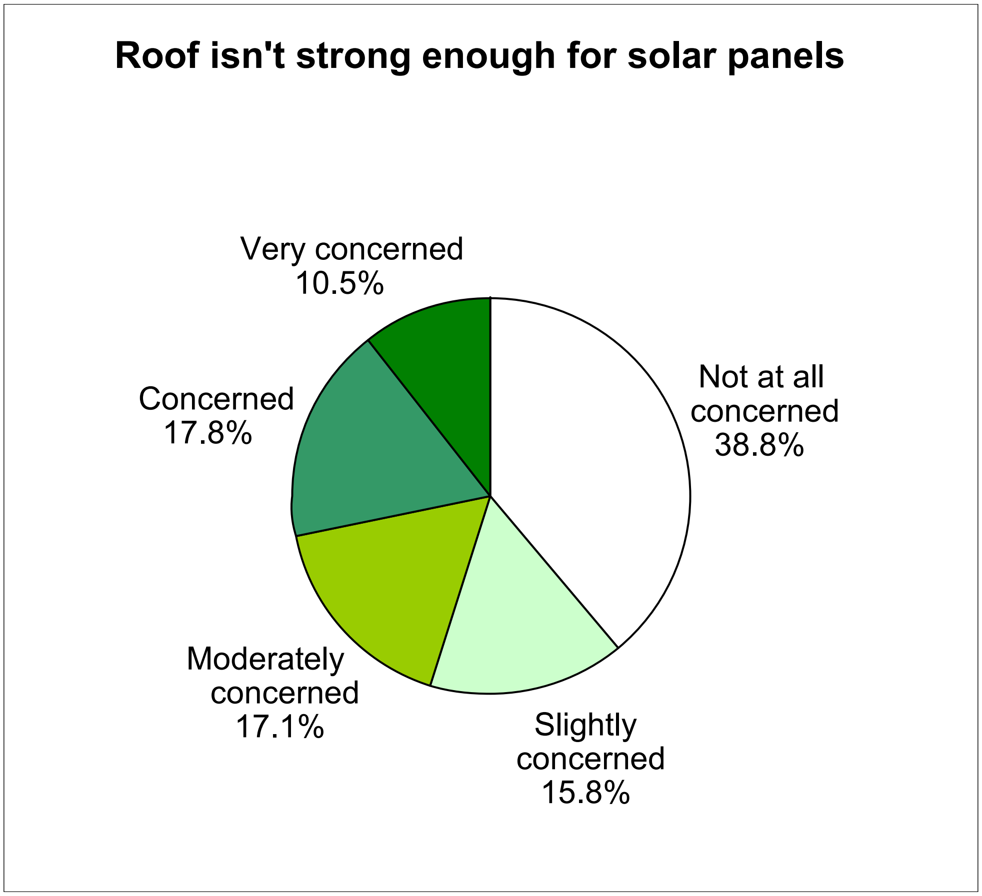
"Would you be concerned that your roof does not have enough strength to support solar panels?"

Responses are presented in table 6.15.

Table 6.15 – Statistics and Frequency of Answers for Question 8

Roof isn't strong enough for solar panels						
		Frequency	**Percent**	**Valid percent**	**Cumulative**
Valid	Not at all concerned	59	36.9	38.8	38.8
	Slightly concerned	24	15.0	15.8	54.6
	Moderately concerned	26	16.3	17.1	71.7
	Concerned	27	16.9	17.8	89.5
	Very concerned	16	10.0	10.5	100.0
	Total n	152	95.0	100.0	
Missing		8	5.0		
Total		160	100.0		
Mean:	2.45				
Median:	2				
Mode:	1				

Figure 6.13 – Percentages of Answers to Question 8



6.6.3.9 Question 9

Question 9 of the questionnaire (Appendix A) asked the participants the following:

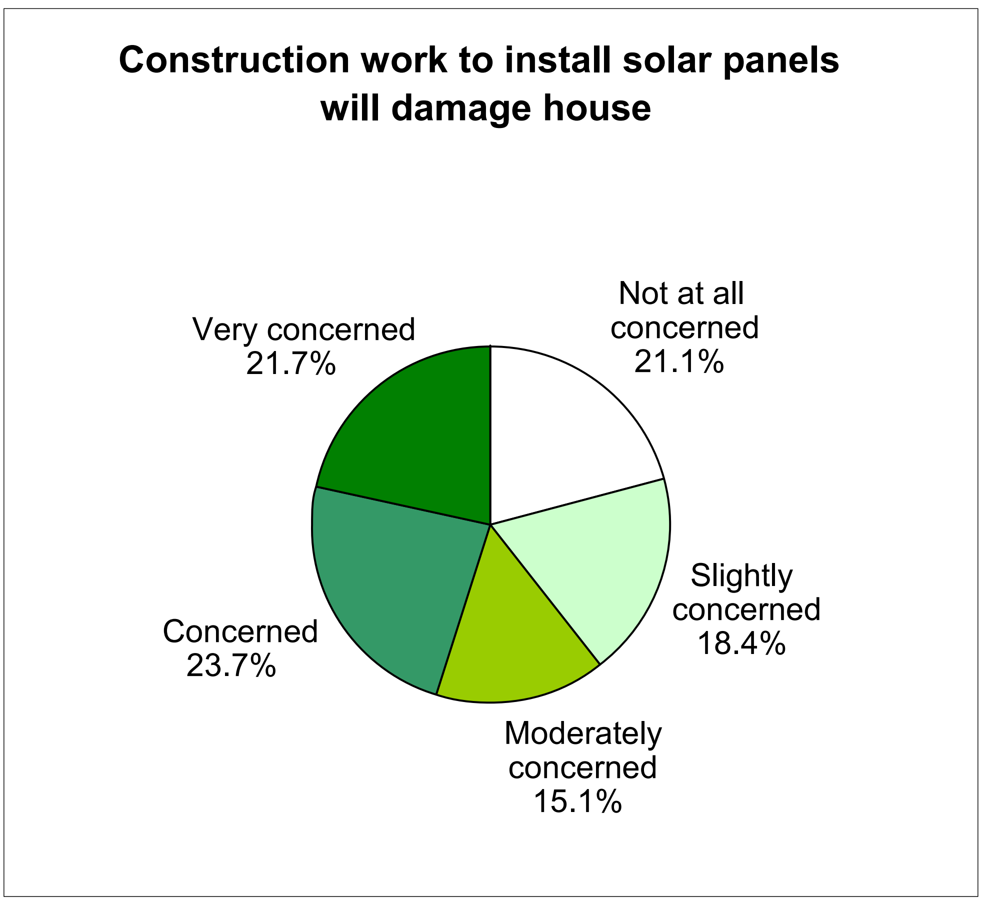
"Would you be concerned that the construction work required to install the solar panels on your roof could cause damage to your house or landscaping?"

Responses are presented in table 6.16.

Table 6.16 – Statistics and Frequency of Answers for Question 9

Construction work to install solar panels will damage house					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Not at all concerned	32	20.0	21.1	21.1
	Slightly concerned	28	17.5	18.4	39.5
	Moderately concerned	23	14.4	15.1	54.6
	Concerned	36	22.5	23.7	78.3
	Very concerned	33	20.6	21.7	100.0
	Total n	152	95.0	100.0	
Missing		8	5.0		
Total		160	100.0		
Mean:	3.07				
Median:	3				
Mode:	4				

Figure 6.14 – Percentages of Answers to Question 9



6.6.3.10 Question 10

Question 10 of the questionnaire (Appendix A) asked the participants the following:

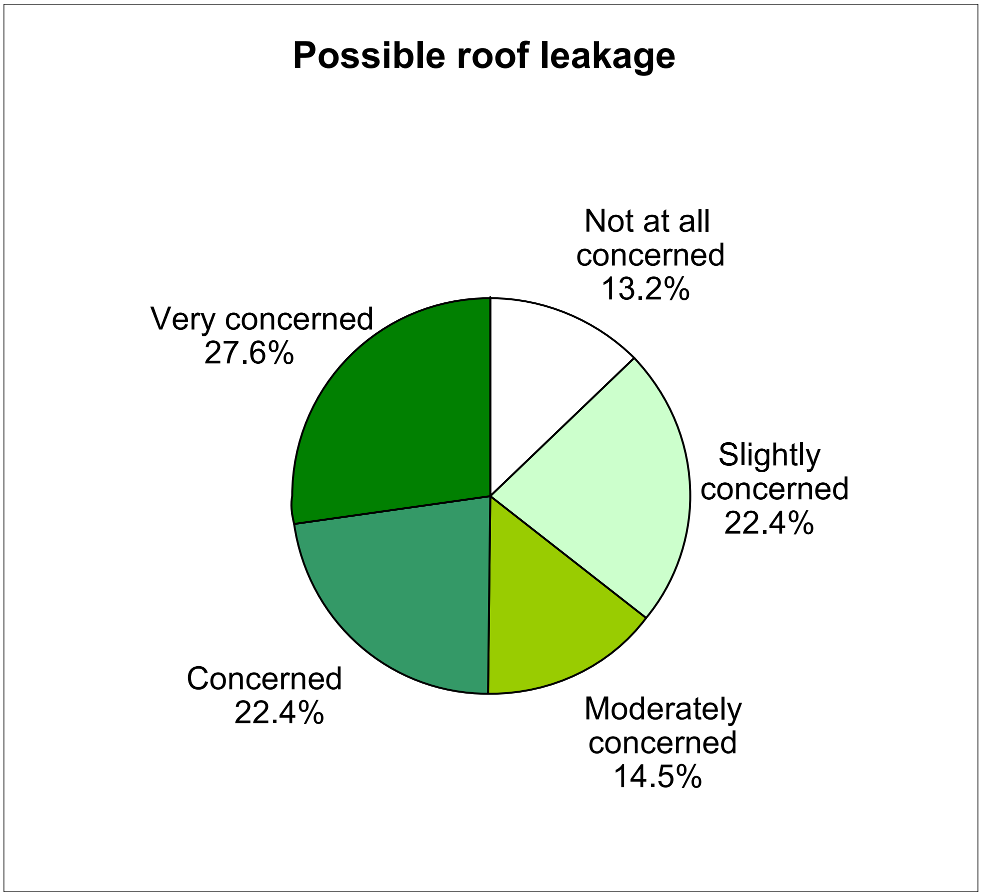
"Would you be concerned that your roof might leak after the solar panels are installed on it?"

Responses are presented in table 6.17.

Table 6.17 – Statistics and Frequency of Answers for Question 10

Possible roof leakage						
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Not at all concerned	20	12.5	13.2	13.2
	Slightly concerned	34	21.3	22.4	35.5
	Moderately concerned	22	13.8	14.5	50.0
	Concerned	34	21.3	22.4	72.4
	Very concerned	42	26.3	27.6	100.0
	Total n	152	95.0	100.0	
Missing		8	5.0		
Total		160	100.0		
Mean:	3.29				
Median:	3.5				
Mode:	5				

Figure 6.15 – Percentages of Answers to Question 10



6.6.3.11 Question 11

Question 11 of the questionnaire (Appendix A) asked the participants the following:

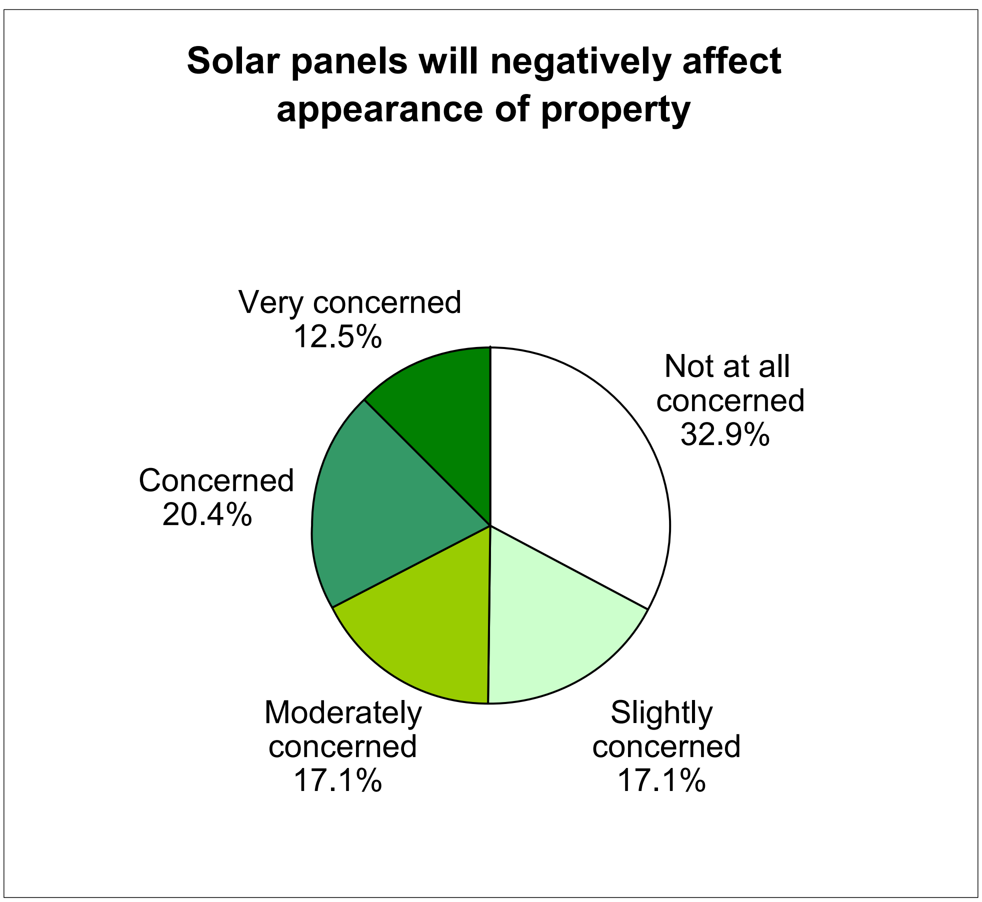
"Would you be concerned that the solar panels would affect the appearance of your property negatively?"

Responses are presented in table 6.18.

Table 6.18 – Statistics and Frequency of Answers for Question 11

Solar panels will negatively affect appearance of property					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Not at all concerned	50	31.3	32.9	32.9
	Slightly concerned	26	16.3	17.1	50.0
	Moderately concerned	26	16.3	17.1	67.1
	Concerned	31	19.4	20.4	87.5
	Very concerned	19	11.9	12.5	100.0
	Total n	152	95.0	100.0	
Missing		8	5.0		
Total		160	100.0		
Mean:	2.62				
Median:	2.5				
Mode:	1				

Figure 6.16 – Percentages of Answers to Question 11



6.6.3.12 Question 12

Question 12 of the questionnaire (Appendix A) asked the participants the following:

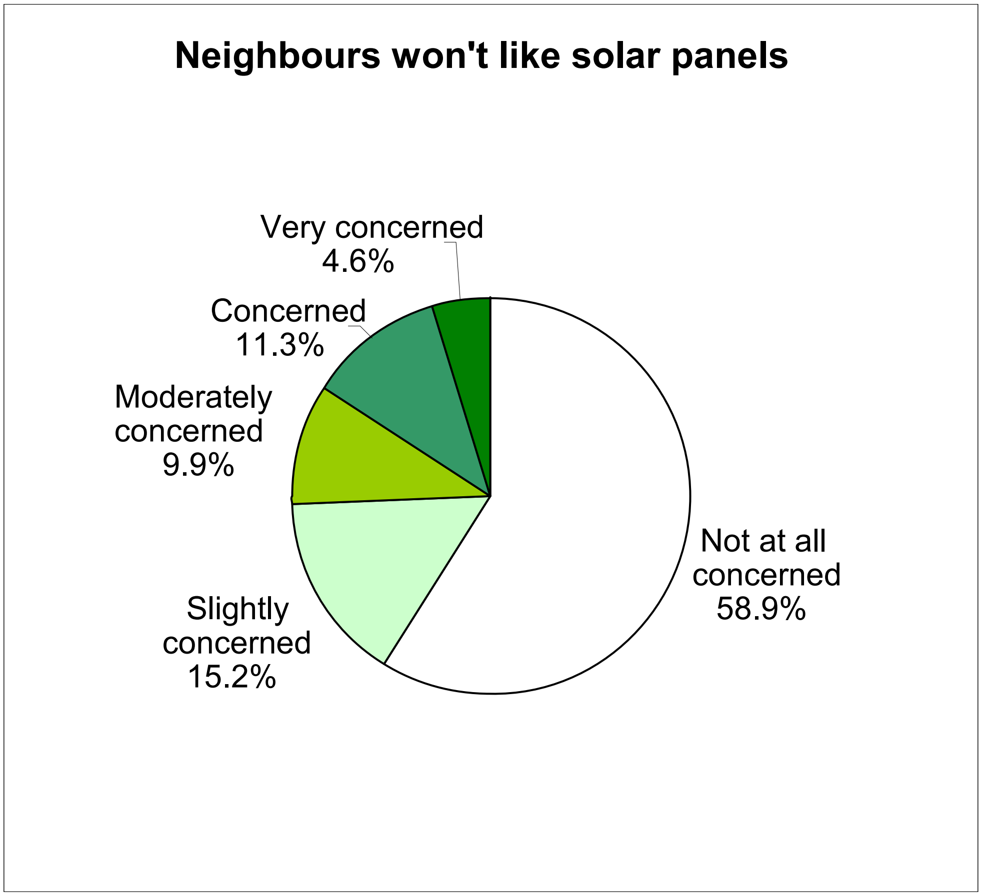
"Would you be concerned that your neighbours might not like the solar panel installation on your roof?"

Responses are presented in table 6.19.

Table 6.19 – Statistics and Frequency of Answers for Question 12

Neighbours won't like solar panels					
		Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	Not at all concerned	89	55.6	58.9	58.9
	Slightly concerned	23	14.4	15.2	74.2
	Moderately concerned	15	9.4	9.9	84.1
	Concerned	17	10.6	11.3	95.4
	Very concerned	7	4.4	4.6	100.0
	Total n	151	94.4	100.0	
Missing		9	5.6		
Total		160	100.0		
Mean:	1.87				
Median:	1				
Mode:	1				

Figure 6.17 – Percentages of Answers to Question 12



6.6.3.13 Question 13

Question 13 of the questionnaire (Appendix A) asked the participants the following:

"Are there any other factors, which have not been mentioned in questions 7 to 12, that could be sources of serious concern about the installation of the solar panels on your roof?"

Responses are recorded in Appendix C.

There were 44 questionnaires received that included an answer to this question. An analysis of the responses to question 13 is not provided in this thesis.

6.6.4 Comments About the Survey at the End of the Questionnaire

There were 59 questionnaires received that included a comment in the space provided at the end of the questionnaire. These are listed in Appendix C. An analysis of these comments is not provided in this thesis.

6.7 Division of Respondents into Groups, According to the Responses to Questions in Part 1

Based on responses to Part 1 of the survey, one can divide the respondents into the six groups previously discussed in chapter 4 – Trusting Good Citizens, Not Trusting Good Citizens, Visibility Junkies, Trusting Odd Participants, Not Trusting Odd Participants, and Naysayers. The answer patterns for each group and the discussion of accepting a response as valid are presented in section 6.4.2.

Table 6.20 shows the frequency of the respondents in each group. Out of 160 valid responses to the survey, there were 155 responses that could be classified as belonging to one of the six groups. Four responses classified as 'Other' are from those who answered the initial question positively. One respondent, who was disqualified from this analysis because of incorrect answers in Part 1, is classified as 'Missing' (see response #155 in Appendix B).

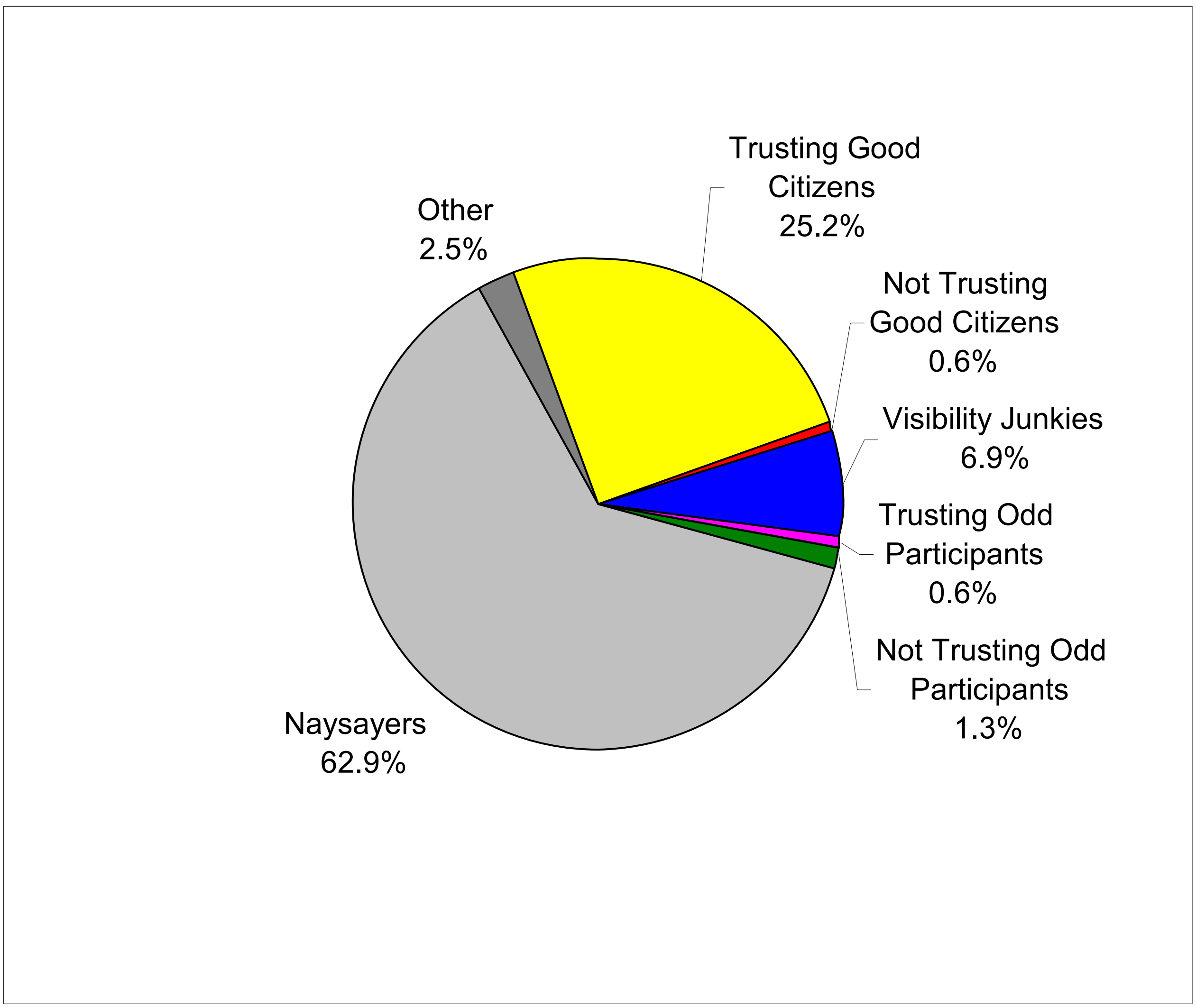
As we can see, the group Not Trusting Good Citizens is sparsely populated. Its only member is the respondent mentioned in the descriptions of the results for questions A1 and B. This is the person who could not decide between positive and negative answers to those questions. If it was decided to strictly apply a general validity rule from section 6.2 to this response, the group would have no members, while the number of disqualified responses would grow to two.

The next chapter will show how these results can be used to test the hypotheses of this thesis.

Table 6.20 – Frequency of Answers for Groups Created by Responses to Questions in Part 1

	Group of Respondents	Frequency	Percent	Valid percent	Cumulative percent
Valid	Trusting Good Citizens	40	25.0	25.2	25.2
	Not Trusting Good Citizens	1	0.6	0.6	25.8
	Visibility Junkies	11	6.9	6.9	32.7
	Trusting Odd Participants	1	0.6	0.6	33.3
	Not Trusting Odd Participants	2	1.3	1.3	34.6
	Naysayers	100	62.5	62.9	97.5
	Other	4	2.5	2.5	100.0
	Total n	159	99.4	100.0	
Missing		1	0.6		
Total		160	100.0		

Figure 6.18 – Percentages for Groups Created by Responses to Questions in Part 1



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With results of the conducted survey now presented, the discussion of their significance for the hypotheses testing will be performed in the following chapter.

Chapter 7: Discussion

Delving into the issues of barriers and attractors to participation in green electricity programs, the goal of this research project has been to determine whether changing the levels of trust concerns that green electricity programs give rise to, and the levels of benefits of visibility the program provides, influences participation in the programs.

In addition, this research project attempts to measure the strength of the two effects.

This chapter will discuss how the results of the conducted survey contribute to the fulfillment of these goals.

7.1 The Influence of Level of Trust Concerns and Benefits of Visibility of a Green Electricity Program on Participation, as Revealed by Part 1 of the Survey

The mathematical calculations of the limits of confidence intervals for all the groups of respondents presented below can be found in Appendix D – Statistical Calculations. Note that sample proportions (percentages) for all the groups are not located in the middle of the confidence interval.

7.1.1 The Influence of Level of Trust Concerns

As discussed in chapter 4, testing the first of the hypotheses, which relates to trust concerns, involves finding a group of households that declare participation in program #2 (familiar solar farm), but not in program #1 (undisclosed solar farms). The group consists of Not Trusting Good Citizens and Not Trusting Odd Participants.

According to the results presented in section 6.7, the sum of Not Trusting Good Citizens and Not Trusting Odd Participants is 3.

Sample proportion p(NTGC+NTOP) = 3/159 = 1.9%

Confidence interval : 0.7% - 5.4%

This result seems to confirm the first of the hypotheses, but only very weakly. Not only is the size of the sought after group small – three households – but one of its members a Not Trusting Good Citizen is a respondent who was almost disqualified from the set of properly completed questionnaires (see sections 6.6.2.2 and 6.6.2.3) . According to the reasoning based on the first part of the survey questions, the level of trust concerns that a green electricity program raises barely influences participation.

7.1.1.1 The Strength of Influence of Level of Trust Concerns

To gain a better understanding of the significance of the difference in participation caused by lowering the level of trust concerns, an analysis of the strength of the effect must be performed. The following ratio, described in chapter 4, has to be calculated, which is a rather straightforward task. However, calculations of its confidence interval at the 95% confidence level turned out to be quite complicated, and are presented thoroughly in Appendix D.

$$\textit{Strength of influence of level of trust concerns} = \frac{\text{Not Trusting Good Citizens + Not Trusting Odd Participants}}{\text{Trusting Good Citizens + Trusting Odd Participants}}$$

According to the results presented in section 6.7, the sum of Trusting Good Citizens and Trusting Odd Participants is 41.

Sample proportion p(TGC+TOP) = 41/159 = 25.8%

Confidence interval : 19.6% - 33.1%

Strength of influence of level of trust concerns = 3/41 = 7.3% $\pm$ 8.6%

There is an obvious problem with the above result, because the value of the ratio cannot be lower then zero. As mentioned in Appendix D, this inconsistency is the result of the approximations made in the first approach to the calculations. We can interpret this result however, by stating that the true value of the ratio is not significantly different from zero. The second approach to the calculations presented in Appendix D confirms this interpretation. This is all that can be determined with this sample size, and at the commonly used confidence level of 95%.

These calculations confirm and strengthen the conclusion that, as revealed by the answers to the questions from Part 1 of the survey, the level of trust concerns that green electricity program has, barely influences participation, if at all. This however, is not the final conclusion of this study. Further discussion will follow.

7.1.2 The Influence of Level of Benefits of Visibility

To test the second of the hypotheses, that relating to benefits of visibility, one needs to find the existence of Visibility Junkies.

According to the results presented in section 6.7, the number of Visibility Junkies is 11.

Sample proportion p(VJ) = 11/159 = 6.9%
Confidence interval : 3.9% - 11.9%

This result seems to confirm the second of the hypotheses well. Therefore, according to the reasoning based on the first part of the survey questions, the level of benefits of visibility that a green electricity program has, does influence participation.

7.1.2.1 The Strength of Influence of Level of Benefits of Visibility

To measure the strength of influence of the level of benefits of visibility, the following ratio, described in chapter 4, has to be calculated. Like in the case of trust concerns, calculations of its confidence interval at the 95% confidence level are quite complicated. They are presented in Appendix D.

$$\textit{Strength of influence of level of benefits of visibility} = \frac{\text{Visibility Junkies}}{\text{Trusting Good Citizens} + \text{Not Trusting Good Citizens}}$$

According to the results presented in section 6.7, the sum of Trusting Good Citizens and Not Trusting Good Citizens is 41.

Sample proportion p(TGC+NTGC) = 41/159 = 25.8%

Confidence interval : 19.6% - 33.1%

Strength of influence of level of benefits of visibility = 11/41 = 26.8% $\pm$ 17.8%

These calculations show that the strength of influence of benefits of visibility is quite large. Even its lowest value at the 95% significance level is still at 9%, while the most probable value (the proportion itself) is over 25%. Benefits of visibility seem to influence participation very much. Again, this is not the final conclusion of this study. Further discussion will follow.

7.1.3 Further Discussion of the Results from Part 1 of the Survey

Analysis of the influence of levels of trust concerns and benefits of visibility cannot stop here. As mentioned in section 4.2, the levels of trust concerns for programs #3 (solar panels on own roof) and #4 (solar panels on roof in community) might be lower than for program #2 (familiar solar farm), sufficient enough to cause some of the households, which refuse participation in program #2 (familiar solar farm) because of trust concerns, to declare participation in at least one of the two 'visible' programs, just because of their low level of trust concerns, and not because of the benefits of visibility. They would, however, be defined as Visibility Junkies, and count towards the combined participation in 'visible' programs, thus exaggerating the effect of visibility. At the same time, they would not count towards the population of Not Trusting Good Citizens, weakening the significance of influence of the level of trust concerns. As one can see, the relative strength of the two factors is still debatable.

7.1.3.1 The Combined Influence of Trust Concerns and Benefits of Visibility

Since one cannot be sure if the assignment to the groups Visibility Junkies and Not Trusting Good Citizens is proper, one can combine the two groups to get a new group that consist of respondents who chose to participate in 'visible' programs #3, or #4 because of low levels of trust concerns raised by the programs *or* because of high levels of visibility benefits provided by them. (Remember these respondents declined participation in program #1 (undisclosed solar farms)). The size of this group indicates the strength of the combined influence of trust concerns and benefits of visibility. This size should be compared to the size of the group that chose to participate in both 'visible' programs #3 or #4, and program #1, i.e. Trusting Good Citizens, by means of calculating a ratio.

According to the results presented in section 6.7, the combined number of Visibility Junkies and Not Trusting Good Citizens is 12.

Sample proportion p(VJ+NTGC) = 12/159 = 7.5%

Confidence interval : 4.4% - 12.8%

The number of Trusting Good Citizens is 40.

Sample proportion p(TGC) = 40/159 = 25.2%
Confidence interval : 19.0 – 32.5%

To measure the strength of the combined influence of the level of trust concerns and the level of benefits of visibility, the following ratio has to be calculated. Calculations of its confidence interval at the 95% confidence level are analogous to the calculations of the ratio from section 7.1.2.1. They are presented in Appendix D.

$$\textit{Strength of combined influence of levels of trust concerns and benefits of visibility} = \frac{\text{Visibility Junkies + Not Trusting Good Citizens}}{\text{Trusting Good Citizens}}$$

Strength of combined influence of level of trust concerns and level of benefits of visibility = 12/40 = 30.0% $\pm$ 19.3%

The combined effect of these two factors emerges very clearly, but in order to be able to say anything more about the relative strength of the influence of level of trust concerns and benefits of visibility, one must use the answers to the questions from Part 2 of the survey. This discussion continues in section 7.2.

7.1.4 Additional Conclusion based on Part 1 of the Survey

The data from Part 1 of the survey make possible the calculation of the percentage of detached and semi-detached home owners in Oakville, who show willingness to participate in a green (or strictly speaking, solar) electricity program. If we add the members of the following groups together: Good Citizens, Visibility Junkies, and Odd Participants, and divide this sum by the number of all respondents who were eligible to answer questions about participation from Part 1 and answered them correctly (155), we will get the willingness to participate.

The sum of the members of the above mentioned groups is 55. The sample proportion p = 55/155 equals 35.5%, and the confidence interval is between 28.4% and 43.2% (see section 1.2 in the Appendix D). This result reaches the lower end of the results from other studies on willingness to pay premium for green electricity, mentioned in chapter 1, which means that Oakville does not stray from the other communities in this respect.

7.2 The Influence of Level of Trust Concerns and Benefits of Visibility of a Green Electricity Program on Participation, as Revealed by Part 2 of the Survey

Part 2 of the survey asks questions about opinions of the survey participants on trustworthiness of the green electricity program providers, and about their levels of appreciation for the benefits of visibility of the solar panels installed on their roofs. By doing so, Part 2 lets one measure each participant's level of trust concerns about green electricity program providers, and level of appreciation for the benefits of visibility. A typical Visibility Junkie should have high levels of appreciation for benefits of visibility, while a typical Not Trusting Good Citizen should have high levels of trust concerns. As explained in latter parts of this section, these data can provide additional insights helpful for testing of the two hypotheses.

Questions 1 to 12 from Part 2 have ordinal answers. Since they are not numerical, even assigning values 1 to 5 to each answer, from the least intense expression of opinion (on the left hand side) to the most intense (on the right), does not mean the intensity of opinion marked by 5 is five times that of the one marked by 1. However, assigning such values makes it easier to discuss the results and attain important insights.

Table 7.1 shows the answers to the three questions about trust concerns (questions 1 – 3), and to the three questions about benefits of visibility (questions 4 – 6) for all Visibility Junkies, and for the sole Not Trusting Good Citizen. The answers are assigned numbers from 1 to 5 in the manner described above.

Table 7.1 – Visibility Junkies and Not Trusting Good Citizen Responses to Questions 1 -6 from Part 2 of the Survey

	Trust questions			Visibility questions			
VJ	**Q 1**	**Q 2**	**Q 3**	**Q4**	**Q 5**	**Q 6**	**Comments**
1	3	4	4	2	2	1	high, low - typical NTGC
2	3	4	4	2	4	3	high, high
3	3	3	4	5	5	5	high, high
4	3	4	3	1	1	1	high, low - typical NTGC
5	3	4	5	5	4	1	high, high
6	3	3	3	-	-	-	high, no data
7	2	3	2	1	1	1	low, low
8	2	2	3	3	3	3	low, high – typical VJ
9	3	3	3	2	2	2	high, low - typical NTGC
10	3	3	2	3	3	3	low, high – typical VJ
11	2	4	3	3	3	3	high, high
NTGC	**Q1**	**Q 2**	**Q 3**	**Q 4**	**Q 5**	**Q 6**	**Comments**
1	3	3	4	1	2	2	high, low - typical NTGC

At the beginning of this discussion, it had to be decided when a respondent is considered to have a low or high level of trust concerns and benefits of visibility. Certainly this is an arbitrary decision, but not without limits, because answers to the questions from Part 2 have a particular meaning that is not completely relative. For each question, an answer that has been assigned a value of 3 expresses a middle intensity of opinion – a trust concern or appreciation for benefits of visibility is definitely present, but not very strong. It was decided then, that a respondent has a high level of trust concerns or appreciation for benefits of visibility, when at least one of the answers in the relevant group is above 3, or all three of them are 3. A respondent has a low level of trust concerns or appreciation for benefits of visibility if the opposite is true.

The comments column in table 7.1 indicates the levels of trust concerns and appreciation of benefits of visibility (low or high), determined according to the rules described above. The sole Not Trusting Good Citizen expresses opinions in line with the classification. However, the picture for Visibility Junkies is rather different than the one emerging from analysis of the questions from Part 1. It turns out that only six members of this group report high levels of appreciation for benefits of visibility. One member did not answer the benefits of visibility questions, and four of them have low levels of appreciation for benefits of visibility.

Out of all 11 members of the Visibility Junkies group, only two expressed opinions that can without a doubt be classified as coming from a true Visibility Junkie (low trust concerns and high appreciation for benefits of visibility), and three express opinions that can without a doubt be classified as coming from a true Not Trusting Good Citizen (high trust concerns and low appreciation for benefits of visibility). Four members, who expressed high levels of both trust concerns and appreciation for benefits of visibility, could be either true Visibility Junkies with a high level of trust concerns, or Not Trusting Good Citizens, for whom program #2 (familiar solar farms) is not trustworthy enough. Two remaining members cannot be easily classified. If one were to reassign the three households that express opinions characteristic of Not Trusting Good Citizens to the Not Trusting Good Citizens group, and split the four that could belong to both, between the Visibility Junkies group and the Not Trusting Good Citizens group, then a much more balanced picture of the influence of levels of trust concerns and benefits of visibility would appear.

However, recalculation of the strengths of influence will not be done here, because the heuristic analysis in the previous paragraph based on the answers to questions from Part 2 does not justify that. In the final conclusion, one can only come back to the term from chapter 1, and state that the level of opaqueness of green electricity programs has a quite pronounced influence on participation – the lower the level of opaqueness, the higher the participation. Two major dimensions of the opaqueness, level of trust concerns and level of benefits of visibility, both seem to have influence on participation – the lower the level of trust concerns, and the higher the level of benefits of visibility, the higher the participation. More precise determination of the relative importance of these two dimensions needs to be researched further.

7.3 The Correspondence between Responses to the Questions from Part 2, and Division into Groups of Respondents based on answers to the Questions from Part 1

As discussed in section 4.2, seeing the correspondence between participants' membership in one of the groups defined by a participation pattern (Trusting Good Citizens, etc.), and their actual expressed opinions on the topics of trust concerns and appreciation of benefits of visibility, is an additional confirmation of the consistency of the results of the study. For this reason, a statistical analysis of answers to the questions from Part 2 was conducted, and two comparisons were performed. In the first, it was investigated whether Trusting Good Citizens appear to be more trusting than Visibility Junkies and Naysayers. In the second, it was investigated whether Visibility Junkies have a higher appreciation for benefits of visibility than Trusting Good Citizens and Naysayers. Since the Not Trusting Good Citizens group has one member only, it was not included in the analysis.

7.3.1 Ways of Analysing the Answers to Questions from Part 2

Each question from Part 2 of the survey can be analysed on its own as an expression of the opinion of Oakville residents living in detached and semi-detached houses. All valid responses to a question count as a size of sample *n*. This is valuable material for the study of participation in green electricity programs, and a brief summary of those results will be provided later.

For each group of respondents – Trusting Good Citizens, etc. – one can do a similar analysis, but this time the size of the sample *n* will go down to the number of valid responses to a given question by members of a particular group.

7.3.2 How to Compare Answers to a Question from Part 2 for Different Groups of Respondents

Since questions 1 to 12 from Part 2 have ordinal answers, even assigning values 1 to 5 to each answer, from the least intense expression of opinion (on the left hand side) to the most intense (on the right), does not make it proper to use statistical analysis (i.e. calculating averages and variances). Still, after assigning such values one can gain important insights about the weight of the answer, by calculating the mean values of answers for all of the groups of interest.

The questions from Part 2 were designed to have ordinal answers to provide more nuanced expressions of respondents' opinions than would be possible through a 'Yes/No' answer. Unfortunately, the consequences of such a design for statistical analysis were not completely thought through at the time of design and implementation. In order to have a more formal mechanism to compare the answers to a question from Part 2 by different groups of respondents, the following strategy was suggested by Prof. Shojaeddin Chenouri from the Department of Statistics and Actuarial Science of Waterloo University: one should turn a five value answer to a question into a 'Yes/No' answer, by deciding arbitrarily how far up the scale an answer is considered a 'No', while every answer above that point would be considered a 'Yes' answer. For example, answers 1 and 2 could be aggregated as 'No' and 3, 4 , and 5 could be aggregated to be 'Yes'. The percentages of Yes answers for different groups could then be compared with the help of a statistical test.

Evidently, the process of such aggregation is very arbitrary. Technically, for all questions 1 to 12, answer 1 ('Not at all/I would not') is a clear 'No', while answers 2, 3, 4, and 5 are varying degrees of 'Yes'. For *questions 1 to 3*, however, one could argue that answers 1 and 2 ('Not at all' and 'Probably not') being considered a more fuzzy 'No', would be a better choice, while answers 3, 4, and 5 ('Maybe yes, maybe no', 'Probably', and 'Very likely') should be treated as a fuzzy 'Yes'. Similar reasoning could apply to *questions 4 to 12*, where answers 1 and 2 ('Not at all/I would not' and 'Slightly') would be a 'No', and answers 3, 4, and 5 would be aggregated as 'Yes'. It was decided to use this aggregation throughout the analysis of various aspects of answers to the questions from Part 2.

In order to investigate how sensitive the above choice was to the way of division, a different division of answers was performed later and it is presented in Appendix F – Sensitivity Study. For all questions 1 to 12, answers 1 and 2 were aggregated to mean ‘No’, and answers 4 and 5 were aggregated to mean ‘Yes’. Answers 3 were removed from the analysis. The results of the new Yes/No aggregation were then compared to the aggregation performed in this chapter.

7.3.3 Comparing Answers to Trust Concern Questions for Different Groups

Different ways of comparing the results for the trust concerns questions are presented below. For comparing the mean value of the answers to each question, no formal statistical methodology is used. For the task of comparing aggregated ‘Yes’ answers, test statistic U1, presented in section 3 of the Appendix D , is employed to properly assess if the percentage of ‘Yes’ answers for a group is significantly higher than the percentage of ‘Yes’ answers for another group. At a 95% confidence level, the value of the U1 statistic must be greater than 1.64 to consider that one percentage is significantly higher than another one, or less than minus 1.64 to consider that one percentage is significantly lower than another one. The calculated U1 statistic values are presented for different group comparisons in corresponding tables.

In this study, the statistic U1 is used instead of the Student’s t-test. The latter is used to test the difference between *means* of two variables that are known to have normal distribution, while the former tests differences between *percentages* (also called sample proportions). In this case of this study, differences between *percentages* (also called sample proportions) are tested. Also note, that the statistic U1 is not the same as the U-test otherwise known as the Wilcoxon rank sum test.

7.3.3.1 Comparing Mean Values of Answers to Trust Concerns Questions

Table 7.2 shows the results of the survey for questions 1 to 3 from Part 2 in the form of percentages for each of the five answers. This is presented for valid responses from the three groups of interest in our analysis.

Table 7.2 – Percentages of Five Answers and Mean Value of Answer for Different Groups for Trust Concerns Questions

Answer number & Mean value	Question 1 Waste	Question 2 Exces.profit	Question 3 Cheat
Trusting Good Citizens	**n = 40**	**n = 40**	**n = 40**
%1	7.5	0.0	10.0
%2	32.5	32.5	55.0
%3	50.0	50.0	32.5
%4	10.0	17.5	2.5
%5	0.0	0.0	0.0
Mean value	**2.6**	**2.9**	**2.3**
Visibility Junkies	**n = 11**	**n = 11**	**n = 11**
%1	0.0	0.0	0.0
%2	27.3	9.1	18.2
%3	72.7	45.5	45.5
%4	0.0	45.5	27.3
%5	0.0	0.0	9.1
Mean value	**2.7**	**3.4**	**3.3**
Naysayers	**n = 95**	**n = 94**	**n = 92**
%1	0.0	0.0	7.6
%2	28.4	30.9	38.0
%3	34.7	31.9	42.4
%4	20.0	24.5	7.6
%5	16.8	12.8	4.3
Mean value	**3.3**	**3.2**	**2.6**

Using the mean values of the answers, one can represent the weight of all the responses in a simple one number form. In general, the differences between the groups are small. For all questions however, the mean values for Trusting Good Citizens are lower than the mean values for Visibility Junkies and Naysayers. This result is in line with the assumption that Trusting Good Citizens are the most trusting group of respondents. This is not a trivial result, because the classification based on answers to questions from Part 1 only indirectly implies that this is so.

7.3.3.2 Comparing Aggregated Yes/No Answers when Answers 3, 4, and 5 Assigned as 'Yes', for Trust Concerns Questions

Table 7.3 contains the results for questions 1 to 3 from Part 2, when answers 1 and 2 are aggregated as 'No' and answers 3, 4, and 5 are aggregated as 'Yes'. This is presented in the form of percentages for valid responses from three groups of interest in this analysis. Note that for any given question, the valid number of responses *n* varies for each group. At the bottom of the table, the values of the statistic U1 are provided. The first row contains the results of comparing percentages of 'Yes' answers for Trusting Good Citizens and Visibility Junkies. The second row contains the results for Trusting Good Citizens and Naysayers. Values for the U1 statistic, which at a 95% confidence level allow confirming a statistically significant difference between the percentages ($|U1| > 1.64$), are printed in bold.

Table 7.3 – Percentages for Aggregated Yes/No Answers, when 1 and 2 Are Aggregated as 'No' and 3, 4, 5 Are Aggregated as 'Yes', for Trust Concerns Questions

Statistics	Question 1	Question 2	Question 3
	Waste	Exces.profit	Cheat
Trusting Good Citizens			
Valid answers	40	40	40
%No	40.0	32.5	65.0
%Yes	**60.0**	**67.5**	**35.0**
Visibility Junkies			
Valid answers	11	11	11
%No	27.3	9.1	18.2
%Yes	**72.7**	**90.9**	**81.8**
Naysayers			
Valid answers	95	94	92
%No	28.4	30.8	45.6
%Yes	**71.6**	**69.2**	**54.4**
U1 statistic values			
TGC vs VJ	-0.79	**-1.76**	**-2.92**
TGS vs NS	-1.30	-0.19	**-2.07**

In this form of Yes/No aggregation, in all three questions Trusting Good Citizens show on average less trust concerns than Visibility Junkies and Naysayers. The difference is statistically significant for questions 2 and 3, when compared to Visibility Junkies, and for question 3, when compared to Naysayers. Again, as discussed in the previous section, this result is in line with the assumption that Trusting Good Citizens are the most trusting group of respondents.

7.3.4 Comparing Answers to Benefits of Visibility Questions for Different Groups

Different ways of comparing the results for benefits of visibility questions are presented below. A statistical approach identical to the one from section 7.3.3 was used in the analysis of the responses.

7.3.4.1 Comparing Mean Values of Answers to Benefits of Visibility Questions

Table 7.4 contains the results for questions 4 to 6 from Part 2, in the form of percentages for each of the five answers. This is presented for valid responses from the three groups of interest in our analysis.

Table 7.4 – Percentages of Five Answers and Mean Value of Answer for Different Groups for Benefits of Visibility Questions

Answer number & Mean value	Question 4 Brag	Question 5 Influence	Question 6 Technology
Visibility Junkies			
%1	20.0	20.0	40.0
%2	30.0	20.0	10.0
%3	30.0	30.0	40.0
%4	0.0	20.0	0.0
%5	20.0	10.0	10.0
Mean value	**2.7**	**2.8**	**2.3**
Trusting Good Citizens			
%1	40.0	15.4	25.6
%2	27.5	28.2	17.9
%3	20.0	25.6	23.1
%4	7.5	28.2	30.8
%5	5.0	2.6	2.6
Mean value	**2.1**	**2.7**	**2.7**
Naysayers			
%1	70.8	56.3	59.4
%2	8.3	16.7	12.5
%3	13.5	18.8	14.6
%4	7.3	7.3	10.4
%5	0.0	1.0	3.1
Mean value	**1.6**	**1.8**	**1.9**

When comparing Visibility Junkies to Naysayers, one can immediately see that mean values for Visibility Junkies are higher than for Naysayers. The differences between Visibility Junkies and Trusting Good Citizens are less pronounced, and in the last question the mean value is actually lower for Visibility Junkies than for Trusting Good Citizens.

7.3.4.2 Comparing Aggregated Yes/No Answers when Answers 3, 4, and 5 Assigned as 'Yes', for Benefits of Visibility Questions

Table 7.5 contains the results for questions 4 to 6 from Part 2, when answers 1 and 2 are aggregated as 'No', and answers 3, 4, and 5 are aggregated as 'Yes'. This is presented in the form of percentages for valid responses from the three groups of interest in our analysis. Note:

for a given question, the valid number of responses *n* varies for each group. At the bottom of the table, the values of the U1 statistic are provided. The first row contains the results of comparing percentages of 'Yes' answers for Visibility Junkies and Trusting Good Citizens. The second row contains the results for Visibility Junkies and Naysayers. Values for the U1 statistic, which at a 95% confidence level allow confirming a statistically significant difference between the percentages ($|U1| > 1.64$), are printed in bold.

Table 7.5 – Percentages for Aggregated Yes/No Answers, when 1 and 2 Are Aggregated as 'No' and 3, 4, 5 Are Aggregated as 'Yes', for Benefits of Visibility Questions

Statistics	Question 4	Question 5	Question 6
	Brag	Influence	Technology
Visibility Junkies			
Valid answers	10	10	10
%No	50.0	40.0	50.0
%Yes	**50.0**	**60.0**	**50.0**
Trusting Good Citizens			
Valid answers	40	39	39
%No	67.5	43.6	43.5
%Yes	**32.5**	**56.4**	**56.5**
Naysayers			
Valid answers	96	96	96
%No	79.1	73.0	71.9
%Yes	**20.9**	**27.0**	**28.1**
U1 statistic values			
VJ vs TGC	1.01	0.21	-0.37
VJ vs NS	**1.87**	**2.04**	1.36

In this form of Yes/No aggregation, in all three questions, Visibility Junkies show on average more appreciation for benefits of visibility than Naysayers. The difference is statistically significant for questions 4 and 5, and close to the significance threshold for question 6. However, the picture of Visibility Junkies' greater appreciation for benefits of visibility is not as clear when compared with Trusting Good Citizens. The difference is not statistically significant for question 4, is smaller for question 5, and is reversed for question 6.

The picture that emerges from the two ways of comparing appreciation for benefits of visibility is not of complete correspondence between the assumed behaviour of Visibility Junkies, and the opinions expressed by them in Part 2 of the survey. Certainly, Visibility Junkies express decidedly more appreciation for benefits of visibility than Naysayers, but their record, when compared to Trusting Good Citizens, is mixed and less convincing. This should not be surprising, taking into consideration the detailed analysis of Visibility Junkies' answers to the questions from Part 2 presented in section 7.2, which shows that not all members of this group are true Visibility Junkies. This less complete correspondence also shows the entanglement between trust and visibility issues, because Trusting Good Citizens do not have to display a low interest in benefits of visibility, therefore the difference between them and Visibility Junkies does not have to be large.

7.4 Analysis of the Answers to Questions 1 to 6 from Part 2 of the Survey for All Valid Responses to the Survey

This section contains a short analysis of the responses of all participants in the survey to questions 1-6 from Part 2 of the survey (trust concerns and appreciation of benefits of visibility questions). Answers to these questions can give an indication of how important these two issues are for the detached and semi-detached house owners/renters of Oakville. This makes the answers a valuable material for the study of levels of participation in green electricity programs. In the case of the benefits of visibility questions, it also makes the answers important for the study of private provision of public goods. All other contributing factors being equal, it is valuable to know how strong of an influence each of these two factors are.

Table 7.6 shows two methods of looking at the data. At the top, numbers of valid answers are shown. They are important for test statistic calculations. Below, the table presents the percentages of each of the five answers to a question, where numbers 1 to 5 mark responses in the same way as in section 7.2. The mean value of the answer follows. Confidence intervals for the percentages at a 95% confidence level are presented in section 5 of Appendix D. They are within a few percent of the values shown in the table, with notable exceptions of small percentages, where the confidence intervals are visibly asymmetrical.

Going down towards the bottom, percentages of aggregated Yes/No answers when answers 1 and 2 are aggregated as 'No', and answers 3, 4, and 5 are aggregated as 'Yes', are shown. This aggregation is preformed the same way as in section 7.3. Each column shows percentages of answers, and the Yes/No aggregation for the same target question.

Below the Yes/No aggregation, results of the test statistic are shown. The proportion of 'Yes' answers for different pairs of questions are compared to determine if one proportion is significantly larger (or smaller) than the other. This is done with the help of the U2 test statistic (see Appendix D, section 4). A value that is immediately to the right of a description is the one that applies to it. For example, the value '-0.08' immediately to the right of the label 'Q1 > Q2:' is the value of the U2 statistic for the test, if the proportion of 'Yes' answers to question 1 is larger/smaller than the proportion of 'Yes' answers to question 2.

In this study, the statistic U2 is used instead of the Student's t-test. The latter is used to test the difference between *means* of two variables that are known to have normal distribution, while the former tests differences between *percentages* (also called sample proportions). In this case of this study, differences between *percentages* (also called sample proportions) are tested. Also note, that the statistic U2 is not the same as the U-test otherwise known as the Wilcoxon rank sum test.

First, trust questions are compared between themselves. To the right of them on the other side of the table, visibility questions are compared between themselves. Finally, below those two sets of statistics, each trust question is compared with each visibility question. One value is significantly larger than the other when the test statistic value is larger than 1.64, and significantly smaller than the other when the test statistic value is smaller than –1.64. Significant values are printed in bold.

Table 7.6 – Percentages for the Five Answers, and for Aggregated Yes/No Answers for the Trust Concerns and Benefits of Visibility Questions – All Valid Responses

	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6
	Waste	**Exces.profit**	**Cheat**	**Brag**	**Influence**	**Technology**
Valid answers	154	153	151	153	153	152
Percentage for each of five answers						
%1	1.9	0.0	7.3	59.5	41.6	48.0
%2	29.2	30.7	41.7	14.4	21.4	14.5
%3	42.9	38.6	39.1	16.3	21.4	18.4
%4	15.6	22.9	8.6	7.2	13.6	15.8
%5	10.4	7.8	3.3	2.6	1.9	3.3
Mean value	**3.0**	**3.1**	**2.6**	**1.8**	**2.1**	**2.1**
Aggregated answers: No-1,2 Yes-3,4,5						
%No	31.1	30.7	49.0	73.9	63.0	62.5
%Yes	**68.9**	**69.3**	**51.0**	**26.1**	**36.9**	**37.5**
U2 stat.values between trust questions			U2 stat.val. between visibility questions			
Q1 > Q2:	-0.08			Q4 > Q5:	**-2.03**	
Q1 > Q3:	**3.19**			Q4 > Q6:	**-2.14**	
Q2 > Q3:	**3.26**			Q5 > Q6:	-0.11	
U2 stat.values between trust and visibility questions						
	Q1 > Q4:	**7.51**	Q2 > Q4:	**7.56**	Q3 > Q4:	**4.46**
	Q1 > Q5:	**5.62**	Q2 > Q5:	**5.68**	Q3 > Q5:	**2.48**
	Q1 > Q6:	**5.50**	Q2 > Q6:	**5.57**	Q3 > Q6:	**2.37**

7.4.1 Questions about Trust Concerns

Percentages of the five different answers to the trust concern questions (numbers 1-3) show that for each dimension of trust concerns, the bulk of responses falls in the middle of the permitted range. It seems then, that the trust concerns about green electricity programs of detached and semi-detached house owners/renters in Oakville are at least moderate, and they cannot be ignored. Particularly, for the first two questions – concerns about wasting of contributed funds (question 1) and excessive profits of the entities delivering the green electricity programs (question 2) – more extreme responses are more highly populated.

An analysis of the ‘Yes/No’ aggregation shows that levels of concerns about the wasting of contributed funds (question 1), and excessive profits of the entities delivering the green electricity programs (question 2), seem to be quite similar. However, the level of concerns about cheating by not delivering the promised, more expensive electricity to the grid (question 3), is lower than the first two. It seems that an illegal behaviour is less fretted about than behaviour that is not desired, but still legal.

7.4.2 Questions about Appreciation for Benefits of Visibility

Percentages of the five different answers to the benefits of visibility questions (numbers 4-6) show that for each dimension of appreciation of benefits of visibility, the bulk of responses fall at the bottom of the permitted range, but there is a sizable response rate at higher end of the scale, especially for being able to influence others (question 5) and being able to see modern technology at work (question 6). It seems that appreciation of the benefits of visibility by detached and semi-detached house owners/renters in Oakville is small to moderate.

An analysis of the ‘Yes/No’ aggregation shows that levels of appreciation for the ability to influence others (question 5), and for the ability to see modern technology at work (question 6) seem to be quite similar. However, the level of appreciation of the fact that one can be seen as supporting green electricity (question 4) is lower than the other two. It seems that the researched population is rather modest, and not very interested in bragging.

7.4.3 Trust Concerns vs. Appreciation for Benefits of Visibility

The difference in response between trust concern questions and questions about appreciation for benefits of visibility is very pronounced when looking at the ‘Yes/No’ aggregation, and less pronounced, but still very noticeable, when looking at the mean values of answers.

One could say that trust concerns are more strongly expressed, than appreciation for benefits of visibility in the tested population. However, one needs to be cautious in jumping to firm conclusions, because the scales of answers to both kinds of questions use somewhat different systems of naming the answer options.

7.5 How Panel Installation Concerns Correlate with Respondents' Choice about Solar Panel Installation on Their Roof

In the final set of the four programs used in the study, respondents are given two options with high levels of benefits of visibility – to participate in a program in which solar panels are to be installed on their own roofs, and to participate in a program in which solar panels are to be installed on some other roof in Oakville. Both programs are considered to give rise to similar levels of trust concerns, and to provide similar levels of benefits of visibility. It is reasoned that some respondents who would otherwise be willing to participate in a program involving solar panel installation on their own roof, would be deterred from doing so because of various concerns about solar panel installation on their own property. The second option is intended to give those participants a viable alternative.

In order to have a window through which the consistency of respondents' behaviour with the proposed model, in the case of the above choice, could be checked, additional questions (number 7 – 12) are included in Part 2 of the survey. These six questions inquire about respondents' concerns related to the installation of solar panels on their own roofs. This section will discuss whether respondents who choose to participate in a program involving the installation of solar panels on their own roof have fewer concerns about solar panel installation than those respondents who do not choose to participate in such a program.

An analysis of data is conducted in a similar way to that in section 7.3, where responses to trust and visibility questions from Part 2, for different groups of respondents important to hypotheses testing, were compared. This includes (1) comparing the mean answers to each question, and (2) comparing, by statistical tests, for each question, the percentages of 'Yes' responses of the two groups, resulting from 'Yes/No' aggregation, where answers 1 and 2 are aggregated as 'No', and answers 3, 4, and 5 are aggregated as 'Yes'.

The two groups to be compared are called the *'Yes, to Panels on My Roof'* group (short name 'My Roof'), and the *'No, to Panels on My Roof'* group (short name 'My Roof Not').

Members of the ‘No, to Panels on My Roof’ group are defined as willing to participate only in the program in which solar panels are installed on some other roof in Oakville, but not on their own roof. Members of the ‘Yes, to Panels on My Roof’ group are defined as willing to at least participate in the program in which solar panels are installed on their own roof, and possibly also in the program to install solar panels on some other roof in Oakville. It is irrelevant whether the members of both groups showed willingness to participate in the program that involves solar farms outside of Oakville.

Table 7.7 shows various methods of looking at the data. Starting at the top, it presents the percentages of each of the five answers to a question, where numbers 1 to 5 mark responses in the same way as in section 7.2. This is presented for both ‘My Roof’ and ‘My Roof Not’ groups. The mean value of the answer follows for each. Above the percentages, numbers of valid answers are shown. They are important for test statistic calculations. Moving down towards the bottom, the percentages of aggregated Yes/No answers are shown for both groups. Each column shows the percentages of answers, and the Yes/No aggregations for the same one question.

At the bottom of the data for the ‘Yes/No’ aggregation, the results of test statistic are shown. They apply to the aggregation above them. The proportions of ‘Yes’ answers to the same question for the two groups are compared, in order to determine if one proportion is significantly larger (or smaller) than the other one. This is done with the help of the U1 test statistic (see Appendix D, section 3). The test is set in such a way that the statistic value is positive when the percentage of ‘Yes’ answers is larger for ‘My Roof Not’ group. The difference is significant when the test statistic value is larger than 1.64, or smaller than minus 1.64. Significant values are printed in bold.

Table 7.7 – Percentages for the Five Answers, and for the Aggregated Yes/No Answers to Questions about Panel Installation Concerns – 'My Roof'/'My Roof Not' Respondents

Statistics	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
	Little sun	Weak roof	Damage	Leak	Appearance	Neighbour
Percentage for each of five answers						
	My roof					
Valid answers	29	29	29	29	29	29
%1	34.5	41.4	27.6	17.2	44.8	58.6
%2	31.0	20.7	24.1	31.0	20.7	17.2
%3	20.7	10.3	13.8	10.3	10.3	10.7
%4	13.8	17.2	20.7	20.7	20.7	10.7
%5	0.0	10.3	13.8	20.7	3.4	3.4
Mean value	**2.1**	**2.3**	**2.7**	**3.0**	**2.2**	**1.8**
	My roof not					
Valid answers	20	20	20	20	20	20
%1	45.0	35.0	20.0	10.0	20.0	45.0
%2	5.0	30.0	5.0	25.0	10.0	30.0
%3	20.0	10.0	20.0	25.0	25.0	0.0
%4	25.0	15.0	40.0	25.0	35.0	10.0
%5	5.0	10.0	15.0	15.0	10.0	15.0
Mean value	**2.4**	**2.4**	**3.3**	**3.1**	**3.1**	**2.2**
Aggregated answers: No-1,2 Yes-3,4,5						
	My roof					
%No	65.5	62.1	51.7	48.2	65.5	75.8
%Yes	**34.5**	**37.9**	**48.3**	**51.8**	**34.5**	**24.2**
	My roof not					
%No	50.0	65.0	25.0	35.0	30.0	75.0
%Yes	**50.0**	**35.0**	**75.0**	**65.0**	**70.0**	**25.0**
	U1 statistic values					
My not > My	1.08	-0.21	**1.92**	0.92	**2.50**	0.06

The picture emerging from the analysis of the data is consistent with the assumption that the 'No, to Panels on My Roof' group has bigger concerns about solar panel installation than the 'Yes, to Panels on My Roof' group. First of all, the mean values of answers to each of the six questions are larger for the 'My Roof Not' group than the corresponding mean values for the 'My Roof' group. The largest differences between the two groups are concerns about damage to the house or the landscaping (question 9), and concerns about the appearance of the property being affected negatively (question 11).

In the case of the ‘Yes/No’ aggregation, for four of the six questions the concerns of the ‘No, to Panels on My Roof’ group are visibly bigger than the other group, in two of these cases the difference is statistically significant. For question #12, however, the difference is smaller, and in the case of question 8, the situation is reversed: the ‘No, to Panels on My Roof’ group has a slightly lower level of concern than the ‘Yes’ group. Overall, the concerns about panel installation on one’s own roof are bigger for the ‘No, to Panels on My Roof’ group.

It is worth noticing that the statistically significant differences apply to concerns about damage to the house or the landscaping (question 9), and concerns about appearance of the property being affected negatively (question 11). This is consistent with the picture emerging from the mean values comparisons. Both concerns are somewhat related to each other. Worries about the aesthetic value of one’s property seem to be quite large for many.

7.6 Analysis of Answers to Questions 7 to 12 from Part 2 of the Survey for All Valid Responses to the Survey

This section contains a short analysis of the responses of all participants in the survey to questions 7-12 from Part 2 of the survey (panel installation concerns). This analysis is not intended to help answer the research question of this thesis. However, answers to these questions can give an indication of how important these concerns are for the detached and semi-detached house owners/renters of Oakville. This makes the answers a valuable source of material for the study of barriers to the diffusion of solar electricity generation.

Table 7.8 shows various methods of looking at the data. At the top, numbers of valid answers are shown. They are important for test statistic calculations. Below, the table presents the percentages of each of the five answers to a question, where numbers 1 to 5 mark responses in the same way as in section 7.2. The mean value of the answer follows. Confidence intervals for the percentages at a 95% confidence level are presented in section 5 of Appendix D. They are within a few percent of the values shown in the table, with notable exceptions of small percentages where the confidence intervals are visibly asymmetrical.

Moving towards the bottom, percentages of the aggregated Yes/No answers when answers 1 and 2 are aggregated as ‘No’, and answers 3, 4, and 5 are aggregated as ‘Yes’, are shown. This aggregation is preformed the same way as in section 7.3. Each column shows the percentages of answers and Yes/No aggregation for the same one question.

Below Yes/No aggregation, results of the test statistic are shown. The proportions of ‘Yes’ answers for different pairs of questions are compared, to determine if one proportion is significantly larger (or smaller) than the other one. This is done with the help of the U2 test statistic (see Appendix D, section 4). A value that is immediately to the right of a description applies to it. For example, the value ‘-1.36’ immediately to the right of the label ‘Q7 > Q8:’ is the value of the U2 statistic for the test, if the proportion of ‘Yes’ answers to question 7 is larger/smaller than proportion of ‘Yes’ answers to question 8.

One value is significantly larger than the other when the test statistic value is larger than 1.64, and significantly smaller than the other when the test statistic value is smaller than minus 1.64. Significant values are printed in bold.

Table 7.8 – Percentages for the Five Answers and for the Aggregated Yes/No Answers to Questions about Panel Installation Concerns – All Valid Responses

	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
	Little sun	**Weak roof**	**Damage**	**Leak**	**Appearance**	**Neighbour**
Valid answers	151	152	152	152	152	151
Percentage for each of five answers						
%1	50.3	38.8	21.1	13.2	32.9	58.9
%2	11.9	15.8	18.4	22.4	17.1	15.2
%3	21.2	17.1	15.1	14.5	17.1	9.9
%4	11.9	17.8	23.7	22.4	20.4	11.3
%5	4.6	10.5	21.7	27.6	12.5	4.6
Mean value	**2.1**	**2.5**	**3.1**	**3.3**	**2.6**	**1.9**
Aggregated answers: No-1,2 Yes-3,4,5						
%No	62.2	54.6	39.5	35.6	50.0	74.1
%Yes	**37.7**	**45.4**	**60.5**	**64.5**	**50.0**	**25.8**
U2 statistic values for differences between all questions						
Q7 > Q8:	-1.36	Q8 > Q9:	**-2.64**	Q9 > Q10:	-0.72	
Q7 > Q9:	**-3.97**	Q8 > Q10:	**-3.35**	Q9 > Q11:	**1.84**	
Q7 > Q10:	**-4.67**	Q8 > Q11:	-0.80	Q9 > Q12:	**6.10**	
Q7 > Q11:	**-2.16**	Q8 > Q12:	**3.56**	Q10 > Q11:	**2.56**	
Q7 > Q12:	**2.22**			Q10 > Q12:	**6.77**	
				Q11 > Q12:	**4.34**	

Even a quick look at the data presented in table 7.8 confirms that the surveyed population has concerns about various issues related to the installation of solar panels on their own roofs. Looking at the percentages of the answers, one can see that even for the weakest concern, the percentage of the highest two levels of the answer combined (concerned and very concerned) is above 15%. For the strongest concern it reaches 50%.

Two concerns can be categorized as small to moderate. These are: roof not having enough solar exposure (question 7), and neighbours not liking the installation (question 12). Two concerns can be considered moderate: roof does not have enough strength to hold the panels (question 8), and panels affecting appearance of the house negatively (question 11). And finally, two concerns seem to be serious: installation causing damage to the house or landscaping (question 9), and danger of a roof leak after the installation (question 10).

The U2 test statistics show that differences between these three sub-groups of concerns are statistically significant. Knowing which concerns are stronger can help optimize interactions of organizers of the programs that promote installation of solar panels on the residential rooftops in southern Ontario with the targeted population. One practical piece of advice comes from the results presented above: it is of utmost importance to create an understanding among the solar panel diffusion program targets, that installation crews who would install the panels are very professional, and would not cause damage to the property.

7.7 Limitations

The limitations of this study can be divided into two categories: limitations of adopted methodology, and limitations of the performed survey.

7.7.1 Methodology Related Limitations

The possibility that the level of trust concerns raised by program #2 (familiar solar farm) is higher than that raised by 'visible' programs #3 and #4, is the first limitation of this research. It introduces uncertainty about the relative strength of the two studied effects, the influence of trust concerns, and the influence of benefits of visibility.

Another limitation is caused by the decision to study *willingness* to participate, and not actual participation. Not facing any financial consequences of their answers, this may have caused respondents to be quite careless about their choices. Their trust concerns might have not been awakened strongly enough, and their benefits of visibility expectations might not have been tempered by a realistic assessment of the practicalities of the installation.

Finally, the findings of this study are based on a single investigation conducted in the summer of 2011, and this might make it obsolete in the fast changing reality of green electricity generation. On one hand, a growing amount of information about green electricity and climate change in the media might cause more interest and willingness to participate in green electricity programs. On the other hand, however, falling solar panel prices might cause more people to question the sensibility of subsidizing green (or at least solar) electricity generation with their own money. The picture of reality caught in the summer of 2011 might be not true in the summer of 2013.

7.7.2 Survey Related Limitations

Overrepresentation of the south-east and central parts of Oakville in the responses received is the first limitation coming from the particular way this survey was implemented. In the general opinion of residents of Oakville, these parts are considered richer, and include more retired households. Since it is impossible to say how well various groups of Oakville households are represented since no demographic and income data were collected, it is impossible to estimate how distorting the discovered overrepresentation of south-east and central Oakville is.

The second limitation in this category comes from the fact that the response rate lies in a grey zone, somewhere between low and adequate. There is significant danger that people interested in the subject of green electricity are overrepresented in the collected sample. However, this might not be as important, because investigation of the influence of trust concerns and benefits of visibility on participation in green electricity programs already implies interest in the issue by the participants.

Unknown measurement error is the last limitation resulting from the adopted experimental method. Even if the analysis of the received responses gives a certain assurance that measurement error due to mistakes was small, it is impossible to say how truthful and careful the responses were. Besides the possibility of mindlessness and mischief, there is also a chance of the presence of the Hawthorne Effect, which is the tendency to respond in such a manner as to fulfill perceived expectations of the researchers or society. This problem, however, brings the discussion back to the issue of studying willingness and not participation. The Hawthorne Effect, mindlessness, and mischief are less of a problem, when someone has to invest their own money.

Chapter 8: Conclusions and Recommendations

8.1 Research Objectives

This study set out to deepen the understanding of the reasons that prevent people from taking part in green electricity programs. Its focus has been on a particular barrier-creating characteristic of the majority of those programs, which was labelled their *opaqueness*. The term describes the fact that in many green electricity programs, the actual physical sources of green electricity are usually unknown to the purchaser, and the process of delivery to a power grid within which the purchaser lives is very opaque. Two main barriers created by the opaqueness of green electricity programs are: 1. Trust concerns raised in prospective participants, and 2. The lack of benefits that a green electricity program may provide through the visual aspects of participation in it (lack of benefits of visibility).

The literature discusses trust concerns that green electricity programs may raise and the lack of benefits of visibility they may provide; in fact, the second concept – benefits of visibility – is more often discussed as an attractor. Researchers usually treat trust concerns as one of many barriers, and do not commit substantial effort to its investigation. Similarly, the existing research acknowledges the role of benefits of visibility as an attractor, but it does not explore it much further. In this study, it was decided to investigate in more detail the influence of trust concerns and benefits of visibility on participation in green electricity programs. In particular, it was decided to study the reactions of electricity consumers to the proposition of participation in green electricity programs in a controlled setting, where levels of trust concerns raised and benefits of visibility provided by the programs could be varied. A survey was conducted that proposed participation in four different green electricity programs. In this way, the following two hypotheses were tested:

H1. More households will participate in the green electricity program that gives rise to a lower level of *trust concerns*.

and

H2. More households will participate in the green electricity program that provides higher level of *benefits of visibility*.

8.2 Research Findings

The study does not bring definite confirmation of either of the two hypotheses, but gives reasons for claim that the influence of both trust concerns and benefits of visibility, taken together, is large on participation in green electricity programs.

The results, strictly based on responses to proposition of participation in the four presented green electricity programs (answers to questions from Part 1 of the questionnaire), point towards complete insignificance of the level of trust concerns raised by a program, while they show strong positive influence of the level of benefits of visibility of a program on participation. This first effect seems very counterintuitive, given the strong argument in the literature about trust concerns being a barrier to participation in green electricity programs. It is suspected that a flaw in the research design may have caused such results. While it was expected that the level of trust concerns of program #2 (a program designed to have a low level of trust concerns and a low level of visibility benefits) was not truly equivalent to the level of trust concerns of programs #3 and #4 (programs designed to have a low level of trust concerns and a high level of benefits of visibility), the difference must have been too big. For thorough discussion of this issue, see sections 4.2 and 7.1.3. This bigger than expected difference, must have caused too large of a mis-assignment between groups of respondents who were to differ in interest in benefits of visibility (Visibility Junkies and Not Trusting Good Citizens). This mis-assignment produced the unexpected results, in which the influence of trust concerns was underestimated and the influence of benefits of visibility overestimated.

Further investigation based on the results from Part 2 of the questionnaire (see section 7.2) confirms the suspicion that the results based on responses to questions from Part 1 are not fully reliable. Analysis of the answers to questions that inquire about opinions of the survey participants on trustworthiness of the green electricity program providers, and about their levels of appreciation for the benefits of visibility of the solar panels installed on their roofs, reveals the problem. Out of 11 respondents who were classified (based on results from Part 1) as choosing to participate in a program because it has high level of benefits of visibility, only six report high levels of appreciation for benefits of visibility. Only two can, without a doubt, be classified as the ones who chose 'visible' programs #3 and #4 due to their high level of benefits of visibility (they reported in Part 2 low trust concerns and high appreciation for benefits of visibility). At the same time, three out of the 11 respondents mentioned above express opinions that can be classified as coming from a respondent who chose 'visible' programs #3 and #4 for the low level of trust concerns they have. One might attempt to reclassify the respondents based on the analysis of answers from Part 2, and recalculate the ratios that show the influence of trust concerns and benefits of visibility, but the author decided that the analysis based on the responses to Part 2 of the questionnaire is too heuristic to be a foundation for solid results.

While the results of this study point towards the conclusion that both factors have influence on participation in green electricity programs (trust concerns negative and benefits of visibility positive), their relative strength cannot be estimated by these results. One can, however, claim that the combined influence of trust concerns and benefits of visibility is quite strong. This research shows that at a 95% confidence level, willingness to participate in a program that proposes paying a premium for electricity from solar panels installed on a participant's roof (low trust concerns, high benefits of visibility) is 30.0% $\pm$ 19.3% higher than willingness to participate in a program that proposes paying a premium for electricity from undisclosed solar farms (high trust concerns, low benefits of visibility).

As an additional result of this study, a set of data on Oakville population's trust concerns, appreciation of benefits of visibility, and concerns about installation of solar panels on one's roof was collected. As well, the received questionnaires contained a large number of comments from the participants. The former could be the subject of more intense quantitative analysis, while the latter could bring valuable insights through qualitative analysis.

8.3 Recommendations for Further Research

The first obvious recommendation for further research is to improve the study design, which would more clearly separate the strength of influence of trust concerns from the influence of benefits of visibility on green electricity program participation. The entanglement of these two factors creates the need for a more precise method of investigation.

Since this research indicates an influence of both – trust concerns and benefits of visibility – on participation in green electricity programs, it would be valuable to study which features of these programs enhance these factors the most.

Finally, it should be important to study change in the relative importance of trust concerns and benefits of visibility among other barriers and attractors in time. As it was briefly discussed in chapter 2, many factors that prevent participation in green electricity programs may substantially diminish in the near future. At the same time, it seems that citizens' trust in government, other public institutions, and large private enterprises is diminishing. Confluence of these two trends may cause at least the trust concerns issue to become, in the near future, very important for green electricity program participation.

8.4 Recommendations for Policy Makers

For jurisdictions in which such programs do not exist, policy makers should seriously consider the creation of independent certification bodies for green electricity programs to enhance their trustworthiness. The existing certification bodies should be held to the highest standards, and guarded from the influences of electricity generators. EcoLogo is a good example of such a well functioning certification body in North America. Call for this action is present in the existing literature already, and this study, with its indication that trust concerns are a factor in green electricity programs participation, only confirms this need.

In order to provide conditions for the creation of more trustworthy and visible green electricity programs, policy should open possibilities for local and small scale development of green electricity sources. This could possibly be done through financial incentives, adjustment of local by-laws, and easing of grid access for smaller local initiatives. Ontario's Feed-in Tariff program is one example of an approach promoting involvement of local communities in green electricity generation.

8.5 Recommendations for Green Electricity Proponents

Green electricity proponents, and in particular, organizers of green electricity programs, should look closely at the programs they propose and answer the questions of how trustworthy these programs look from the point of view of prospective participants, and what benefits of visibility they provide to them. They should consider making these programs more local and more present in communities that are asked to support them financially. When the programs use green electricity sources that are not local, enhancing trust and visibility should be done with the help of internet applications.

In general, sources of green electricity used by green electricity programs, and the delivery of that electricity to the grid should be made less opaque, by the continuous spread of information about the location of the green electricity sources, and the ways green electricity replaces conventional electricity in the grid. Personal interaction of the public with the green electricity generation facilities should be encouraged, not only through internet resources, but also through visits to the generation locations.

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Appendix A – Questionnaire and Communications with Participants

This appendix contains the questionnaire and all materials used to communicate with the survey participants. It also includes a follow-up letter and a modified follow-up questionnaire, which were not used, but were prepared for the survey and went through the University of Waterloo Office of Research Ethics approval process – file # 17172.

Because of the need to use the space efficiently, most of the materials occupy the entire page. It is therefore impossible to insert headings to describe each piece. The list below will help the reader find them in this appendix.

UNIVERSITY OF
WATERLOO

July 21, 2011

Oakville Resident
142 Cedarglen Crt.
Oakville, ON L6M 2X1

Dear Oakville Resident,

I am writing to ask for your help with an important study designed to understand the attitudes of Oakville residents, like yourself, towards solar electricity generation. This research is a part of my graduate studies in the Department of Environment and Resource Studies at the University of Waterloo being supervised by Dr. Ian Rowlands. In a few days you will receive a package in your mailbox with a questionnaire asking you to provide your opinion about different scenarios and programs for solar electricity support. You will be asked to return the questionnaire in a self-addressed stamped envelope that will be provided.

I would like to make this experience easy and pleasant for you. Therefore, I am writing to you in advance because many people prefer to know ahead of time that they will be asked to complete a questionnaire. My research project can only succeed when people like you decide to provide their help by participating.

To express my gratitude, a small token of appreciation will be enclosed with the questionnaire. The questionnaire will take 15 to 20 minutes to complete. I hope that you will take the time needed to answer the questions. Most of all, I hope that you find the questionnaire interesting and the task of sharing your opinions about the solar electricity programs exciting.

If you have any questions about my research please contact me by phone at (416)-565-5651, or e-mail at achlobow@uwaterloo.ca. You may also contact my supervisor, Dr. Ian Rowlands by phone at (519)-888-4567, or e-mail at irowland@uwaterloo.ca.

This study has been reviewed and received ethics clearance from the Office of Research Ethics at the University of Waterloo.

Best wishes,

Andrew Chlobowski
Graduate Student in the Department of Environment and Resource Studies
at the University of Waterloo

UNIVERSITY OF
WATERLOO

Oakville Resident
142 Cedarglen Crt.,
Oakville, On L6M 2X1

July 27, 2011

Dear Oakville Resident,

This letter is an invitation to participate in a research study to help us learn about the attitudes of Oakville residents, like you, towards solar electricity generation. Enclosed with this letter, is a questionnaire asking you to share your opinions about several solar electricity programs. Your address was selected at random as one of **a small number** of households in Oakville to participate in this study. Your help would be very much appreciated.

At present, solar electricity provides less than 1% of the electricity supplied to homes and businesses in Ontario. You might have heard that in 2009, the Ontario government introduced a feed-in tariff program to encourage the development of alternative sources of electricity, including solar panels. Within this program, those who are willing to invest their money and install solar panels on their property receive payments for the electricity they deliver directly to the power grid. In this way, Ontario's feed-in tariff program not only enables the participation in solar electricity production, but it can also provide a reasonable return for the person who invests in 10 kW or larger solar panel system; however, it requires a 20-year commitment.

Unfortunately, Ontario's feed-in tariff program does not make it easy to get involved in solar electricity production for those homeowners who are not able to finance the cost of the solar panels, and/or are not willing to make a 20-year commitment. The same applies to those Ontario residents who are renting and cannot place the solar panels on their roofs without agreement from their landlord. I am investigating alternative programs for solar electricity support through this research project, which is a part of my graduate studies in the Department of Environment and Resource Studies at the University of Waterloo being supervised by Dr. Ian Rowlands. Your opinions are important to this research study.

The questionnaire should take no more than 15 to minutes to complete. Please have the **person or persons responsible for the financial decisions in your household** complete the questionnaire, and then return the questionnaire to the researchers in the enclosed self-addressed stamped envelope as soon as possible.

Your participation is voluntary and you may decline answering any question you feel you do not wish to answer by leaving it blank. All information you provide will be considered confidential and grouped with responses from other participants. Further, you will not be identified by name in any report or publication. There are no known or anticipated risks to your participation in this study.

A number is printed on the back of your questionnaire. This is done so that I can check your address off the mailing list when your questionnaire is received and no reminder will be sent to you. The list of addresses will be destroyed at the completion of the study and no one other than the researchers has access to this list. The completed questionnaires will be kept for a period of three years in my supervisor's locked office at the University of Waterloo, and will be destroyed after this period of time.

If you have any questions about this study or the questionnaire, please contact Andrew Chlobowski by phone at 416-565-5651, or e-mail at achlobow@uwaterloo.ca. You may also contact my supervisor, Dr. Ian Rowlands by phone at (519)-888-4567, or e-mail at irowland@uwaterloo.ca.

This study has been reviewed and received ethics clearance from the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours. If you have any questions or concerns regarding your participation in this study please contact Dr. Susan Sykes, Director, Office of Research Ethics at 519-888-4567 ext.36005 or ssykes@uwaterloo.ca

By taking a few minutes to share your thoughts about solar electricity issues in Oakville, you will be helping our research immensely. A small token of appreciation ($2 coin) is enclosed as a thank you.

I hope you enjoy completing the questionnaire and look forward to receiving your responses.

Many Thanks,

Andrew Chlobowski
Graduate Student in the Department of Environment and Resource Studies
at the University of Waterloo

SOLAR ELECTRICITY SURVEY - INTRODUCTION

Please read carefully all of the information provided, as it is important for answering the questions that follow.

On the next page you will find a description of three hypothetical solar electricity generation programs. We would like you to consider that the organizer of these programs would be a *non-profit* organization and would handle all the tasks related to their implementation.

If you, as a homeowner or renter, were to participate in any of these programs we would like you to consider the following:

1. Participation would enable the delivery of 370 kWh of solar electricity *per month* to the Ontario power grid. This solar electricity would replace almost half of the average Ontario household monthly consumption of what would otherwise be conventional electricity.

2. To enroll in any of these programs, you would be asked to remain committed for a minimum of two years, with the requirement of one-year's notice to withdraw from the program at any time following that initial two year period.

3. The programs are not designed to bring you any financial gain, but rather they require a financial commitment on your part. As such, their goal is to enable *voluntary financial support* for solar electricity.

4. In each of the programs, you would be asked to commit to a *monthly payment* of $25 on top of your regular electricity bill, for the entire period of your involvement with the program.

5. The need for your financial support arises from two factors: first, these programs allow a short-term commitment, which creates additional costs to the organizer; second, the programs either use relatively small solar panel systems that can fit on an average roof, but that do not bring enough profit under Ontario's feed-in tariff program, or they purchase the solar electricity from sources that are not covered by Ontario's feed-in tariff program.

To stress it once again – these programs are about voluntary financial support for solar electricity, and will not give you any monetary rewards. It is also important to understand that none of these programs would deliver solar electricity directly to your home to offset electricity consumption. The generated electricity would be fed directly to the Ontario power grid.

The programs, however, may benefit all Ontario residents by both cutting air pollution from electricity generation, and lowering carbon emissions, thus being valuable in the fight against climate change.

Continues on the back …

PROGRAM DESCRIPTIONS:

Please note that, if you are renting your house, programs 1 and 3 still apply to you. Therefore, your participation in this research as a renter is still important and desired.

Program 1 – electricity from solar farms outside of Oakville:

The organizers of this program would arrange the delivery of the electricity generated by solar farms (large solar panel installations) directly to the Ontario grid. Your monthly payments would enable the purchase of 370 kWh of solar electricity per month generated by these solar farms. The farms would *not* be located in or close to Oakville as none are available.

Program 2 – electricity from solar panels on your roof:

The organizers of this program would place a 4 kW solar panel system on your rooftop, which would feed, on average, about 370 kWh of solar electricity per month directly to the Ontario grid. The organizers would determine whether the roof of your house has proper structural strength and sun exposure to participate in the program.

Your monthly payments would enable the organizers to hire a subcontractor, who would install, maintain and insure the panels. At the end of your commitment period, the panels would be professionally removed from your roof.

As an additional benefit, at your request the current power output of the system and other interesting statistics would be available for you and your friends to view on a dedicated website.
You would also have the option (especially useful if the panels were not visible from the street) to place a free, customized, aesthetically-pleasing, and visible lawn sign in front of your house, informing the public about your participation.

Program 3 – electricity from solar panels in Oakville, but not on your roof:

The organizers of this program would place a 4 kW solar panel system on one of the municipal building rooftops, or on one of the community organization building rooftops, in Oakville. The selected rooftop would be well suited for solar panels. The system would feed, on average, about 370 kWh of solar electricity per month directly to the Ontario grid.

Your monthly payments would enable the organizers to hire a subcontractor, who would install, maintain and insure the panels. At the end of your commitment period, the panels would be professionally removed from the hosting rooftop.

As an additional benefit, at your request the current power output of the system and other interesting statistics would be available for you and your friends to view on a dedicated website.
You would have the option to place a free, customized, aesthetically-pleasing, and visible lawn sign in front of your house, informing the public about your participation. Additionally, you would be able to have a plaque with your name placed on the building where the panels would be located, thus further marking your contribution.

QUESTIONS:

Attention, if you currently:

- are taking part in a program in which you pay premium for green electricity generation, or
- have solar panels installed on your roof, or
- signed a contract to install solar panels in the near future,

please mark 'x' in the box below and go directly to Part 2, skipping questions A to E in Part 1.

☐

PART 1

Please answer the following questions regarding your willingness to participate in the three proposed programs. Please select the ONE response that best represents your position, by marking 'x' in the appropriate oval.

A. Please indicate how likely you are to participate in program 1 (electricity from solar farms outside of Oakville) if this were the only program option offered to you?

Definitely participate	Probably	Probably not	Definitely not participate
◯	◯	◯	◯

If you answered 'Definitely participate' or 'Probably' to question A, please go directly to question B on the next page

If you answered 'Probably not' or 'Definitely not participate' to question A, please, answer the next question (A1).

A1. Please indicate how likely you are to participate in program 1 (electricity from solar farms outside of Oakville) if you personally knew a senior manager of the particular solar farm that was contracted to deliver the solar electricity?

Definitely Participate	Probably	Probably not	Definitely not participate
◯	◯	◯	◯

Please continue to question B on the next page …

B. Please indicate how likely you are to participate in program 2 (electricity from solar panels on your roof) if this were the only program option offered to you?

Definitely participate	Probably	Probably not	Definitely not participate
◯	◯	◯	◯

C. Please indicate how likely you are to participate in program 3 (electricity from solar panels in Oakville, but not on your roof) if this were the only program option offered to you?

Definitely participate	Probably	Probably not	Definitely not participate
◯	◯	◯	◯

D. If you chose answers '<u>Definitely not participate</u>' or '<u>Probably not</u>' to **all** of the above four questions - *<u>A</u>*, *<u>A1</u>*, *<u>B</u>*, and *<u>C</u>*, - please state the main reason that is discouraging you from participating in any of these programs.

◯ $25 per month is too much money for me to pay.

◯ Two years is too long of a commitment period for me.

◯ I do not think we need solar power.

◯ I would rather take part in the feed-in tariff program directly.

◯ Other - please elaborate in the space immediately below:

E. Please feel free to elaborate upon any or all of your answers for questions A to D:

PART 2

Please answer the following questions related to the proposed solar electricity programs. Select the ONE response that best represents your position, by marking 'x' in the appropriate oval.

1. Are organizers of solar electricity programs, like the ones described above, likely to waste the money paid by people like you?

Not at all likely to waste money	Probably not	Maybe yes, maybe no	Probably	Very likely to waste money
◯	◯	◯	◯	◯

2. Are organizers of solar electricity programs, like the ones described above, or businesses contracted by them, likely to make excessive profits from such programs?

Not at all likely to make excessive profits	Probably not	Maybe yes, maybe no	Probably	Very likely to make excessive profits
◯	◯	◯	◯	◯

3. Are the organizers of program 1 (electricity from solar farms outside of Oakville) likely to cheat by delivering electricity generated by other, less expensive methods, and not by the solar panels?

Not at all likely to cheat	Probably not	Maybe yes, maybe no	Probably	Very likely to cheat
◯	◯	◯	◯	◯

4. Assume that the installation of solar panels on your roof was feasible and safe. Would you then feel better about yourself if other people could see the panels on your roof, and understand that you are supporting solar electricity?

I would not feel differently	I would feel slightly better	I would feel moderately better	I would feel much better very	I would feel much better
◯	◯	◯	◯	◯

5. How important is it to you that your decision to place solar panels on your roof, or on a visible roof in your community, can influence other people who see them to follow your example?

Not at all important to me	Slightly important to me	Moderately important to me	Important to me	Very important to me
◯	◯	◯	◯	◯

6. Assume that the installation of solar panels on your roof was feasible and safe. Would placing solar panels on your roof then make you feel good because you like modern technology?

I would not feel differently	I would feel slightly good	I would feel moderately good	I would feel good	I would feel very good
◯	◯	◯	◯	◯

In questions 7 – 13, reflect on practical issues related to solar panel installation on your roof:

7. Would you be concerned that your roof does not have enough solar exposure for solar panels to generate any significant amount of electricity?

Not at all concerned	Slightly concerned	Moderately concerned	Concerned	Very concerned
◯	◯	◯	◯	◯

8. Would you be concerned that your roof does not have enough strength to support solar panels?

Not at all concerned	Slightly concerned	Moderately concerned	Concerned	Very concerned
◯	◯	◯	◯	◯

9. Would you be concerned that the construction work required to install the solar panels on your roof could cause damage to your house or landscaping?

Not at all concerned	Slightly concerned	Moderately concerned	Concerned	Very concerned
◯	◯	◯	◯	◯

10. Would you be concerned that your roof might leak after the solar panels are installed on it?

Not at all concerned	Slightly concerned	Moderately concerned	Concerned	Very concerned
◯	◯	◯	◯	◯

11. Would you be concerned that the solar panels would affect the appearance of your property negatively?

Not at all concerned	Slightly concerned	Moderately concerned	Concerned	Very concerned
◯	◯	◯	◯	◯

12. Would you be concerned that your neighbours might not like the solar panel installation on your roof?

Not at all concerned	Slightly concerned	Moderately concerned	Concerned	Very concerned
◯	◯	◯	◯	◯

13. Are there any other factors, which have not been mentioned in questions 7 to 12, that could be sources of serious concern about the installation of the solar panels on your roof?

Please write here any comments you may have about this survey:

Thank you for your participation. Please place your completed questionnaire in the self-addressed stamped envelope and drop it in your nearest mail box.

If you are interested in learning about the results of this study please contact the researchers at achlobow@ uwaterloo.ca.

UNIVERSITY OF WATERLOO

Andrew Chlobowski
c/o Prof. Ian Rowlands
Department of Environment and Resource Studies
University of Waterloo
200 University Avenue West
Waterloo, ON N2L 3G1

Oakville Resident
142 Cedarglen Crt.,
Oakville, ON L6M 82X

Re: Solar Electricity for Oakville

Re: Solar Electricity for Oakville

Andrew Chlobowski
c/o Prof. Ian Rowlands
Department of Environment and Resource Studies
University of Waterloo
200 University Avenue West
Waterloo, ON N2L 3G1

August 2, 2011

Last week a letter containing a questionnaire was sent to you because your household was randomly selected to participate in a research project studying the attitudes of Oakville residents towards solar electricity generation. If someone in your household has already completed and mailed the questionnaire back, **please accept my sincere thanks**. If not, please have **the person or persons responsible for the financial decisions in your household** do so right away.

If you did not receive the questionnaire, or if it was misplaced, please call me at 416-565-5651 or send an email to achlobow@uwaterloo.ca and I will have another one sent to you today.

Sincerely,

Andrew Chlobowski
Graduate Student in the Department of Environment
and Resource Studies at the University of Waterloo

This study has been reviewed by, and received ethics clearance through the Office of Research Ethics, University of Waterloo.

UNIVERSITY OF
WATERLOO

Andrew Chlobowski
c/o Prof. Ian Rowlands
Department of Environment and Resource Studies
University of Waterloo
200 University Avenue West
Waterloo, ON N2L 3G1

Oakville Resident
142 Cedarglen Crt.
Oakville, ON L6M 2X1

Re: Solar Electricity for Oakville

UNIVERSITY OF
WATERLOO

Oakville Resident
1420 Cedarglen Crt.,
Oakville, ON L6M 2X8

Aug 30, 2011

Dear Oakville Resident,

In late July I mailed a letter to your address asking for a member of your household to fill out a questionnaire about issues related to the attitudes of Oakville residents towards solar electricity generation. This questionnaire is a part of my research as a graduate student in the Department of Environment and Resource Studies at the University of Waterloo. According to my records, it has not yet been returned.

I am writing to you again because of the importance that your household questionnaire holds in helping to attain meaningful results. It is only by receiving the answers from nearly everyone in the randomly selected small group that I can be sure the results truly represent Oakville residents. Therefore, I hope **the person or persons responsible for the financial decisions in your household** will fill out and return the questionnaire soon.

Your participation is voluntary and you may decline answering any question you feel you do not wish to answer by leaving it blank. All information you provide will be considered confidential and grouped with responses from other participants. Further, you will not be identified by name in any report or publication. There are no known or anticipated risks to your participation in this study.

As mentioned previously, the questions should only take about 15 minutes to complete. Your answers are voluntary and will be kept confidential. A questionnaire number is printed on the back so that I can check your address off the mailing list when your response is received. The list of addresses will be destroyed so that they cannot be connected to the questionnaires under any circumstances. The questionnaires will be kept for a period of three years in my supervisor's locked office at the University of Waterloo, and then will be destroyed.

If you have any questions about this study, please contact Andrew Chlobowski by phone at 416-565-5651, or e-mail achlobow@uwaterloo.ca. or Dr. Ian Rowlands by phone at (519)-888-4567, or e-mail at irowland@uwaterloo.ca. This study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. However, the final decision about participation in yours. If you have any questions or concerns regarding your involvement in this study, please contact Dr. Susan Sykes, Director, at 519-888-4567 ext. 36005 or ssykes@uwaterloo.ca.

I hope that you enjoy the questionnaire.

Sincerely,

Andrew Chlobowski
Graduate Student in the Department of Environment and Resource Studies
at the University of Waterloo

SOLAR ELECTRICITY SURVEY - INTRODUCTION

Please read carefully all of the information provided, as it is important for answering the questions that follow.

At present, solar electricity provides less than 1% of the electricity supplied to homes and businesses in Ontario. You might have heard that in 2009, the Ontario government introduced a feed-in tariff program to encourage the development of alternative sources of electricity, including solar panels. Within this program, those who are willing to invest their money and install solar panels on their property receive payments for the electricity they deliver directly to the power grid. In this way, Ontario's feed-in tariff program not only enables the participation in solar electricity production, but it can also provide a reasonable return for the person who invests in 10 kW or larger solar panel system; however, it requires a 20-year commitment.

Unfortunately, Ontario's feed-in tariff program does not make it easy to get involved in solar electricity production for those homeowners who are not able to finance the cost of the solar panels, and/or are not willing to make a 20-year commitment. The same applies to those Ontario residents who are renting and cannot place the solar panels on their roofs without agreement from their landlord. I am investigating alternative programs for solar electricity support through this research project, which is a part of my graduate studies in the Department of Environment and Resource Studies at the University of Waterloo being supervised by Dr. Ian Rowlands. Your opinions are important to this research study.

On the next page you will find a description of three hypothetical solar electricity generation programs. We would like you to consider that the organizer of these programs would be a *non-profit* organization and would handle all the tasks related to their implementation.

If you, as a homeowner or renter, were to participate in any of these programs we would like you to consider the following:

1. Participation would enable the delivery of 370 kWh of solar electricity *per month* to the Ontario power grid. This solar electricity would replace almost half of the average Ontario household monthly consumption of what would otherwise be conventional electricity.

2. To enroll in any of these programs, you would be asked to remain committed for a minimum of two years, with the requirement of one-year's notice to withdraw from the program at any time following that initial two year period.

3. The programs are not designed to bring you any financial gain, but rather they require a financial commitment on your part. As such, their goal is to enable *voluntary financial support* for solar electricity.

4. In each of the programs, you would be asked to commit to a *monthly payment* of $25 on top of your regular electricity bill, for the entire period of your involvement with the program.

Continues on the back …

5. The need for your financial support arises from two factors: first, these programs allow a short-term commitment, which creates additional costs to the organizer; second, the programs either use relatively small solar panel systems that can fit on an average roof, but that do not bring enough profit under Ontario's feed-in tariff program, or they purchase the solar electricity from sources that are not covered by Ontario's feed-in tariff program.

To stress it once again – these programs are about voluntary financial support for solar electricity, and will not give you any monetary rewards. It is also important to understand that none of these programs would deliver solar electricity directly to your home to offset electricity consumption. The generated electricity would be fed directly to the Ontario power grid.

The programs, however, may benefit all Ontario residents by both cutting air pollution from electricity generation, and lowering carbon emissions, thus being valuable in the fight against climate change.

Proceed to the next page

From this point the questionnaire continues as in the version from the first mailing.

Appendix B – Data

This appendix contains responses to the questionnaire questions (see Appendix A for a copy of the questionnaire.) In the case of open-ended questions and requests for comments, only the presence or absence of an answer is marked below. The full text of all comments can be found in Appendix C – Answers to Open-ended Questions and Comments.

The data is divided according to the classification into groups of respondents defined for the purposes of this research, i.e., Trusting Good Citizens, Visibility Junkies, etc. Within each group the questionnaires are ordered numerically. Blue cell backgrounds mark answers that did not follow the instructions provided with the questionnaire, or missing answers.

Explanation of column headings and codes:

Column 1 "Question're number" – a unique number assigned to each questionnaire, which is marked on the envelope and on the first page of the materials received.

Column 2 "Involved already" – answer to the Initial Question: Y – box marked, N – box not marked.

Column 3 "QA" – answer to question A: 1 – 'Definitely participate', 2 – 'Probably', 3 – 'Probably not', 4 – 'Definitely not participate', N – No answer.

Column 4 "QA1" – answer to question A1: 1 – 'Definitely participate', 2 – 'Probably', 3 – 'Probably not', 4 – 'Definitely not participate', N – No answer.

Column 5 "QB" – answer to question B: 1 – 'Definitely participate', 2 – 'Probably', 3 – 'Probably not', 4 – 'Definitely not participate', N – No answer.

Column 6 “QC” – answer to question C: 1 – ‘Definitely participate’, 2 – ‘Probably’, 3 – ‘Probably not’, 4 – ‘Definitely not participate’, N – No answer.

Column 7 “QD” – answer to question D: 1 – ‘$25 per month …’, 2 – ‘Two years …’, 3 – ‘I do not think …’, 4 – ‘I would rather …’, 5 – ‘Other …’, N – No answer.

Column 8 “QE” – answer to question E (request for comment): Y – Comment present, N – No comment.

Column 9 “Q1” – answer to question 1: 1 – ‘Not at all likely to waste money’, 2 – ‘Probably not’, 3 – ‘Maybe yes, maybe no’, 4 – ‘Probably’, 5 – ‘Very likely to waste money’, N – No answer.

Column 10 “Q2” – answer to question 2: 1 – ‘Not at all likely to make excessive profits’, 2 – ‘Probably not’, 3 – ‘Maybe yes, maybe no’, 4 – ‘Probably’, 5 – ‘Very likely to make excessive profits’, N – No answer

Column 11 “Q3” – answer to question 3: 1 – ‘Not at all likely to cheat’, 2 – ‘Probably not’, 3 – ‘Maybe yes, maybe no’, 4 – ‘Probably’, 5 – ‘Very likely to cheat’, N – No answer.

Column 12 “Q4” – answer to question 4: 1 – ‘I would not feel differently’, 2 – ‘I would feel slightly better’, 3 – ‘I would feel moderately better’, 4 – ‘I would feel much better’, 5 – ‘I would feel very much better’, N – No answer

Column 13 “Q5” – answer to question 5: 1 – ‘Not at all important to me’, 2 – ‘Slightly important to me’, 3 – ‘Moderately important to me’, 4 – ‘Important to me’, 5 – ‘Very important to me’, N – no answer.

Column 14 “Q6” – answer to question 6: 1 – ‘I would not feel differently’, 2 – ‘I would feel slightly good’, 3 – ‘I would feel moderately good’, 4 – ‘I would feel good’, 5 – ‘I would feel very good’, N – No answer.

Column 15 "Q7" – answer to question 7: 1 – 'Not at all concerned', 2 – 'Slightly concerned', 3 – 'Moderately concerned', 4 – 'Concerned', 5 – 'Very concerned', N – No answer.

Column 16 "Q8" – answer to question 8: 1 – 'Not at all concerned', 2 – 'Slightly concerned', 3 – 'Moderately concerned', 4 – 'Concerned', 5 – 'Very concerned', N – No answer.

Column 17 "Q9" – answer to question 9: 1 – 'Not at all concerned', 2 – 'Slightly concerned', 3 – 'Moderately concerned', 4 – 'Concerned', 5 – 'Very concerned', N – No answer.

Column 18 "Q10" – answer to question 10: 1 – 'Not at all concerned', 2 – 'Slightly concerned', 3 – 'Moderately concerned', 4 – 'Concerned', 5 – 'Very concerned', N – No answer.

Column 19 "Q11" – answer to question 11: 1 – 'Not at all concerned', 2 – 'Slightly concerned', 3 – 'Moderately concerned', 4 – 'Concerned', 5 – 'Very concerned', N – No answer.

Column 20 "Q12" – answer to question 12: 1 – 'Not at all concerned', 2 – 'Slightly concerned', 3 – 'Moderately concerned', 4 – 'Concerned', 5 – 'Very concerned', N – No answer.

Column 21 "Q13" – answer to question 13 (open-ended): Y – Answer present, N – No answer.

Column 22 "Comments at the end" - request for comment at the end of the questionnaire: Y – Comment present, N – No comment.

Question're number	Involved already	QA	QA1	QB	QC	QD	QE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Comments at the end
Trusting Good Citizens																					
1	N	2	N	2	2	2	N	3	3	3	2	3	3	3	4	3	4	4	3	N	N
3	N	2	N	2	2	N	N	2	2	1	3	1	1	1	4	4	4	4	2	N	N
4	N	1	N	2	2	N	Y	4	4	2	3	4	2	4	1	4	5	1	1	N	N
7	N	2	N	3	2	1	N	3	3	2	3	4	4	5	5	5	5	4	1	N	N
8	N	2	N	3	2	N	Y	3	3	2	1	2	2	1	1	1	2	2	1	N	Y
9	N	2	N	2	2	N	N	2	2	2	1	4	4	1	1	1	3	1	1	N	Y
10	N	2	2	2	2	N	N	3	3	3	3	3	3	3	4	4	4	3	3	N	N
12	N	2	N	3	2	4	N	4	4	3	3	3	3	2	1	4	3	4	2	Y	N
13	N	2	N	2	2	N	N	2	2	2	1	1	4	3	4	5	5	4	4	Y	N
14	N	1	N	1	1	N	Y	3	2	2	1	3	4	1	1	4	4	1	1	N	Y
15	N	2	N	1	1	N	Y	1	2	1	5	3	4	2	2	2	2	4	4	Y	Y
16	N	2	N	2	2	N	Y	3	4	2	1	3	1	2	1	2	3	2	1	N	N
17	N	2	N	2	2	N	N	2	3	2	1	2	2	4	4	4	4	1	1	N	N
18	N	2	N	2	2	N	N	3	3	3	2	N	4	2	2	2	2	1	1	N	Y
Respondent marked two answers: '2' and '3', for question 5.																					
20	N	2	N	2	3	N	N	2	3	1	2	1	3	1	5	4	5	2	1	N	N
21	N	2	N	3	2	1+2	N	3	4	3	2	3	1	1	3	2	2	1	1	N	N
22	N	2	N	3	2	N	N	3	2	2	1	2	2	N	N	N	N	N	N	Y	N
23	N	2	N	3	2	N	Y	3	3	3	1	2	4	4	2	1	2	3	2	Y	Y
25	N	2	N	3	2	N	N	2	2	2	2	2	2	3	1	3	2	4	2	N	N
26	N	2	N	2	2	N	N	2	3	2	3	3	4	4	3	2	1	1	1	N	N
27	N	2	N	2	2	N	N	2	3	3	1	5	1	1	1	1	1	1	1	N	Y
28	N	1	N	2	1	N	N	4	3	2	1	2	2	4	3	5	5	5	3	N	N
30	N	2	N	2	N	N	N	2	2	2	4	4	4	3	3	3	4	1	2	N	N
31	N	1	N	3	1	N	N	1	4	4	1	1	1	1	1	1	1	1	5	N	N
32	N	2	N	3	2	N	N	3	4	3	5	4	4	3	4	4	4	4	1	Y	Y
33	N	2	N	3	1	N	Y	3	2	2	2	4	1	1	2	4	3	3	1	N	Y
34	N	2	N	3	2	2	N	4	3	2	1	2	3	1	1	3	2	4	1	N	N

Question're number	Involved already	QA	QA1	QB	QC	QD	QE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Comments at the end
Trusting Good Citizens continued																					
35	N	2	N	2	2	N	N	3	2	2	3	3	3	2	1	3	2	2	2	Y	N
36	N	2	N	4	2	N	N	2	3	2	2	2	1	4	2	4	4	3	5	Y	N
40	N	2	N	3	2	N	N	3	2	3	2	4	1	3	4	4	4	3	2	N	Y
41	N	2	N	3	1	N	N	3	3	3	1	4	3	4	2	3	3	5	1	Y	N
42	N	2	N	3	2	N	Y	3	3	2	1	1	1	1	1	1	1	1	1	Y	Y
44	N	2	N	2	2	N	N	2	3	2	2	4	5	2	2	1	1	1	1	Y	N
45	N	2	N	2	2	3	N	3	3	3	2	2	4	2	2	2	2	4	5	N	N
46	N	2	N	2	2	N	N	3	2	2	4	2	4	2	2	2	2	2	1	N	Y
47	N	2	N	2	2	N	N	2	3	2	1	1	N	1	1	3	2	1	1	Y	Y
48	N	2	N	2	1	N	N	1	2	1	4	4	3	3	5	5	5	3	1	Y	Y
50	N	1	N	4	2	N	Y	2	3	2	1	4	1	1	2	5	5	1	1	N	Y
51	N	2	N	4	2	N	N	3	4	3	2	2	2	4	5	5	5	5	5	N	N
52	N	2	N	2	2	N	N	3	3	3	3	3	3	3	5	5	5	3	2	N	N

Question're number	Involved already	QA	QA1	QB	QC	QD	QE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Comments at the end
Visibility Junkies																					
2	N	4	3	2	4	N	Y	3	4	4	2	2	1	1	1	1	2	1	1	N	N
6	N	4	4	4	2	N	N	3	4	4	2	4	3	1	1	4	3	4	4	N	N
11	N	4	3	2	1	5	N	3	3	4	5	5	5	1	1	1	3	2	1	N	N
19	N	3	3	3	2	5	N	3	4	3	1	1	1	1	2	3	4	3	2	Y	N
24	N	4	4	1	3	N	N	3	4	5	5	4	1	2	2	1	2	1	1	N	N
29	N	4	4	4	2	N	N	3	3	3	N	N	N	N	N	N	N	N	N	N	Y
37	N	3	3	2	2	N	N	2	3	2	1	1	1	1	1	1	1	1	1	N	Y
38	N	3	3	2	3	N	N	2	2	3	3	3	3	1	1	1	1	4	4	N	Y
39	N	3	3	3	2	2	N	3	3	3	2	2	2	3	3	4	3	2	2	N	N
43	N	3	3	3	2	N	N	3	3	2	3	3	3	4	4	4	4	4	4	Y	N
49	N	3	3	2	2	N	N	2	4	3	3	3	3	2	1	2	2	2	2	N	N
Trusting Odd Participants																					
53	N	2	N	3	3	N	N	3	2	2	1	2	1	1	3	4	4	4	3	N	N
Not Trusting Odd Participants																					
153	N	3	2	3	3	N	Y	2	2	2	1	3	4	1	1	2	2	1	1	N	Y
154	N	3	2	3	3	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Not Trusting Good Citizens																					
5	N	3	2	2	3	5	N	3	3	4	1	2	2	1	3	3	3	3	2	N	Y
Respondent marked answers '2' and '3' for question 'A1', and marked response between answers '2' and '3' for question 'B'. Due to comments answer '2' assigned in both cases.																					

Question're number	Involved already	QA	QA1	QB	QC	QD	QE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Comments at the end
Naysayers																					
54	N	3	3	3	3	1	Y	3	3	3	1	1	1	1	4	5	5	4	1	Y	Y
55	N	4	4	4	4	5	Y	4	4	4	1	1	1	1	3	5	5	2	1	Y	N
56	N	4	4	4	4	3	N	3	3	3	1	1	1	1	1	1	1	1	1	N	N
57	N	4	4	4	4	5	Y	3	2	2	1	1	4	3	3	4	4	2	1	Y	Y
58	N	3	3	3	3	1+2	N	2	3	1	1	2	3	1	1	3	3	3	1	N	N
59	N	4	4	4	4	3	N	5	4	3	1	1	1	3	5	5	5	5	5	Y	Y
60	N	4	4	4	4	3	Y	5	5	4	1	1	1	1	4	4	5	5	4	N	N
61	N	3	3	3	3	4	Y	2	2	2	1	2	4	3	1	3	3	2	1	Y	N
62	N	3	3	4	3	5	Y	3	2	2	3	4	3	1	3	5	4	5	2	N	N
63	N	4	4	4	4	5	N	4	4	2	1	1	1	1	1	2	2	2	2	N	Y
64	N	4	4	4	4	1	Y	4	5	4	3	3	3	1	4	4	4	4	3	Y	Y
65	N	3	3	3	3	5	Y	3	2	3	1	1	1	3	2	1	1	2	2	N	Y
66	N	4	4	4	4	1+2	N	5	4	3	1	1	1	1	4	5	5	5	4	N	N
67	N	3	3	4	3	1	N	3	2	2	1	2	1	1	1	1	2	2	1	N	N
68	N	4	4	4	4	1	N	2	2	2	3	3	3	3	2	3	4	3	2	Y	N
69	N	4	4	4	4	5	Y	3	3	3	2	2	1	3	1	2	2	1	1	N	N
70	N	4	4	4	4	4	Y	2	3	3	4	3	3	1	1	2	1	2	1	N	Y
71	N	3	3	3	3	1	Y	2	3	2	4	4	5	1	1	4	5	1	1	N	Y
72	N	4	3	4	4	5	Y	2	2	2	2	1	2	3	2	2	1	1	1	N	N
73	N	4	4	4	4	1	N	4	3	3	1	1	1	4	5	5	5	5	1	N	N
74	N	4	4	4	4	1	N	5	5	5	1	4	1	1	1	5	5	1	3	Y	Y
75	N	4	4	4	4	3	N	3	3	3	1	1	1	1	1	5	5	4	1	N	N
76	N	4	4	4	4	5	N	5	5	2	1	1	1	1	1	1	1	5	1	N	Y
77	N	4	4	4	4	5	N	2	2	2	1	1	1	3	3	4	4	3	1	N	N
78	N	4	4	4	4	1	Y	5	5	3	4	3	2	3	5	5	5	5	5	N	N
79	N	3	3	3	3	1+5	N	2	2	2	1	1	3	1	3	1	3	1	1	Y	Y
80	N	4	4	4	4	1+2+5	Y	2	2	2	4	4	4	5	5	5	5	3	1	Y	Y
81	N	4	3	4	4	1+2	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Question're number	Involved already	QA	QA1	QB	QC	QD	QE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Comments at the end
Naysayers continued																					
82	N	3	3	3	3	1+2	Y	4	4	2	1	1	2	3	3	4	4	5	4	N	N
83	N	4	4	3	4	1+2	N	4	4	5	1	1	1	5	5	5	5	4	4	Y	N
84	N	4	3	3	3	3	Y	5	2	3	1	1	1	4	3	2	2	1	1	N	N
85	N	3	3	3	3	1	N	3	4	2	3	2	1	1	3	2	2	2	2	N	N
86	N	4	4	4	4	5	Y	4	N	N	1	1	1	N	4	4	5	4	N	N	N
87	N	4	4	4	4	5	N	5	3	2	1	1	1	1	1	1	1	3	3	N	N
88	N	3	3	3	3	1+2+3	Y	3	4	3	2	2	2	1	4	4	4	4	1	Y	N
89	N	3	4	3	3	1+5	Y	3	2	2	1	1	1	1	1	1	1	1	1	N	Y
90	N	3	3	4	4	1	Y	3	3	1	2	3	4	3	4	4	4	1	1	N	Y
91	N	4	4	4	4	1+2+4	Y	N	N	N	1	1	3	1	5	5	5	1	1	N	N
92	N	3	3	3	3	1	Y	2	2	2	4	4	1	3	1	2	2	1	1	N	N
93	N	4	4	3	4	1	Y	5	5	3	1	1	5	1	2	3	3	1	1	N	Y
94	N	3	3	3	3	5	N	3	4	4	1	2	1	3	4	5	5	5	4	Y	N
95	N	3	3	3	3	1	N	2	2	2	1	3	1	1	1	1	1	1	1	N	Y
96	N	4	4	4	4	1	Y	3	3	2	1	1	1	1	1	2	2	1	1	N	N
97	N	3	3	3	3	5	Y	3	3	3	1	3	1	1	1	5	5	1	1	Y	Y
98	N	4	4	4	4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
99	N	4	3	3	3	1+4	Y	4	4	2	3	3	3	2	3	4	3	3	1	Y	N
100	N	3	3	3	3	5	Y	4	4	3	1	1	4	4	4	4	5	4	1	Y	Y
101	N	4	4	4	4	1	Y	5	5	3	1	1	1	4	4	4	4	4	3	Y	Y
102	N	3	3	3	3	4	N	2	3	2	1	1	3	1	1	2	2	1	1	N	N
103	N	3	3	3	3	2	N	2	2	2	1	2	3	1	1	2	2	2	2	N	N
104	N	3	3	4	3	3	N	3	3	3	1	1	1	1	1	2	2	3	2	N	N
105	N	4	3	4	4	4	Y	4	5	3	1	1	1	1	3	3	3	4	1	N	N
106	N	4	4	4	4	1	Y	2	2	3	1	1	1	1	1	2	3	3	1	N	N
107	N	4	4	3	4	1	Y	2	2	3	3	3	4	1	3	3	4	2	3	N	N
108	N	3	3	3	3	2	N	3	3	3	2	2	2	2	4	4	5	3	3	Y	N

Question're number	Involved already	QA	QA1	QB	QC	QD	QE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Comments at the end
Naysayers continued																					
109	N	4	4	4	4	3	N	5	5	3	1	1	1	5	5	5	5	5	5	N	N
110	N	4	3	4	3	4	Y	3	3	2	1	1	4	4	1	3	2	4	2	Y	Y
111	N	3	3	4	3	2+4+5	N	3	2	2	2	3	1	3	4	3	4	4	1	Y	N
112	N	3	3	4	4	5	Y	3	3	N	2	1	2	5	5	5	5	4	4	Y	N
113	N	3	3	3	3	4	N	4	3	3	1	2	3	1	1	1	2	1	1	N	N
114	N	3	3	3	3	4	N	2	4	3	3	4	3	3	1	1	1	1	1	N	N
115	N	3	3	4	3	1	Y	3	4	3	1	3	1	1	4	2	5	2	1	N	Y
116	N	4	4	4	4	3	N	5	5	5	1	1	1	1	3	5	5	5	1	N	N
117	N	3	3	3	3	1	Y	4	4	3	1	3	2	1	1	2	2	1	1	N	N
118	N	4	4	4	4	1	N	2	2	1	3	2	4	1	4	5	4	1	1	N	N
119	N	4	4	4	4	5	N	2	4	1	1	5	4	1	1	1	5	1	1	N	N
120	N	4	4	4	4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Respondent did not answer any questions, but comments show no interest in any of the scenarios, therefore assigned answer '4' for questions A to C.																					
121	N	4	3	4	4	1+5	N	5	4	2	1	3	1	3	4	5	5	2	1	N	N
122	N	3	3	3	3	2	N	2	2	3	1	1	1	3	3	3	5	4	3	N	N
123	N	4	4	4	4	5	Y	4	2	3	3	3	3	1	1	2	2	1	1	N	Y
124	N	4	4	4	4	1+2+3	Y	5	5	5	1	1	1	1	1	1	5	4	4	N	Y
125	N	4	4	4	4	5	Y	5	5	3	1	1	1	1	1	5	5	1	1	N	Y
126	N	4	4	4	4	1+2+5	N	3	3	3	1	1	1	4	3	2	2	3	1	N	N
127	N	3	3	3	3	2	N	3	3	3	3	3	1	1	3	4	4	3	3	N	N
128	N	3	3	3	3	3	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
129	N	3	3	3	3	1	N	3	4	3	1	1	2	3	3	3	3	3	3	N	Y
130	N	4	4	4	4	5	N	3	3	3	1	1	1	1	1	5	5	5	3	Y	Y
131	N	4	4	4	3	5	Y	4	4	3	1	1	1	1	4	5	4	5	1	N	N
132	N	3	3	3	3	4	N	3	4	2	1	1	1	3	2	4	4	3	4	N	N
133	N	3	3	3	3	1	Y	2	3	1	2	3	2	2	2	2	3	2	1	N	Y
134	N	3	3	3	3	1	N	3	3	3	1	1	1	3	1	2	3	1	1	N	N

Question're number	Involved already	QA	QA1	QB	QC	QD	QE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Comments at the end
Naysayers continued																					
135	N	3	3	3	3	1	Y	3	4	4	1	2	2	2	1	3	3	1	1	N	N
136	N	4	4	4	4	1	Y	3	4	3	1	1	1	1	3	3	4	4	4	Y	Y
137	N	4	4	3	3	2	N	3	2	2	1	1	1	1	3	3	3	1	1	Y	Y
138	N	4	3	4	4	1+2	Y	2	3	2	4	3	4	1	2	4	4	2	1	N	N
139	N	3	3	4	3	4	N	2	3	3	3	2	3	3	1	1	1	1	1	N	N
140	N	3	3	4	4	1	Y	2	4	1	4	3	1	1	1	1	1	1	1	N	Y
141	N	3	3	3	3	1	Y	4	2	4	1	1	1	1	2	2	2	1	1	N	Y
142	N	4	4	4	4	1	Y	4	3	2	1	2	1	3	1	3	4	4	3	Y	N
143	N	3	3	4	3	1+5	N	2	2	1	3	2	1	5	4	1	3	3	1	Y	N
144	N	3	3	3	3	5	Y	2	2	2	1	2	2	1	1	1	2	2	1	N	Y
145	N	4	4	4	4	1+2+4	N	4	2	2	1	1	1	5	4	5	5	2	1	N	N
146	N	3	3	3	3	2	N	3	3	3	1	1	1	2	2	1	2	1	1	N	N
147	N	3	3	3	3	1+5	N	2	3	2	3	4	5	4	5	5	5	3	2	Y	N
148	N	4	4	4	4	1	N	5	3	N	1	1	1	1	2	4	4	4	2	N	N
149	N	3	3	4	3	1+2	N	3	2	2	1	1	1	2	2	4	4	3	1	N	Y
150	N	4	4	4	4	5	N	4	4	4	1	1	1	1	5	5	5	5	4	Y	Y
152	N	4	3	4	4	5	Y	3	2	2	1	1	1	1	3	4	4	3	1	N	N
159	N	3	3	4	3	2	N	2	2	2	1	1	2	2	1	4	1	5	4	N	N
160	N	3	3	3	3	5	Y	4	3	3	1	1	1	1	2	4	4	2	1	N	N

Question're number	Involved already	QA	QA1	QB	QC	QD	QE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Comments at the end
Disqualified from Part 1																					
151	N	3	3	N	N	N	N	3	2	4	1	1	1	N	N	N	N	N	N	Y	Y
Involved with other forms of green electricity support already																					
155	Y	N	N	N	N	N	N	3	3	3	N	4	N	4	5	1	1	1	1	N	Y
156	Y	N	N	N	N	N	N	3	3	3	3	3	3	1	1	1	5	2	2	N	N
157	Y	N	N	N	N	N	N	4	3	2	1	1	2	2	1	1	2	1	1	N	Y
158	Y	N	N	N	N	N	N	2	2	2	4	2	4	4	4	5	5	5	4	N	Y

Appendix C - Answers to Open-ended Questions and Comments

This appendix contains all answers to open-ended questions, and comments that were written next to other, not open-ended questions in the questionnaire. For a copy of the questionnaire, see Appendix A. Comments were recorded with original spelling and punctuation. Illegible words were marked by three questions marks.

Questionnaire 1

No comments

Questionnaire 2

Question E: The cost of base load for night and cloudy days ruins economics unless you have B.C.–like elevations for water storage.

Questionnaire 3

No comments

Questionnaire 4

Question E: Would prefer to keep the solar panels on the roof after two years for personal use as incentive.

Questionnaire 5

Question A1: it depends

Question B: possibly

Question D: I need more information. It's possible that the info is out there, but I have not seen it.

End of Survey Comment: more info required. Intriguing.

Questionnaire 6

No comments

Questionnaire 7

No comments

Questionnaire 8

Question E: Not for profit is too generic for me. It implies that costs can run away, but still not be "generating a profit". As long as there are caps on expenditures and government is not involved or Ontario hydro, then it might be feasible.

End of Survey Comment: Interesting!

Questionnaire 9

End of Survey Comment: Good luck with the survey.

Questionnaire 10

No comments

Questionnaire 11

Question D: Option C is a viable choice.

Questionnaire 12

Question 13: that the savings will not materialize after several years, and government involvement with such programs. Change of local/provincial political party may have a different view on solar electricity and pricing.

Questionnaire 13

Question 13: If any issues arose from the solar panels installation on my roof like leaks, damage to the roof, it would be completely repaired at the installers' expense.

Questionnaire 14

Question E: I would support any alternative clean energy problem.

End of Survey Comment: Can I have some of the solar power panel electricity directed to my home directly?

Questionnaire 15

Question E: Solar panels in my opinion would be a great idea and beneficial to all.

Question 13: I would be slightly concerned on the leak problems, neighbour's view on the issue, but most importantly I would feel better if I was helping the environment.

End of Survey Comment: great survey, good luck!

Questionnaire 16

Question E: The $25/month fee is the only thing I would hesitate on...but I'd probably still be on board for any option.

Questionnaire 17

No comments

Questionnaire 18

End of Survey Comment: I'm hopeful about your plan and sincerely hope that this can be tested, rolled out and executed across Ontario to evolve current energy sources to better care for our people in Ontario and the environment. Good luck!

Questionnaire 19

Question D: I use solar to heat my pool, roof already being used for this. Idea of solar farms is appealing.

Question 13: I have solar to heat my pool and I would lose this if panels were put on my roof.

Questionnaire 20

No comments

Questionnaire 21

No comments

Questionnaire 22

Question 13: Aesthetics. Effect on property value. Impact of selling home during term.

Questionnaire 23

Question E: How does the sale of the house impact the terms of the contractual agreements? New owner may not wish to participate in the program. Also the shape of our roof does not allow us to put panels on our roof effectively.

Question 13: We were already considering solar panels on our roof to heat our pool – couldn't do both options.

End of Survey Comment: The question should be asked is whether participants would feel good about contributing to the reduction of our collective carbon footprint.

Questionnaire 24

No comments

Questionnaire 25

No comments

Questionnaire 26

No comments

Questionnaire 27

Question 1: Honestly didn't think about it until this questionnaire put doubt in my mind.

Question 2: Is this possible?

Question 3: Again, is this possible?

Question 7: We know it doesn't – have already looked into it.

End of Survey Comment: In the end, you are asking about our desire to contribute to the "greater good". We would, but a lot of people can't afford an extra $300 per month. It would feel better if we could see some direct benefit – lower energy fees overall, reduced municiple taxes after 2 years...If we paid for some kind of alternate energy generating service or device ultimately we all benefit.

Questionnaire 28

No comments

Questionnaire 29

End of Survey Comment: I do hope the information gleaned from this research study is not to be shared by or for the benefit of the McGuinty government. The Ontario government should not have access to this information during the upcoming election campaign.

Questionnaire 30

No comments

Questionnaire 31

No comments

Questionnaire 32

Question 13: Whether the solar panels would be the only source of energy to my house or would I use both? How expensive are solar panels? Would they lower my bills?
End of Survey Comment: Good luck with the survey! It shows a lot of commitment.

Questionnaire 33

Question E: Would be concerned, program 2, about the longer term implication to the integrity of the roof
End of Survey Comment: I like these programs as I think we need to find alternative energy sources. I particularly think solar panels on municipal or commercial buildings makes sense as

you would be able to install more panels, making the program more cost efficient, and many of the roofs are “out of sight”. The cost of $25/month is no prohibitive....for many residents in Oakville.

Questionnaire 34

No comments

Questionnaire 35

Question 13: How panels would be interconnected electrically?

Questionnaire 36

Question 13: Constant repairs and maintenance needed as per reported by media because of Cdn. winters.

Questionnaire 37

End of Survey Comment: Good luck, hope this helps!

Questionnaire 38

End of Survey Comment: In the end it is a matter of cost/benefit as well. I suppose the questions asked are more theoretically (...only option offered).

Questionnaire 39

No comments

Questionnaire 40

End of Survey Comment: I would support starting with municipal buildings and demonstrating that the panels are not unattractive and that they cause no problems to the roof. Perhaps some business (commercial) buildings would buy into this as part of their “green programme” – particularly if they were given recognition.

Questionnaire 41

Question 13: Community or municipal roofs would be much better as larger and more efficient panels could be installed and would not cause cosmetic issues or otherwise on personal homes.

Questionnaire 42

Question E: I thought there was a program in Ontario that paid people for the power they generate. If I was going to have solar panels on my roof (program 2) I would want to be compensated for power generated.

Question 13: As already stated I would rather be paid to generate power. The points covered from questions 7-12 would be my concern, as long as I was being paid for power generated.
End of Survey Comment: I'm in favour of supplementing small power producers, I'm not sure how it should be done.

Questionnaire 43

Question 13: Any roof repairs would be difficult.

Questionnaire 44

Question 13: I would love to have solar panels on my roof but would prefer to have them generate power for my own household rather than the grid. My other concern is cost. And after the 2 years what if I wanted to keep the panels?

Questionnaire 45

No comments

Questionnaire 46

End of Survey Comment: Sorry for the delay with our response. It has been a very busy summer. I trust that you can still use this information. Good luck on your project.

Questionnaire 47

Question 13: Outdated technology or obsolete in a few years...the pace of improvements are much shorter than life expectancy of panels.

End of Survey Comment: All the best!

Questionnaire 48

Question 13: I will be putting my house up for sale soon and would be concerned that this might impact negatively on selling the house profitably. Also I could not commit myself at this point.

End of Survey Comment: As it is all hypothetical, people may not answer completely honestly.

Questionnaire 49

No comments

Questionnaire 50

Question 3: I would hope not

Question E: Concerned about potential damage caused to roof, if panels were installed and removed after program.

End of Survey Comment: Thank you for including me in the survey.

Questionnaire 51

No comments

Questionnaire 52

No comments

Questionnaire 53

No comments

Questionnaire 54

Question E: Solar energy is great and readily available. What is the benefit for me financially to participate? If I were to get an advantage (instead of paying $25 per month) then it would feel like a worthwhile option. If there is no financial benefit to the person getting the panels and participating in paying $25/month why should we do it? It seems that you do something nice for your fellow Canadians by inconveniencing yourself with possible problems on your roof – inside your house (with leaks) – and unknown contractors coming around your house. I miss the advantage for me!

Question 13: All of them are serious concerns. Repairs due to a leak are extremely annoying (hard to find) and very expensive – been there/done that.

End of Survey Comment: Maybe I missed the boat on what the advantage is for the normal Joe. Maybe more info is important to ensure all questions are looked at. If you are selling it as a concerned for our environment issue, why isn't the Ontario Hydro paying the $25. Why would the people who don't participate have to pay it. If I have the system I am benefiting #1 the environment and #2 my fellow Canadians. Why should they not pay the $25 a month for not participating and helping out? Am I being "zinged" for wanting to help? Again I am struggling to find the benefit for an individual to participate. $25 is a lot of money for a growing family. That could be their whole budget for entertainment, or kids clothes, or charity money.

Questionnaire 55

Question D: Why should I pay in any form for solar panels to generate when I get no direct benefit and your commitment and withdrawal times are too long.

Question E: I agree solar electricity generation is good (??? with wind) I just don't like your proposed models.

Question 13: Installation is only one factor, removal is also of great concern. I don't think/or have seen a viable (100% install/removal) solar product on the market yet that satisfies my concerns about penetrating the most important weather proof membrane on the house.

Questionnaire 56

No comments

Questionnaire 57

Question E: We do need solar recovery methods equipment development. I am thinking about solar panel usage for personal consumption usage i.e.: pool pump/1hp/12hr days (daylight hours). An isolated system. Not interested in grid feed. Cost of panels, space requirements, maintenance are presently too prohibitive.

Question 13: One factor of concern relates to the power grid interface and my home power/metering/stability of voltage and ??(ac). Also lightening strikes and isolation.

End of Survey Comment: Thank you for the $2 but you shouldn't have. Now I owe you a coffee. I perceive your research study on attitudes to be more of how "marketable" solar power is in a community. I also see this as a possible request for a research donation of approximately $900, plus facility, plus risk. Cheers.

Questionnaire 58

No comments

Questionnaire 59

Question 13: Would not allow this under any circumstances.

End of Survey Comment: Questionnaire is very biased pro-solar energy.

Questionnaire 60

Question E: Solar power and wind power are far too expensive.

Questionnaire 61

Question E: I'm definitely in favour of solar electricity, but I don't think that I should have to pay $25 for it! I would be happy to allow a solar panel installation on my roof but at no cost to me (i.e. you can use my roof but don't expect me to pay extra for it). The government gives incentives for energy saving renos why not for allowing the use of your roof. I'm not expecting to have a decrease on my bill – just not an increase.

Question 13: When the solar panels are installed I assume that holes will be made in a few shingles to secure the panels to our joists. When the panels are removed how are the holes repaired? I have extra shingles but not everyone does.

Questionnaire 62

Question E: Do not understand why I as an individual would be funding any of these programs.

Questionnaire 63

Question D: I find the feed in tariff/guaranteed return to producer excessive and poorly designed.

End of Survey Comment: The whole philosophy - ??? returns by ??? Government – especially on a technology that is inefficient (but improving) – is offensive. Hence those taking part are likewise offensive. Andrew FYI the $2 coin was missing.

Questionnaire 64

Question E: As a retired senior citizen I am on a budget.

Question 13: $

End of Survey Comment: I wouldn't mind installing if I did not have to pay and the panels become mine after the study!!

Questionnaire 65

Question D: see section E

Question E: My understanding is that Ontario is currently subsidizing the solar providers at a rate of between 65 cents to 80 cents per kilowatt hour when compared to existing forms of power costing around 7 cents per kilowatt hour. This is out of the range I or most consumers could afford. These subsidies are currently buried in our overall taxes which is wrong. The consumers should be allowed to see the real costs in order to determine their willingness to participate.

End of Survey Comment: As mentioned previously, my main concern is real cost. Solar may be a good idea in area where no access to the grid is available but in urban centres it becomes a question of how much do you want to pay to be green or appear green. $25 per month would not cover the cost.

Questionnaire 66

No comments

Questionnaire 67

No comments

Questionnaire 68

Question 13: $25 per month not reasonable. Should subsidize homeowner (ex. $50/month) to allow panels on roof – guaranteed against leaks, etc.

Questionnaire 69

Question E: We are not opposed to solar power, but we already contribute to charity and this would not be one we would choose. We would consider the use of solar panels, if we were experiencing the benefits of the production by a reduction in our electricity bill.

Questionnaire 70

Question E: We are considering having solar panels installed on our roof for our personal use and/or to sell back into the grid. I believe in solar power but it has to be beneficial to all parties.
End of Survey Comment: $25 per month out of our pocket with no benefit to us except cleaner power? Nobody would participate without a tax benifit, or bill reduction equal to $25 to compensate. You are basically asking for a $1200 donation.

Questionnaire 71

Question E: It would be difficult to commit to a $25 monthly fee, for two years, with young children at home.

End of Survey Comment: Interesting survey...however with 5 young children at home, energy conservation and "green power" is very important but being able to afford the basics of life right now, is on the top of our list. We aren't interested in gaining monetary gain → only to reduce our hydro costs associated with having a large family (i.e. solar panels installed with a purpose to also reduce our own hydro consumption 3 points is appealing). If the panels are being installed then we should also have access to it, in order to reduce our own hydro costs...esp. if we are paying $25 per month. Thank you!!

Questionnaire 72

Question D: Any fee is not going to make me feel like I'm doing my part.
Question E: The price of electricity should rise: a) to encourage conservation, and b) to make small solar (et. al) economic.

Questionnaire 73

No comments

Questionnaire 74

Question 13: What about snow cover?
End of Survey Comment: The questions and the approach were very professional. The idea of supporting the Provincial Electrical Grid (in light of the wasteful use of funds historically) vs. supporting our own home use does not appeal to me.

Questionnaire 75

No comments

Questionnaire 76

Question D: I already pay for my electricity. Why should I pay again?
End of Survey Comment: Why should I make my house look undesirable and affect my sale price by putting these things on my roof for someone else to benefit when they don't have them

on their own house. If I were to make the decision to put them up (which I wouldn't) I would want the power for my own use.

Questionnaire 77

Question D: I believe solar power is the cost of Ontario Power making us less competitive as compared to other jurisdictions.

Questionnaire 78

Question E: All Europe is using solar energy, we don't need experimental programs to prove its benefit.

Questionnaire 79

Question D: I believe that there are other means to obtain efficient use of, and clean production of electricity, that are more cost effective than solar.

Question 13: I'm hopeful that such projects would be monitored in such a way that there would not be needless waste or cheating, however my main concern is whether it is a wise use of money, particularly in a climate where we have limited sun exposure for a good part of the year.

End of Survey Comment: I'm surprised that you're not collecting any demographic information. I would think that would be important in assessing the survey results.

Questionnaire 80

Question E: I'm also concern that whoever agrees to this program, will the organizers help with home insurance cost as it may affect existing policies cost.

Question 13: 1. What if my financial situation require me to sell without adequate notice to (you) organizers of the program – who will then be responsible for the solar panel removal? 2. What are the implication on home insurance.

End of Survey Comment: I am all for solar electricity and modern technology, however I do not like the fact that the organizers are asking for financial commitment when I will be putting the safety of my home at their disposal. Thank you for letting me share my opinion.

Questionnaire 81

Question A1: How close? Relative?

Question B: Otherwise cut off?

Question E: I am 82 years old. I do not read fiction and I play no games.

Questionnaire 82

Question E: Why would I pay $25/month if there is no savings to me personally?

Questionnaire 83

Question 13: a) cost/expense to install such system. b) possibility of structural damages to building.

Questionnaire 84

Question E: Subsidies for solar in wealthy countries, especially Germany only raise the cost of solar and make the likelihood of its adoption in poorer but more sunny regions of the world less feasible.

Questionnaire 85

No comments

Questionnaire 86

Question E: I am too old to take this program.

Questionnaire 87

Question D: The feed in tariff program involves an obscene waste of public funds. Solar power is not economically feasible at this time in the absence of massive government subsidies at a time when governments are running unacceptable deficits.

Questionnaire 88

Question E: Use natural power generation methods i.e. water-Niagara falls.

Question 13: Removal expenses

Questionnaire 89

Question D: I should get the power generated directly into my home. If my usage is great than the power generated, I could (still) get it from the grid.

Question E: I know I own a 24 000 square foot building in Toronto (Rexdale) I got pricing to install panels on the (flat) roof. When I found out I couldn't use the power generated I did not proceed.

End of Survey Comment: It is not necessary to offer me any money. In fact, I feel "slighted". I'm sure you can make better use of the money, so, it's returned. You can put it towards your education, or, go to the campus pub!

Questionnaire 90

Question E: Also, I don't think I'd like to be part of a beta test site with so many unknowns as that may impact the value of my home. If the program was well established and the kicks solved, I might consider it.

End of Survey Comment: Good luck have a coffee on me!

Questionnaire 91

Question E: We need solar power but I feel it is the responsibility of the Ontario Government to institute such a plan. The taxpayer should not be paying more money – on top of our existing energy bill – to introduce solar energy. The McGuinty Government's record on energy consumption (conservation) finding new sources is abysmal – a sham.

Questionnaire 92

Question E: Obviously much time and effort has gone into the planning of this research study and I commend you on this worthwhile project. I would have liked to assist you in any of the three programs but financial limitations unfortunately prohibit my involvement. I wish you success in your endeavours.

Questionnaire 93

Question 4: That would not bother me – I'd do it for myself

Question E: I think these are all good programs – But I would want to see the solar power generated offset my monthly payment. This will generate profit – & I do not want to pay twice.

End of Survey Comment: I have no issues in participating in 2 – but it should not cost me if I produce/provide energy to the grid. Same for 3 – the costs should be offset by the savings provide by using less energy from the grid. If we are doing "you" a favour we should not be asked to pay for it. Thanks!

Questionnaire 94

Question D: I believe we already pay more than enough for hydro. The waste, mismanagement, and excess over the past decades at OPG would make my $25 per month look silly. The only program I might consider is a renewable source on my property that benefited my home. Otherwise OPG can stop paying huge severances to incompetent managers and they will have plenty of money for any solar program.

Question 2: If given a monopoly by the government like Rogers Bell OPG.

Question 13: Option for homeowner to purchase panels at end of two year program and connect directly into house if cost made sense.

Questionnaire 95

End of Survey Comment: All three options would be of interest to me – in 2-3years when our cash flow situation has improved. My parents have had solar panels on their roof to heat their pool since the mid 80s so I'm not concerned re appearance/safety etc. I'm fully supportive of solar power/energy...would choose 'definitely participate' if our cash flow situation was better.

Questionnaire 96

Question E: Out of pocket expense of $600 over 2 year period. Programs should have been designed to break even for participants.

Questionnaire 97

Question D: 1. Issues with insurance and responsibility if roof is damaged, PGM2. 2. Everyone that uses the KW generated should share the cost and government should drive the progam.

Question E: I would support the program if its run by the provincial government and the cost and benefits are explained in details.

Question 13: The program has to proof to the public that it is fair and open to those that contribute and those that benefit.

End of Survey Comment: I do not think pgm 2 and 3 are cost effect. But I strongly support the idea of solar energy. Maybe if we can get enough voice from the public, we can get funding from the government instead. There is not enough details in the survey to convince me that this is viable.

Questionnaire 98

No comments

Questionnaire 99

Question E: The government needs to enact such green energy plans by eliminating some costs for traditional or electric energy and then charging a small amount (i.e. $5 → $10) per household to establish and fun an official solar energy plan. To expect members of the community who pay an extraordinary amount of money in electricity costs as well as property taxes would be far to much for the average consumer to handle in this economy.

Question 13: Reputable contractors who take full and immediate accountability for work done – or for any potential problems that may arise. It is quite a well known issue noted in the media – the amount of fraud and non-regulated contractors that came out of the woodwork, scamming citizens who wanted to participate in "government green energy" incentives. This has generated a lot of public scepticism unfortunately.

Questionnaire 100

Question D: I'm not yet convinced by market pricing that current electricity costs are high enough to persuade people to opt into a plan that would be for the general good.

Question E: Until all wastage and excess are removed from the power generating bureaucracy and operations I cannot imagine the collective altruism required for a plan of this nature finding acceptance within the public imagination.

Question 13: Also concerned that the one year lead time for opt out is not flexible enough to allow sale of a property.

End of Survey Comment: Good luck with your survey, the results should be posted to a website send me url if this takes place.

Questionnaire 101

Question E: Would this increase decrease/adjust the regular monthly charge now? I want to save money, not spend more. What is the savings per household? None. Since there is no financial gain in the household, I would not support this by participating.

Question 13: How long do solar panels last before repairs are necessary? What is the expense involved to replace a panel broken?

End of Survey Comment: What percentage of savings would a regular household receive once they switched to solar panels?

Questionnaire 102

No comments

Questionnaire 103

No comments

Questionnaire 104

No comments

Questionnaire 105

Question E: Already paying enough for electricity, not willing to pay extra even if it's environmentally beneficial.

Questionnaire 106

Question E: As a pensioner, hydro is way too expensive already.

Questionnaire 107

Question E: I like the idea of solar energy. I have a good roof for it but feel a positive incentive to participate should be offer aside from benefiting the greater good. My power bill is already expensive. I'm looking for ways to reduce my costs.

Questionnaire 108

Question 13: If something goes wrong and there is damage to my roof at installation or in future, who would pay for the damage and how would it be rectified?

Questionnaire 109

No comments

Questionnaire 110

Question E: The offer has no direct benefits to offset costs and the hassle. I do believe we need solar power. $25 is not too much at all. Two years is not an issue. Front of my house faces south, with no clear ??? for the panels. I would need to be made to feel more secure about its organizers. I would say 'Probably' to question 1a, if I knew and trusted its organizers.
Question 13: I don't see why the installations would be removed after 2 yrs. I don't see why a contributor could not receive benefit for the investment of time and money, at some point in time, eg. at the end of the 2yrs.
End of Survey Comment: Your proposition lacks assurances and seems to vague and would require blindness and/or naiveté to join. However, I would support a charitable organization who were going to get solar off the ground, if I was given the appropriate assurance.

Questionnaire 111

Question D:

- Want more specifics as to benefits and short term solutions
- "Programs may benefit all Ontario residents" – need more assurances that our $ will create benefits that are tangible and measurable.

Question 13: It is the least attractive of the three options. Prefer the farms and/or municipal buildings as locations. I don't feel enough was said about the confirmed benefits of a such a program. How valuable is a program where participants can opt in or out in a short period of time?

Questionnaire 112

Question E: I think that the production of all energy should be provided by one company namely Ontario Hydro. Recently we had to work to avoid gas fire generation near residential homes in our area! No individual company should have control in only one area. The money for research should be provided by hydro as we already pay taxes as well as individual payments for energy. There must be concerted effort by all jurisdictions to control pollution of the atmosphere in all areas.

Question 13: 1. What kind of air conditioning would be required to keep the home free from problems of high heat and pollution that would increase problems with allergies? 2. What would be the cost of restructuring the roof and decreasing the amount of shade around the property?

N.B. our home was built in 1956 in King's Wood where all vegetation was well preserved by the contractors. It is now a jungle of trees that provide a large amount of shade.

Questionnaire 113

No comments

Questionnaire 114

No comments

Questionnaire 115

Question E: Love the idea of solar power in general theory and we would love to participate in such a program. However, we have young kids and when we look at the monthly demands on our budget (mortgage, property taxes, daycare, groceries, rising cost of gas, RESP + RRSP contributions, etc) we just can't afford one more expense – especially a voluntary one.

End of Survey Comment: Very interesting survey. Good luck!

Questionnaire 116

No comments

Questionnaire 117

Question E: Other companies offer to pay rental for use of the roof for solar panels.

Questionnaire 118

No comments

Questionnaire 119

Question D: While we agree we need green energy, why would I as an individual pay to feed the general grid, where there would be participants and non-participants. We do our bit, and conserve, but this should be a general surtax to fund initiatives.

Questionnaire 120

End of Survey Comment: We think that solar electricity is a great idea. But for us to pay $25 extra a month to be part of a program which we do no benefit at all is not appealing. We have enough bills to pay on a fixed income. If the program help us to save money, then maybe. We are already paying for the hydro debt as it is. We should not have to pay for poor management.

Questionnaire 121

Question D: There should be a financial incentive to use solar.

Questionnaire 122

No comments

Questionnaire 123

Question E: No logic to these scenarios. I pay so others benefit who do not pay. It does nothing to develop lower or more efficient use of energy. If it is such a good idea, tax all Ontarians $25 a month. I think solar energy is perfectly sensible: the scenarios unfortunately make no sense to motivate support from the public.

Part 2 questions are basically irrelevant because the original scenarios provide no incentive to take part in the program. A lawn sign? Come on, participants need a direct benefit.

Questionnaire 124

Question E: I do not choose to participate in any solar electricity programs.

End of Survey Comment: Waste of my time

Questionnaire 125

Question D: I have a cottage. My electricity used was $1.45 but my bill was almost $50. The government or hydro gets enough money, I should not have to pay anymore.

Question E: If they want to their solar projects, they can, but we are “rip off” for governments to survive, my income has not gone up since 2004.

End of Survey Comment: I think solar power is not efficienty, the govt pays alot of subsidies for “green jobs”, they have cause all the good jobs to leave for China, now they are trying to make these “green jobs”. The corporations profit have double and triple and still they do not hire more people, what we need is to stop, take a look what we have in the past 20 years and say we screwed up. Solar jobs. Okay. But I should not have to pay for it. The government have no – idea on what they are doing.

Questionnaire 126

Question D: Solar power is not competitive with other forms.

Questionnaire 127

No comments

Questionnaire 128

No comments

Questionnaire 129

End of Survey Comment: I would favour solar panels if they were to benefit to me financially.

Questionnaire 130

Question D: There is no assurance that my financial sacrifice would result in a net benefit to anyone. In other words, I pay for green energy, but I don't get a personal benefit, financial or otherwise. I don't get lower bills myself because my energy usage is reduced by amount I generate, and I don't even get to use the energy so I have the satisfaction of reducing my personal carbon footprint. At the community level, I don't know that my actions have a green result – I just might be putting money into the pockets of Oakville Hydro, or creating extra electricity capacity that enables someone else's energy gluttony.

Question 4: Note: I would feel worse. I don't want ugly panels on my house.

Questions 13: Yes I would not go to the trouble or expense associated with doing this unless someone could demonstrate the clear personal or societal benefit that would result.

End of Survey Comment: If this is a serious proposition, you should consider 1. Using smart meters to credit participants in some way related to amount of electricity created. 2. Tax credits for participants. 3. Industry participation tied to business licensing (eg. new businesses licensed must offset all/part of carbon footprint by mandatory participation).

Questionnaire 131

Question E: No interested in paying $ to receive this service. Should be the other way around if solar panels are on our property feeding into a "grid".

Questionnaire 132

No comments

Questionnaire 133

Question E: We have too many monthly expenses right now to consider participating in a program such as this. We would theoretically be more likely to participate in a program that would directly reduce our electrical bill.
End of Survey Comment: I support any initiatives whose goal is to reduce greenhouse gas emissions, and look forward to the day when such programs are affordable for all homeowners.

Questionnaire 134

No comments

Questionnaire 135

Question E: I think we already pay enough for electricity and there is no incentive to the homeowner to participate in this program. If we need more funds to implement solar energy then all consumers should pay equally into the program. If I were to allow the installation of the panels on my roof, I would expect some sort of discount or compensation.

Questionnaire 136

Question E: Unless there is a business case that proves savings to the consumer by using solar energy, specially in the current financial situation, I would not participate.
Question 13: Concerned about the effectiveness of solar panels when they are covered with snow in the winter, as well as the possible requirement to clean them (if needed).

End of Survey Comment: I am a strong proponent of solar energy, however I believe that there has to be a solid business case that allows early adopters to benefit financially as opposed to pay more just by feeling good. Thank you.

Questionnaire 137

Question 13: One year's notice to withdraw from the program is too long.

End of Survey Question: Good luck!

Questionnaire 138

Question E: I think we do need to explore alternatives, but a $600 commit + another year is too much – sorry!

Questionnaire 139

No comments

Questionnaire 140

Question E: If our house was able to use a portion of the solar power, that would certainly change my answer.

End of Survey Comment: Thank you and good luck!

Questionnaire 141

Question E: Would be interested if there were tax benefits or other possible financial benefits only. Possibly if installed on my roof reduction in current electricity bill.

End of Survey Comment: Good luck Andrew.

Questionnaire 142

Question E: Retired and 88 years old.

Question 13: Upkeep and maintenance of the installation – i.e. Too frequent, costly, etc.

Questionnaire 143

Question D: $25 is not too much for me to pay, but I would be unwilling to invest directly. If solar power isn't currently financially competitive, the role of government is to provide the incentive otherwise #1 or #3 would get my support.

Question 7: Heavy tree cover!

Question 8: Old house.

Question 13: Yes, I would worry about what would happen when it's time to get the roof re-shingled.

Questionnaire 144

Question D: If I'm paying a fee to have a solar panel on my roof or elsewhere, why wouldn't I benefit from that electricity? Are we talking "charity"? If so why isn't this labelled donation?

Question E: This questionnaire is bizarre. "Senior manager"? What are you talking about?

End of Survey Comment: I really don't understand the purpose of this research. Hopefully others do. I would do lots for the environment (I already do) but what this is about is a donation program. First financially and then to possible use my roof for others to benefit.

Questionnaire 145

No comments

Questionnaire 146

No comments

Questionnaire 147

Question D: No incentive to participate. Damage to property if roof leaks.

Question 13: Any financial commitment with no return is not likely going to receive an overwhelming response i.e. paying $25/mth to feel good and incur risks on damage to property won't be very popular

Questionnaire 148

No comments

Questionnaire 149

End of Survey Comment: No financial benefits or "concrete" incentives to the homeowner. Pay more...but any positive outcomes not immediate (long term impact). Added financial expense as a result not favourable (or feasible when costs already very high). (Major corporations could be encouraged to participate with some tax incentives, etc → ? more cost effective for them perhaps?)

Questionnaire 150

Question D: I do not see the value or ROI for myself?

Question 13: What happens when panels are removed? What would be the condition of the roof?

End of Survey Comment: I would be very surprised if you had any positive interest in any of these program. Putting a micro Fit installation on a high end home would be challenging enough.

Questionnaire 151

Question 13: I don't get it – why would we put solar panels on our roof and get nothing in return except a headache to deal with!

End of Survey Comment: What happens if the house needs a new roof. What the cost of removing the panels and replacing them after the repairs. ??? this survey leaves us with a lot of unanswered questions.

Questionnaire 152

Question E: I would be subsidizing the power grid, in addition to paying high rates for the power I use. While I support solar power, for me to only pay with no benefit that is tangible to myself is unreasonable.

Questionnaire 153

Question E: We would be more likely to participate if the $25/month would be deductible as a donation tax credit. In fact, this may be a deciding factor.

End of Survey Comment: Regarding question #6 I would feel good about using solar panels mostly because of the positive effect on the environment and less because of the use of modern technology.

Questionnaire 154

Question E: You picked the wrong house. We have been here since 1949. Are 82 and 80 years old. This may be beneficial for a younger family.

Questionnaire 155

End of Survey Comment: Much of survey does not concern us as we have and have had for several years roof solar panels with service our pool. Some survey questions are strangely worded e.g. “would you feel better?”.

Questionnaire 156

No comments

Questionnaire 157

End of Survey Comment: Question #1, we all pay a premium for green electricity in Ontario. We all subsidize wind turbines and solar panels by purchasing power at over market rates, and by installing back up power plants to back up the “green electricity generation”. We need to better understand what “green” means, like “whole grain”, “natural ingredients”, “homemade”.

Questionnaire 158

End of Survey Comment: I would not spend $25 a month with no power delivered to my house unless it was mandatory that everyone be mandated to do so. That doesn’t make sense to me. Sounds like our government needs to invest in solar energy development.

Questionnaire 159

No comments

Questionnaire 160

Question E: I would not participate until I was comfortable with the management and proven track record of the project.

Questionnaires that were returned not completed.

Only questionnaires with comments are listed.

Questionnaire 164

Comment on a separate piece of paper: Senior unable to participate.

Questionnaire 165

Comment on a separate piece of paper: Sorry! We are advanced age seniors. For this and other reasons, we cannot participate in your project. We wish you success because it seems a good idea. We return the twoonie herewith.

Questionnaire 168

Comment on a separate piece of paper: Dear Andrew, thanks for the invitation to participate in your research study, but unfortunately I can not participate, I'm hoping that my house will be sold by the time this survey is over. Sorry, and I hope you can send all this info to another address. All the best for the future!!

Questionnaire 175

Comment on separate piece of paper. Unable to participate. Sorry! Thank you.

Appendix D – Statistical Calculations

The content of this Appendix is based on statistical methods advice, provided by Prof. Wlodzimierz Godlowski from the Institute of Physics at Opole University, Poland.

1. Confidence Interval for Proportions of Various Groups of Respondents, Determined by Their Answers to Questions from Part 1

For survey results, the formula below is commonly used for calculations of confidence intervals for population proportion *p* at a 95% confidence level. Population proportion is defined as the probability of selecting, from a given population, an element that has the characteristic being tested for. There is a 95% probability that:

$$-1.96 * \mathrm{sqrt}(k/n\ (1-k/n) / n) < p < 1.96 * \mathrm{sqrt}(k/n\ (1-k/n) / n)$$

where: k - number of elements with tested characteristic in the selected sample
n - sample size.

As one will be able to see from the analysis presented below, this formula is a good approximation of the confidence intervals for a population proportion when *n* is large, and a sample proportion *k/n* is either not very small or not very large. (There is an obvious problem when *k/n* is either 1 or 0.)

Application of the above formula to an analysis of survey results assumes that statistic $h = k/n$ has a standard Gaussian distribution, which is not true. Also the formula applies to a priori probability analysis, while for survey results, a posteriori probability analysis should be used.

Since the probability of selecting an element of particular characteristics from a given population (i.e. population proportion *p*) is not known, it must be estimated. The actual proportion of elements with the tested for characteristic in the sample *k/n* is a good estimator of *p,* from the point of view of statistical analysis (maximum likelihood, consistent, and unbiased estimator).

Next, two functions f1(k,n) and f2(k,n) must be found, such that the probability *P* that the value of *p* is between f1 and f2 is equal to 0.95:

$$P(f1 < p < f2) = 0.95$$

For samples in which $n > 100$, one can approximate statistic $h = n/k$ with a Gaussian distribution with the expected value $EX = p$, and variance $D2X = p(1-p)/n$. This implies that a new statistic $U = [(k/n) - p]^{\text{sqrt } [p(1-p)/n)]}$ has a <u>standard</u> Gaussian distribution (where $EX=0$ and $D2X=1$).

From the properties of a standard Gaussian distribution, and the fact that one wants to reject values of a statistic that differ from the expected value EX in both directions, one can prove that the probability that the value of the statistic U falls between -1.96 and 1.96 is 0.95:

$$P (-1.96 < U < 1.96) = 0.95$$

Which leads to the following inequalities:

$$-1.96 < [(k/n) - p]^{\text{sqrt } [p(1-p)/n)]} < 1.96$$

Solving this set of inequalities for *p* leads to formulas for functions *f1* and *f2*. For clarity, the solution is presented with the help of the additional functions A, B, and C:

$A (B-C) < p < A (B+C)$

where $A = n / (n + 1.96^2)$

$B = k/n + 1.96^2 /2n$

$C = 1.96 * \text{sqrt}\{ [k(n-k)/n] + 1.96^2/4 \} / n$

In general, these formulas can be used for other levels of confidence, with appropriate constants in place of 1.96.

1.1 Calculations of Confidence Intervals for Various Groups of Respondents

With the help of the above formulas, confidence intervals can be calculated for population proportions for the different groups of respondents that are of interest to this research.

Since the sample size is the same for all groups (159), A = 0.976 for all of them.

Trusting Good Citizens:
k = 40 members
sample proportion p = 40/159 = 25.2% :
B = 0.264 C = 0.069
A(B-C) = 0.19 A(B+C) = 0.325
confidence interval: 19.0% < p < 32.5%

Not Trusting Good Citizens:

$k = 1$ member

sample proportion $p = 1/159 = 0.6\%$

$B = 0.018$ $C = 0.017$

$A(B-C) = 0.001$ $A(B+C) = 0.034$

confidence interval: $0.1\% < p < 3.4\%$

Visibility Junkies:

$k = 11$ members

sample proportion $p = 11/159 = 6.9\%$

$B = 0.081$ $C = 0.041$

$A(B-C) = 0.039$ $A(B+C) = 0.119$

confidence interval: $3.9\% < p < 11.9\%$

Naysayers:

$k = 100$ members

sample proportion $p = 100/159 = 62.9\%$

$B = 0.641$ $C = 0.076$

$A(B-C) = 0.551$ $A(B+C) = 0.700$

confidence interval: $55.1\% < p < 70.0\%$

Not Trusting Good Citizens + Not Trusting Odd Participants:

$k = 3$ members

sample proportion $p = 3/159 = 1.9\%$

$B = 0.031$ $C = 0.024$

$A(B-C) = 0.07$ $A(B+C) = 0.054$

confidence interval: $0.7\% < p < 5.4\%$

Trusting Good Citizens + Trusting Odd Participants

and

Trusting Good Citizens + Not Trusting Good Citizens:

k = 41 members

sample proportion p = 41/159 = 25.8%

B = 0.270 C = 0.069

A(B-C) = 0.196 A(B+C) = 0.331

confidence interval: 19.6% < p < 33.1%

Visibility Junkies + Not Trusting Good Citizens:

k = 12 members

sample proportion p = 12/159 = 7.5%

B = 0.088 C = 0.043

A(B-C) = 0.044 A(B+C) = 0.128

confidence interval: 4.4% < p < 12.8%

1.2 Calculations of Confidence Intervals for Willingness to Participate

For calculations of willingness to participate, sample size n = 155.

Sum: Good Citizens + Odd Participants + Visibility Junkies = k = 55 members

sample proportion p = 55/155 = 35.5%

A = 0.976 B = 0.367 C = 0.076

A(B-C) = 0.284 A(B+C) = 0.432

confidence interval: 28.4% < p < 43.2%

2. Confidence Intervals for the Ratios of Groups of Respondents, as Determined by Their Answers to Questions from Part 1

2.1 Confidence Interval for a Ratio of Two Random Variables

In this section, confidence interval calculations will be presented for the random variable Z = A/B, where A, B are also random variables, and are not independent of each other, as is the case with the variables in the ratios discussed in sections 7.1.1.1 and 7.1.2.1. The values for these variables are determined by sampling the same population by the methods of this research project. True values A_t, B_t in the population (and therefore, expected values of random variables A, B) are not known.

The proper way of solving this problem would be to calculate the probability density for the function Z, but this is not an easy task since functions A, B are not independent of each other. In the words of Professor Godlowski – 'this would be a good topic for a PhD dissertation in mathematics, in the good old times when getting PhD was really an achievement'. Another way of approaching this task would be to perform a computer simulation, as for example presented in Biesiada et al. (2005). This would be a very time consuming task, and one that might be beyond the author's abilities. The level of precision called for in this type of research project – a master's thesis – does not justify the effort. Therefore, a middle way of approximate calculations was chosen, and is presented below.

First, variance $\sigma^2(Z)$ has to be calculated. This can be done with the help of the propagation of error formula, but to apply it there must be a linear relation between old and new variables, and this is not the case here, since Z = A/B. The first approximation then will be to use a Taylor expansion of the first order of the function Z for the propagation of error formula. This approximation introduces errors, as discussed in Godlowski (2012), but is commonly used.

In order to use the propagation of error formula, two sets of variables with the same number of elements are required – old variables A, B and new variables Z, W. Variable Z is defined above, while variable W can be defined in such a way that it does not influence the calculations, for example, as a constant function W = 1 (so its derivative will be zero).

The full formula for the Covariance Matrix C_y of the set Y of the new variables (Z, W) as a function of Covariance Matrix C_x of the set X of the old variables (A,B) is given below:

$$C_y = GC_xG^T$$

Matrix G is a transformation matrix, resulting from the Taylor expansion, and matrix G^T is its transposition. Elements of matrix G are partial derivatives of new variables with respect to the old ones:

$$G_{ij} = \partial Y_i / \partial X_j$$

In this case, only derivatives of the variable $Y_1 = Z$ will be different from zero.

Covariance Matrix C_x is given by the formula:

$$c_{ij} = np_i (\delta_{ij} - p_j)$$

where n – sample size

p_i – probability of selecting from a given population, an element that has the characteristic being tested for (i.e. population proportion)

δ_{ij} – Kronecker delta which equals 1 when $i = j$, and equals 0 when $i \neq j$.

Therefore, variances of variables A, B (marked as $X_{i,}$ and i = 1,2) are:

$$\sigma^2(X_i) = np_i (1 - p_i)$$

while covariances are:

$$cov(X_i, X_j) = - np_ip_i$$

From the formula for Covariance Matrix C_y applied to this case, it follows that the variance of variable Z is given by the formula:

$$\sigma^2(Z) = \Sigma\Sigma\ (\partial Z/\partial X_i)\ (\partial Z/\partial X_j)\ \mathrm{cov}(X_i,X_j)$$

where $i,j = 1,2$ and $\mathrm{cov}(X_i,X_i) = \sigma^2(X_i)$

Therefore:

$$\sigma^2(Z) = (\partial Z/\partial A)^2\, \sigma^2(A) + (\partial Z/\partial B)^2\, \sigma^2(B) + 2(\partial Z/\partial A)\ (\partial Z/\partial B)\ \mathrm{cov}(A,B)$$

And since $Z = A/B$ then :

$$\partial Z/\partial A = 1/B$$

$$\partial Z/\partial B = -\, A/B^2$$

With this general formula one can now turn to solution of actual cases.

2.2 Ratio for Trust Concerns Influence Estimation (see section 7.1.1.1)

2.2.1 First Approach

The sum of Not Trusting Good Citizens and Not Trusting Odd Participants can be treated as one new *random variable N*. The sum of Trusting Good Citizens and Trusting Odd Participants, can be treated as one new *random variable T*. For the purpose of investigation of trust concerns, the fact that a respondent declared participation in contract #3 (solar panels on own roof) or #4 (solar panels on roof in community) is irrelevant. The relevant fact is whether a respondent declared participation in contract #2 (familiar solar farm) only, or in contract #1 (undisclosed solar farms) as well. The former group is represented by variable N, and the latter by variable T.

The ratio confidence interval which is sought, has now the following form:

$Z_1 = N/T$

Since the true values of random variables N, T are not known, and by the same token probabilities p_i , one has to do the second approximation by estimating them with the results of the survey performed as part of this thesis:

$N_{est} = 3$
$T_{est} = 41$

$P_N=3/159$
$P_T=41/159$

This is not the most elegant assumption, but it is allowable since the sample size is greater than 100.

This approximation yields the following results:

$\partial Z_1/\partial N = 1/41 = 0.0244$
$\partial Z_1/\partial T = - 3/(41)^2 = -0.0018$

$\sigma^2(N) = n\, p_N(1- p_N) = 159*3/159*(1-3/159) = 2.9434$
$\sigma^2(T) = n\, p_T(1- p_T) = 159*41/159*(1-41/159) = 30.4277$
$cov(T,N) = - np_T\, p_N = - 159*41/159*3/159 = - 0.7736$

Substitution of these values for the appropriate elements of the formula for the variance of Z_1:

$$\sigma^2(Z_1) = (\partial Z_1/\partial N)^2 \sigma^2(N) + (\partial Z_1/\partial T)^2 \sigma^2(T) + 2(\partial Z_1/\partial N)(\partial Z_1/\partial T) \operatorname{cov}(N,T)$$

gives the following result:

$$\sigma^2(Z_1) = 0.00192$$
$$\sigma(Z_1) = 0.0438$$

One last approximation has to be made. If Z_{1est} is the value of Z_1 that results from this particular survey ($Z_{1est} = N_{est}/T_{est} = 3/41 = 0.073$), and Z_{1t} is the unknown true value of Z_1, then $(Z_{1est} - Z_{1t})/\sigma(Z_1)$ is a random variable. If one assumes that this variable has a <u>standard</u> Gaussian distribution (which for such a small value of Z_{1est} <u>might not be a reasonable approximation</u>), then at a 95% confidence level, the confidence interval is given by the following formula:

$$Z_{1est} - 1.96*\sigma(Z_1) < Z_1 < Z_{1est} + 1.96*\sigma(Z_1)$$

Final calculations give the following result:

$$-1.3\% < Z_{1t} < 15.9\% \quad \text{or} \quad Z_{1t} = 7.3\% \pm 8.6\%$$

There is an obvious problem with this result, because the value of Z_1 cannot be smaller than zero. This inconsistency is the result of the approximations, especially the last one. One can interpret this result however, as evidence that the true value of Z_1 is not significantly different from zero.

2.2.2 Second Approach

One can confirm the fact that the true value for the random variable $Z_1 = N / T$ is not significantly different from zero by a different statistical approach. It is also based on approximation, but one that is more accurate than the last of the approximations from the method described in the previous section.

Let's consider the two following random variables:

$W_1 = (T + N) / n$
$W_2 = T / n$

Since the sample has more than 100 elements (n = 159), one can estimate the true values of T and N with the results from the survey, and calculate estimates for the true values of random variables W_1 and W_2 .

$W_{1est} = (41 + 3) / 159 = 0.2767$
$W_{2est} = 41 / 159 = 0.2579$

Using the formula for the confidence interval for a proportion developed in section 1 of this appendix, a one-tailed confidence interval that contains all the values significantly smaller than $W_{1,}$ at the 95% confidence level can be calculated.

$A (B – C) < W_{1t}$

where $A = n / (n + 1.64^2)$
$B = k/n + 1.64^2 /2n$
$C = 1.64 * \text{sqrt}\{ [k(n-k)/n] + 1.64^2/4 \} / n$
$k = 44, \; n = 159$

Note that *1.64* replaced *1.96* in the formula, due to the one-tailed interval calculations.

Since W_{2est} is larger than the critical value A(B - C) = 0.2226, and falls within the W_{1t} confidence interval, one cannot say that the true value W_{2t} is significantly smaller than the true value W_{1t}. However, since $W_1 = (T + N) / n$ and $W_2 = T / n$, W_{1t} cannot be smaller than W_{2t}.

In this indirect way, it can be said that W_{2t} is not significantly different from $W_{1t.}$.

Therefore, the ratio
$W_{1t} / W_{2t} = ((T_t + N_t) / n) / (T_t / n) = (T_t + N_t) / T_t = 1 + N_t / T_t$
is not significantly different from 1.

If this is true, then the ratio $N_t / T_t = Z_{1t}$
is not significantly different from zero.

Note: one cannot use the methods described in section 3 of this appendix to test if the proportion of W_1 is larger than that of W_2. The random variables W_1 and W_2 are not independent of each other.

2.3 Ratio for Benefits of Visibility Influence Estimation (see section 7.1.2.1)

Visibility Junkies are a single *random variable V*. The sum of Trusting Good Citizens and Not Trusting Good Citizens, can be treated as single new *random variable T*. For the purpose of investigation of benefits of visibility, the fact that a respondent declared participation in contract #1 (undisclosed solar farms) is irrelevant. The relevant fact is whether a respondent declared participation in contract #2 (familiar solar farm), a common characteristic of all Good Citizens.

The ratio confidence interval which is sought, has now the following form:

$Z_2 = V/G$

Since we do not know true values of random variables V, G and by the same token, probabilities p_i , we have to do the second approximation by estimating them with the results of the survey performed as part of this thesis:

$V_{est} = 11$
$G_{est} = 41$

$p_V = 11/159$
$p_G = 41/159$
This is not the most elegant assumption, but it is allowable since the sample size is greater than 100.

This approximation yields the following results:

$\partial Z_2/\partial V = 1/41 = 0.0244$
$\partial Z_2/\partial G = - 11/(41)^2 = - 0.0065$

$\sigma^2(V) = n\, p_V(1- p_V) = 159*11/159*(1-11/159) = 10.2390$
$\sigma^2(G) = n\, p_G(1- p_G) = 159*41/159*(1-41/159) = 30.4277$
$cov(V,G) = - np_V\, p_G = - 159*11/159*41/159 = - 2.8365$

Substitution of these values for the appropriate elements of the formula for the variance of Z_2,

$$\sigma^2(Z_2) = (\partial Z_2/\partial V)^2\, \sigma^2(V) + (\partial Z_2/\partial G)^2\, \sigma^2(G) + 2(\partial Z_2/\partial V)\, (\partial Z_2/\partial G)\, cov(V,G)$$

gives the following result:

$\sigma^2(Z_2) = 0.00828$
$\sigma(Z_2) = 0.0910$

One last approximation has to be made. If Z_{2est} is the value of Z_2 that results from this particular survey ($Z_{2est} = V_{est}/G_{est} = 11/41 = 0.268$), and Z_{2t} is the unknown true value of Z_2, then $(Z_{2est} - Z_{2t})/ \sigma(Z_2)$ is a random variable. If one assumes that this variable has a standard Gaussian distribution (which is a reasonable approximation this time), then at a 95% confidence level, the confidence interval is given by the following formula:

$$Z_{2est} - 1.96*\sigma(Z_2) < Z_{2t} < Z_{2est} + 1.96*\sigma(Z_2)$$

Final calculations give the following result:

$$9.0\% < Z_{2t} < 44.6\% \text{ or } Z_{2t} = 26.8\% \pm 17.8\%$$

2.4 Ratio for Combined Influence of Trust Concerns and Benefits of Visibility Estimation (see section 7.1.3.1)

Since these calculations are analogous to the calculations from the previous section, only the formulas without comments will be presented.

The ratio confidence interval which is sought now has the following form:

$$Z_3 = R/S$$

$R_{est} = 12$
$S_{est} = 40$

$p_R = 12/159$
$p_S = 40/159$

$\partial Z_3/\partial R = 1/40 = 0.0250$
$\partial Z_3/\partial S = - 12/(40)^2 = - 0.0075$

$\sigma^2(R) = n\, p_R(1- p_R) = 159*12/159*(1-12/159) = 11.0943$

$\sigma^2(S) = n\, p_S(1- p_S) = 159*40/159*(1-40/159) = 29.9371$

$cov(R,S) = - np_R\, p_S = - 159*12/159*40/159 = - 3.0189$

$\sigma^2(Z_3) = (\partial Z_3/\partial R)^2 \sigma^2(R) + (\partial Z_3/\partial S)^2 \sigma^2(S) + 2(\partial Z_3/\partial R) (\partial Z_3/\partial S) cov(R,S)$

$\sigma^2(Z_3) = 0.00975$

$\sigma(Z_3) = 0.0987$

$Z_{3est} = R_{est}/S_{est} = 12/40 = 0.300$

$Z_{3est} - 1.96*\sigma(Z_3) < Z_{3t} < Z_{3est} + 1.96*\sigma(Z_3)$

Final calculations give the following result:

$10.7\% < Z_{3t} < 49.3\%$ or $Z_{3t} = 30.0\% \pm 19.3\%$

3. Testing for the Differences in Population Proportions of Aggregated 'Yes' Answers to the Same Question from Part 2, for Different Groups of Respondents

In order to determine if, for example, the proportion of Visibility Junkies' aggregated 'Yes' answers to a question from Part 2 is larger than proportion of Trusting Good Citizens' aggregated 'Yes' answers to the same question, one needs to verify a hypothesis about equality of population proportions for two populations which do not have common elements. Even though it is assumed here that the random variables are independent, the exact solution of this problem is quite complicated, so an approximation is used for the test statistic.

Because the samples in question have less than 100 elements (Visibility Junkies, Trusting Good Citizens, and Naysayers), one has to use the following test statistic U1:

$$U1 = \{2*\arcsin [\mathrm{sqrt}(m_1/n_1)] - 2*\arcsin [\mathrm{sqrt}(m_2/n_2)]\} * \mathrm{sqrt} [n_1 n_2/(n_1+n_2)]$$

where: m_1, m_2 – number of elements with the tested characteristic in each selected sample
n_1, n_2 – sample sizes.

If the null hypothesis that the population proportions are equal is true, this statistic has a standard Gaussian distribution.

If the alternative hypothesis is that the proportions are different, at a 95% confidence level, one can reject the null hypothesis when:

$U1 > 1.96$ or $U1 < - 1.96$

If the alternative hypothesis is that the proportion for one population is bigger than the proportion for the second population (one-tailed test), at a 95% confidence level, one can reject the null hypothesis when:

$U1 > 1.64$

And if the alternative hypothesis is that the proportion for one population is smaller than the proportion for the second population (one-tailed test), at a 95% confidence level, one can reject the null hypothesis when:

$U1 < - 1.64$

Values of the test statistic U1 in tables 7.3, 7.5, 7.7 were calculated with the formula presented above, and one-tailed tests were performed to confirm the differences between the various proportions (percentages).

4. Testing for the Differences in Population Proportions of Aggregated 'Yes' Answers to Different Questions from Part 2, for All Valid Responses

In order to determine if, for example, the proportion of aggregated 'Yes' answers to question #1 from Part 2 for all valid responses is larger than the proportion of aggregated 'Yes' answers to question #2 for all valid responses, one can use a variation of the type of statistic described in section 3 of this appendix, again assuming that the random variables are independent. In particular, because the number of all valid responses is larger than 100, the following test statistic U2 needs to be applied:

$U2 = (\theta_1 - \theta_2) / \mathrm{sqrt}(\theta(1-\theta)/n)$

$\theta_1 = m_1/n_1$

$\theta_2 = m_2/n_2$

$\theta = (m_1 + m_2)/(n_1 + n_2)$

$n = m_2 * n_2/(n_1 + n_2)$

where: m_1, m_2 – number of elements with the tested characteristic in each selected sample

n_1, n_2 – sample sizes.

If the null hypothesis that the population proportions are equal is true, this statistic has a standard Gaussian distribution.

If the alternative hypothesis is that the proportions are different, at a 95% confidence level, one can reject the null hypothesis when:

$U2 > 1.96$ or $U2 < -1.96$

If the alternative hypothesis is that the proportion for one population is bigger than the proportion for the second population (one-tailed test), at a 95% confidence level, one can reject the null hypothesis when:
$U2 > 1.64$

And if the alternative hypothesis is that the proportion for one population is smaller than the proportion for the second population (one-tailed test), at a 95% confidence level, one can reject the null hypothesis when:
$U2 < -1.64$

Values of the test statistic U2 in tables 7.6, 7.8 were calculated with the formula presented above, and one-tailed tests were performed to confirm the differences between various proportions (percentages).

5. Confidence Intervals at a 95% Confidence Level for Percentages of Each of the Five Answers to Questions 1-12 from Part 2 of the Survey, when All Valid Responses Are Considered

In this section, confidence intervals for the percentages of each of the five answers to questions 1-12 from Part 2 of the survey are provided. The formula developed in the appendix section 1 is used in the calculations. The intervals are included in the appendix to avoid cluttering the tables in the main text of the thesis, since these values are not essential for the discussions presented there. Note the asymmetry of the confidence interval around small values. As mentioned in section 1, applying the commonly used formula would lead, in some cases, to border values smaller than zero, which is logically impossible.

Table D.1 – Confidence Intervals at a 95% Confidence Level for Percentages of Each of the Five Answers to Questions 1-12 from Part 2 of the Survey

	Question 1		Question 2		Question 3	
	Waste		Exces.profit		Cheat	
Answer	Expected value	Confidence interval	Expected value	Confidence interval	Expected value	Confidence interval
%1	1.9	0.6-5.5%	0.0	0-2.4%	7.3	4.1-12.6%
%2	29.2	22.6-36.8%	30.7	23.9-38.4%	41.7	34.1-49.7%
%3	42.9	35.3-50.8%	38.6	31.3-46.5%	39.1	31.7-47.1%
%4	15.6	10.7-22.2%	22.9	17-30.2%	8.6	5.1-14.2%
%5	10.4	6.5-16.2%	7.8	4.5-13.2%	3.3	1.4-7.5%

	Question 4		Question 5		Question 6	
	Brag		Influence		Technology	
Answer	Expected value	Confidence interval	Expected value	Confidence interval	Expected value	Confidence interval
%1	59.5	51.6-67.0%	41.6	34.1-49.5%	48.0	40.2-55.9%
%2	14.4	9.7-20.8%	21.4	15.6-28.6%	14.5	9.8-21.0%
%3	16.3	11.3-23.0%	21.4	15.6-28.6%	18.4	13.0-25.3%
%4	7.2	4.1-12.4%	13.6	9.1-19.9%	15.8	10.9-22.4%
%5	2.6	1.0-6.5%	1.9	0.6-5.5%	3.3	1.4-7.5%

	Question 7		Question 8		Question 9	
	Little sun		Weak roof		Damage	
Answer	Expected value	Confidence interval	Expected value	Confidence interval	Expected value	Confidence interval
%1	50.3	42,4-58.2%	38.8	31.4-46.7%	21.1	15.4-28.3%
%2	11.9	7.7-18.0%	15.8	10.9-22.4%	18.4	13.0-25.3%
%3	21.2	15.4-28.4%	17.1	11.9-23.9%	15.1	10.3-21.6%
%4	11.9	7.7-18.0%	17.8	12.5-24.7%	23.7	17.6-31.1%
%5	4.6	2.2-9.2%	10.5	6.6-16.4%	21.7	15.9-28.9%

	Question 10		Question 11		Question 12	
	Leak		Appearance		Neighbour	
Answer	Expected value	Confidence interval	Expected value	Confidence interval	Expected value	Confidence interval
%1	13.2	8.7-19.5%	32.9	25.9-40.7%	58.9	50.9-66.4%
%2	22.4	16.5-29.7%	17.1	11.9-23.9%	15.2	10.3-21.8%
%3	14.5	9.8-21.0%	17.1	11.9-23.9%	9.9	6.1-15.7%
%4	22.4	16.5-29.7%	20.4	14.8-27.5%	11.3	7.2-17.3%
%5	27.6	21.1-35.2%	12.5	8.2-18.7%	4.6	2.2-9.2%

Appendix E – Detailed Examples

Example 1 – Cost of Solar Electricity

For example, a 2 kW solar panel system installed in Toronto, Ontario at the end of 2010, when this research was entering the final stages of the experiment design, would have cost about $19,000, and would have generated 2220 kWh per year. If the panels worked for 25 years, the straight calculation is as follows: $19,000/(25*2220) and reveals the cost per kWh to be about 34 cents. In the summer of 2012, when the price of a 2 kW system was $14,000, this straight cost calculation was: $14,000/(25*2220) and would have equalled about 25 cents per kWh. Taking into account forgone interest income on the invested amount, diminishing efficiency of the panels, and maintenance and repair costs over a 25 year period, the cost per kWh would be much higher. (All solar system installation costs come from the author's personal communications with southern Ontario solar system installers. The amount of the solar electricity generated was calculated using RETScreen software.)

While it is difficult to calculate the effective grid-supplied electricity rate per kWh in Ontario due to fixed charges and the Time of Use tariff system, for illustration purposes one can divide the total payable for electricity from a sample residential bill in Oakville (received in November 2012 by the author) by a number of kWh used, and get a rate of 17 cent per kWh, taxes included.

Example 2 - Economics of 4kW System Installation

In the author's model, the organizer would go to the money markets and borrow the funds to finance the purchase and original installation of the solar panel systems. It then would receive FIT program payments for each installed solar panel system, and the $25 monthly ($300 yearly) payments from the consumer/homeowner. From those payments, it would repay the loan, insure the panels, maintain and repair them (including the inverter replacement), and pay for re-installation of the panels in the new location after a consumer terminates the contract. From this fund, the organizer would also cover all administrative costs, losses that arise when panels are not installed due to problems with finding a willing homeowner, and any other losses.

Based on the author's private communication with installers in late 2010 (the survey was conducted in summer of 2011), a 4 kW solar panel system with the installation costs included and all the rebates deducted, cost about $33,000. Such a system generates, on average, 4440 kWh of electricity in the first year of its operation. Therefore, it brings about $3560 in FIT payments in the first year ($0.802 per kWh – based on original FIT tariff, valid at the time). There is an assumption made here that the organizer would be able to take over the FIT program payments, as well as all the governmental rebates for the systems installed on the private properties where the installations would be performed.

The FIT program contract lasts for 20 years, but solar panels lose 1% of their efficiency per year. Taking this into consideration, it was calculated that, averaged over the 20-year period, $33 per year would be lost in FIT payments.

The inverter that is necessary to make solar panel generated electricity usable in the grid has a warranty of 10 years. Assuming that it would have to be replaced once during the 20-year period, and that it costs $3000 (end of 2010 price), it would add $150 per year to the costs of operation.

After consulting insurance brokers (end of 2010), it was assumed that it would cost about $70 to insure a 4 kW solar panel system, therefore this number needs to be added to the operating costs.

In order to have no surprises with interest rates, the model assumes that the organizer would borrow money for a 20-year term, at the rate offered to a 20-year term mortgage by Royal Bank of Canada, which at the end of 2010 was about 8%. The payments on the $33,000 loan at 8% amortized over the 20 year period are $3312 per year.

Doing the math, one arrives at: $3560(FIT first year) + $300(participant payments) - $3312(loan payment) - $33(average efficiency loss) - $150(inverter portion) - $70(insurance) = $295 surplus per year.

From that additional $295 per year per system, the organizer should be able to cover all additional costs. It could also recoup any losses by selling the panels after the 20 year period, as they still should have a residual value.

Appendix F – Sensitivity Study

In chapter 7, there was an issue encountered in which ordinal, five value answers to questions 1 to 12 of the survey had to be converted into 'Yes/No' answers. The choice of how to divide a five value answer to a question into a 'Yes/No' answer is a very arbitrary one (see discussion in section 7.3.2). In order to investigate how sensitive the choice made during the analysis of the results of this study was to the way of division, a different division of answers was performed. For all questions 1 to 12, answers 1 and 2 were aggregated to mean 'No', and answers 4 and 5 were aggregated to mean 'Yes'. Answers 3 were removed from the analysis.

This appendix contains tables showing the new division, and an analysis of the picture emerging from this different perspective of the results.

Table F.1 – Percentages for Aggregated Yes/No Answers, when 1, 2 Are Aggregated as 'No', and 4, 5 Are Aggregated as 'Yes', for Trust Concerns Questions

Statistics	Question 1	Question 2	Question 3
	Waste	Exces.profit	Cheat
Trusting Good Citizens			
Valid answers	40	40	40
%No	80.0	65.0	96.3
%Yes	**20.0**	**35.0**	**3.7**
Visibility Junkies			
Valid answers	11	11	11
%No	100.0	16.6	33.3
%Yes	**0.0**	**83.4**	**66.7**
Naysayers			
Valid answers	95	94	92
%No	43.5	45.3	79.3
%Yes	**56.5**	**54.7**	**20.7**
U test results			
TGC vs VJ	**2.72**	**-3.05**	**-4.48**
TGS vs NS	**-4.09**	**-2.12**	**-2.94**

In the above form of Yes/No aggregation (table F.1), with the exception of question 1, in which Trusting Good Citizens show more trust concerns that Visibility Junkies, the results seem to follow the same pattern (but even stronger) as with the Yes/No aggregation used in chapter 7. In general, Trusting Good Citizens again appear to be the most trusting group of respondents.

Table F.2 – Percentages for Aggregated Yes/No Answers, when 1, 2 Are Aggregated as 'No', and 4, 5 Are Aggregated as 'Yes', for Benefits of Visibility Questions

Statistics	Question 4	Question 5	Question 6
	Brag	Influence	Technology
Visibility Junkies			
Valid answers	10	10	10
%No	71.4	57.1	83.3
%Yes	**28.6**	**42.9**	**16.7**
Trusting Good Citizens			
Valid answers	40	39	39
%No	84.4	58.6	56.6
%Yes	**15.6**	**41.4**	**43.4**
Naysayers			
Valid answers	96	96	96
%No	91.5	89.9	84.2
%Yes	**8.5**	**10.1**	**15.8**
U test results			
VJ vs TGC	0.89	0.08	**-1.69**
VJ vs NS	1.62	**2.34**	0.07

In the above form of Yes/No aggregation (table F.2), the results are clearly following the same pattern as the results from the Yes/No aggregation used in chapter 7.

Table F.3 – Percentages for Aggregated Yes/No Answers, when 1, 2 Are Aggregated as ‘No’, and 4, 5 Are Aggregated as ‘Yes’, for the Trust Concerns and Benefits of Visibility Questions – All Valid Responses

	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6
	Waste	**Exces.profit**	**Cheat**	**Brag**	**Influence**	**Technology**
Valid answers	154	153	151	153	153	152
Aggregated answers: No-1,2 Yes-4,5						
%No	54.5	50.0	80.5	88.3	80.2	76.6
%Yes	**45.5**	**50.0**	**19.5**	**11.7**	**19.8**	**23.4**
U-statistics between trust questions				U-statistics between visibility questions		
Q1 > Q2:	-0.78			Q4 > Q5:	**-1.93**	
Q1 > Q3:	**4.84**			Q4 > Q6:	**-2.69**	
Q2 > Q3:	**5.57**			Q5 > Q6:	-0.78	
U-statistics between trust and visibility questions						
	Q1 > Q4:	**6.55**	Q2 > Q4:	**7.25**	Q3 > Q4:	**1.88**
	Q1 > Q5:	**4.82**	Q2 > Q5:	**5.56**	Q3 > Q5:	-0.04
	Q1 > Q6:	**4.07**	Q2 > Q6:	**4.82**	Q3 > Q6:	-0.82

In the above form of Yes/No aggregation (table F.3), the results are following the same pattern as the results from the Yes/No aggregation used in chapter 7, with the notable exception of answers to question 3 (cheating). In the Yes/No aggregation used in chapter 7, the percentage of ‘Yes’ answers to question 3 was also the lowest from the group of questions about trust concerns, but it was higher from all percentages of ‘Yes’ answers to questions about benefits of visibility. This is not the case with the different division.

Table F.4 – Percentages for Aggregated Yes/No Answers, when 1, 2 Are Aggregated as 'No', and 4, 5 Are Aggregated as 'Yes', to Questions about Panel Installation Concerns – 'My Roof'/'My Roof Not' Respondents

Statistics	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
	Little sun	Weak roof	Damage	Leak	Appearance	Neighbour
	My roof					
Valid answers	29	29	29	29	29	29
	My roof not					
Valid answers	20	20	20	20	20	20
Aggregated answers: No-1,2 Yes-4,5						
	My roof					
%No	82.6	69.3	60.0	53.7	73.1	84.2
%Yes	**17.4**	**30.7**	**40.0**	**46.3**	**26.9**	**15.8**
	My roof not					
%No	62.5	72.2	31.3	46.7	40.0	75.0
%Yes	**37.5**	**27.8**	**68.7**	**53.3**	**60.0**	**25.0**
	U1 statistic values					
My not > My	1.57	-0.22	**2.01**	0.49	**2.35**	0.79

In the above form of Yes/No aggregation (table F.4), the results are clearly following the same pattern as the results from the Yes/No aggregation used in chapter 7.

Table F.5 – Percentages for Aggregated Yes/No Answers, when 1, 2 Are Aggregated as 'No', and 4, 5 Are Aggregated as 'Yes', to Questions about Panel Installation Concerns – All Valid Responses

	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
	Little sun	Weak roof	Damage	Leak	Appearance	Neighbour
Valid answers	151	152	152	152	152	151
Aggregated answers: No-1,2 Yes-4,5						
%No	78.9	65.9	46.5	41.6	60.3	82.2
%Yes	**20.9**	**34.1**	**53.5**	**58.5**	**39.7**	**17.6**
U-statistics for differences between all questions						
Q7 > Q8:	**-2.57**	Q8 > Q9:	**-3.40**	Q9 > Q10:	-0.88	
Q7 > Q9:	**-5.86**	Q8 > Q10:	**-4.26**	Q9 > Q11:	**2.41**	
Q7 > Q10:	**-6.68**	Q8 > Q11:	-1.00	Q9 > Q12:	**6.51**	
Q7 > Q11:	**-3.55**	Q8 > Q12:	**3.28**	Q10 > Q11:	**3.28**	
Q7 > Q12:	0.72			Q10 > Q12:	**7.32**	
				Q11 > Q12:	**4.24**	

In the above form of Yes/No aggregation (table F.5), the results are clearly following the same pattern as the results from the Yes/No aggregation used in chapter 7.