The Social Acceptance of School-based Solar Photovoltaic Projects: An Ontario, Canada Case Study

Project Report to Stakeholders

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Executive Summary

The installation of solar photovoltaic (solar PV) technology on elementary and secondary schools has been undertaken around the world in an attempt to tie together positive environmental action, innovative environmental education, and potential economic gains. In Ontario, the advent of the Renewable Energy Standard Offer Program and the increased focus on environmental education by the Ontario Ministry of Education has resulted in preliminary interest from some Ontario school boards in installing solar PV technology on schools. However, simply installing the technology on school roof-tops does not guarantee that the potential benefits of a school-based solar PV project will be realized. Drawing from the literatures describing the social acceptance of innovation and technology, the social acceptance of renewable energy innovation and technology, and the social acceptance of educational innovation and technology in schools, this research attempts to identify non-technical factors that may impede school-based solar PV project development, and ultimately, attempts to identify factors that help maximize potential benefits.

The research was conducted in two distinct phases, with the results from Phase 1 informing the focus and design of Phase 2. Phase 1 consisted of nine key-informant interviews with individuals directly involved in school-based solar PV projects in Canada and the United States, and Phase 2 consisted of a case study in the Halton District School Board (HDSB) and the Halton Catholic District School Board (HCDSB) (Ontario, Canada). Both quantitative and qualitative data were collected in Phase 2 through 30 stakeholder interviews and 50 stakeholder surveys.

Respondents in the HDSB and HCDSB generally have a positive perception of solar PV technology, but are concerned to some extent about the cost and economic viability of implementing this kind of project. Five funding models for school-based solar PV projects were evaluated by respondents to determine the effect of project funding models on overall project social acceptance. The results show that the project funding model does affect social acceptance, with 78.1% of respondents reporting that at least one of the

five models would cause their support for the project to either increase or decrease. Respondents indicated a strong preference for the government/utility model, while the corporate funding model was shown to be the most controversial.

This report recommends that a broad-based, inclusive, stakeholder-oriented approach to project development could improve trust and communication between project stakeholders, and thus improve the social acceptance for any of the five funding models. Additionally, with any funding model, teacher and administrative support and social acceptance is particularly important to help maximize the educational component of the project. Finally, educational materials should be developed in conjunction with any school-based solar PV project to improve the educational impact of the project.

1 Introduction

Electricity is essential in the day-to-day lives of all Canadians. However, electricity production has significant environmental impacts. For example, electricity production by coal is a significant contributor to greenhouse and smog-causing gases in Canada. Both nuclear and fossil fuel power plants consume a significant amount of water resources, and produce toxic and hazardous waste. All centralized generating facilities require a significant amount of land for the location of the facilities. Public environmental awareness is growing, as evidenced by opinion polls in 2007 indicating that the environment has overtaken both health care and education as Canadians' number one issue of concern (Laghi, 2007). Coal powered generation is a particularly 'dirty' way to generate electricity, and in response to the demand from Ontarians for cleaner electricity sources, the provincial government has committed to phasing out coal entirely by 2014. However, demand for electricity in Ontario continues to grow (fuelled by both population growth and a growing economy); therefore, the Ontario government must find a way to reduce the environmental impact of the electricity industry, while at the same time meeting electricity demand. Additionally, the existing nuclear facilities in Ontario are up for retirement or refurbishment, so there will be additional strain on the electricity system if alternate generating capacity is not found.

As part of a broader strategy to address the challenges of electricity production and consumption, the government of Ontario has identified that "renewable energy is a key component of the Ontario government's plan as it builds a cleaner sustainable energy future for Ontario" (Ontario Ministry of Energy, 2007a). In 2004, the Ontario Ministry of Energy set a target for the province to produce five per cent of its electricity from renewable sources by 2007 and ten per cent by 2010. According to their website, the government is currently on track to achieve these targets (Ontario Ministry of Energy, 2007b). The Ontario government has established a variety of policies designed to encourage renewable energy generation. For the purposes of this thesis, the most salient policy initiative is the Renewable Energy Standard Offer Program (ReSOP).

The ReSOP was announced in March of 2006, and applications to participate have been accepted since November 2006. This program is intended to specifically stimulate the growth of small-to-medium size renewable energy projects. According to the final rules available from the Ontario

Power Authority (OPA), in order to qualify for this program, project capacity must be 10 MW or less, and generate electricity from a qualifying renewable source (Ontario Power Authority, 2006). The eligible renewable technologies are as follows: wind, solar photovoltaic (solar PV), solar thermal electric, renewable biomass, biogas, biofuel, landfill gas and waterpower (Ontario Power Authority, 2006). Under this policy, owners of qualifying projects will sign a 20-year contract with the OPA which will guarantee that the owner will be able to sell the electricity generated at a fixed rate. The current contract rate is 11 cents per kilowatt-hour for all renewable technologies except for solar PV, which will be paid 42 cents per kilowatt-hour. The price paid will be partially indexed for inflation every year, again with the exception of solar PV technology which will receive 42 cents per kilowatt-hour for the entire term of the contract. Solar PV technology is also exempt from the 'on-peak' production bonus which is available to other non-intermittent renewable energy technologies. Policies similar to the ReSOP (i.e., feed-in tariffs) have been used to stimulate the growth of the renewable energy sector in Europe, and Ontario is the first jurisdiction in North America to implement this type of policy (Toke, 2007). As of May 12, 2008, the ReSOP program has been temporarily suspended pending a review of the program rules. The revisions are expected to be completed by the end of summer 2008, and are intended to make the program more efficient, equitable and accessible to all proponents (Ontario Power Authority, 2008).

One application of small-scale renewable energy that is growing in popularity in Canada (and around the world) is the installation of solar PV technology on elementary and secondary schools. "Solar Schools", as these installations are often called, are designed to generate electricity from a renewable source, but are also intended to be used in conjunction with school curriculum as a hands-on educational tool. There are many potential benefits to installing renewable energy technologies on schools. For one, data from the technology can be incorporated into the curriculum, or can be used as a focus for school projects. Solar PV technology can also be connected directly to the electricity grid, and thus could be a source of renewable electricity, thus helping to achieve provincial renewable energy targets. Further, production of electricity from solar PV technology has been shown to correspond reasonably well with peak electricity demand in Ontario, and therefore could be useful in reducing the province's dependence on coal-powered generation during times of peak demand (Rowlands, 2005). As well, locating solar PV technology on schools is an excellent way to raise energy awareness in a community. Schools are community gathering places, and locating a renewable energy project in such a centralized location can improve the profile of renewable energy and conservation in general.

Some jurisdictions in the United States and Australia have been relatively aggressive about installing solar PV technology on schools, and both countries have organizations (both private and public) dedicated to the development of new Solar Schools (e.g., The Foundation for Environmental Education in the United States, and solarschools.net in Australia). However, in Canada, solar PV development (in general, let alone on elementary and secondary schools) has lagged in comparison to our major trading partners. According to the latest statistics available from the International Energy Agency, in 2005, Canada's gross electricity generation from solar photovoltaic technology was 17 GWh as compared to 1282 GWh in Germany (International Energy Agency, 2008a; International Energy Agency, 2008b). However, the announcement of the ReSOP in Ontario caused a huge jump in demand for solar PV systems, and the Canadian Solar Industries Association (CanSIA) estimates that due to this policy, sales of grid connected solar PV systems "soared in Canada by over 400% in the first half of 2006" (Canadian Solar Industries Association, 2006).

The ReSOP is a step forwards for the development of the solar industry in Canada. This policy has helped to reduce some of the financial barriers that limited solar PV projects in the past. Public interest in renewable energy generation is high, and there is significant growth in the number of installed solar PV projects.

Concurrent with, and largely independent of, the development of the ReSOP, in March 2007, the Ontario Ministry of Education Curriculum Council appointed a working group to evaluate elementary and secondary curricula in Ontario. The first topic selected for review was environmental education. The working group's recommendations address educational policy, leadership and accountability, curriculum, and teaching and resources (Ontario Ministry of Education Working Group on Environmental Education, 2007). The working group calls for a more systematic, integrated approach to environmental education in Ontario, and argues that environmental education should be the new "basic" for education in the 21st century (Ontario Ministry of Education Working Group on Environmental Education, 2007, p. 17). The Ontario government has indicated that it plans to implement all of the recommendations put forward by the working group (Ontario Ministry of Education, 2007). Resources are currently being developed to assist teachers in incorporating environmental education into existing curricula, and some are already available on the Ministry of Education's website (Ontario Ministry of Education Curriculum Council, 2008). It appears that environmental education will have an increased profile in the Ontario education system in the coming years.

Within this provincial policy context, there has been interest from several school boards in Ontario in installing solar PV projects on elementary and secondary schools. The ReSOP helps to reduce the financial barrier for solar PV projects, and the growing focus on environmental education at the Ontario Ministry of Education has provided the impetus for schools to explore creative ways to deliver environmentally-focused curriculum. The enthusiasm for Solar School projects in Ontario is high, both inside and outside the school system. However, there is relatively little local experience or 'know-how' as to the best way to plan and develop Solar School projects, and little knowledge as to the barriers and challenges associated with project development. Indeed, even amongst countries with more advanced Solar School programs and organizations, there is little evaluation or criticism of how to best plan, develop and implement Solar School projects, particularly to maximize the potential benefits of the projects. Therefore, this thesis is designed to explore these areas, and ultimately, to help to fill this gap in understanding.

2 Literature Review

This research draws from the literatures describing the social acceptance of innovation and technology, the social acceptance of renewable energy innovation and technology, and the social acceptance of educational innovation and technology in schools, and attempts to identify non-technical factors that may impede school-based solar PV project development, and ultimately, attempts to identify factors that help maximize potential benefits.

The literatures used for this research outline how the issue of social acceptance has been studied in the context of technology and innovation, renewable energy innovation, and educational technology. Social acceptance as defined in these contexts can be understood from a societal scale, a community scale and an individual scale. At the societal scale, renewable energy technology has typically been evaluated positively in public opinion polls. However, as has been demonstrated in the wind energy literature, positive public opinion does not always translate into positive perceptions of specific projects. Therefore, it should not be assumed that positive public perceptions of a specific technology in general will translate into high levels of either community or individual social acceptance. Turning to solar PV technology specifically, this technology has been most extensively studied from the perspective of individual acceptance. This scale of social acceptance draws heavily from the technology and innovation literature, and examines characteristics of the technology itself to determine why (or why not) a technology is adopted by individuals. This focus on individual social acceptance is because solar PV technology is typically implemented on private households. In this case, the individual home-owner's decision to adopt (or not adopt) the technology is determined generally by the home-owner's evaluation of the technology itself, and is also determined by the individual home-owner's personal characteristics. However, while this solar PV technology literature is relevant, it does not explore social acceptance for a community-scale solar PV project. Therefore, it is necessary to turn again to the wind energy literature, which in recent years has begun to extensively study the social acceptance of wind energy technology at the community scale.

Key conclusions from this literature are that perceptions of the technology itself are important, but how a project is implemented can have a greater impact on the social acceptance of the project. Key community stakeholders should be involved early in the development process, and ideally should be involved directly in the decision-making process. Good stakeholder communication is key, and trust between the project proponents and the community also helps to increase community social acceptance. Finally, drawing on the educational technology literature, in order to facilitate the educational use of technology in schools, the social acceptance of key stakeholders such as teachers and school administrators is critical.

Based on the key conclusions of the literature review, social acceptance at a societal, community and individual level may be important to the overall social acceptance of a school-based solar PV project. Characteristics of both the technology itself, as well as how (and by whom) the project is implemented may be important. Key stakeholders from within the school, and also from the wider community are likely to be important to include to both minimize the factors that may impede the development of a project, and also to maximize the potential benefits of the project.

In order to evaluate if *how and by whom* a project is implemented may affect the social acceptance of the projects, five funding models representing the range of models used to implement school-based solar PV projects worldwide were identified. Schools do not generally have the funds necessary to purchase solar PV technology outright, and therefore have resorted to creative funding models to finance school-based solar PV projects. However, the origin of the funding for a project determines, to some extent, what actors are involved in the planning and development of the project, and what role stakeholders can play in the process of implementing a project. The five funding models were used as a way to identify what aspects of *how and by whom* the school-based solar PV project was implemented would most greatly affect stakeholder social acceptance. The models vary in project proponent, project owner and operator, source of funding, and school and stakeholder involvement and responsibility in planning and implementing the project.

The five funding models identified were: renting school roof-space; corporate sponsorship; community fundraising; community co-operatives; and government/utility programs, and were identified through the literature review and through an online review of existing school-based solar PV projects, and were confirmed through key informant interviews early in the research project. Each of the five funding models can have a great deal of variation in actual real-life implementation; however, distinction among the five models allows them to be evaluated and will allow for the identification of specific characteristics of each model that may have an effect on social acceptance. In particular, the models involving a corporate entity may be less acceptable due to resistance to corporate involvement in schools (Bell McKenzie & Joseph Scheurich, 2004). Based on the wind energy literature, models that allow for greater stakeholder involvement are likely to result in greater social acceptance at the community scale. Funding models that feature proponents perceived to be trustworthy by key stakeholders and the wider community are also likely to be more socially acceptable.

2.1 Describing the Funding Models

Through the review of existing school-bases solar PV projects, and through the key informant interview responses, it because clear that there were five distinct sources of project funding. Typically, projects would use a combination of two or more of the five funding models to fund a single project. However, for comparative purposes, the models were described as distinct choices in order to isolate aspects of each of the five funding models that potentially affect the social acceptance of the school-based solar PV project as a whole

The five distinct funding models were: renting school roof-space, corporate sponsorship, community fundraising, community co-operatives, and government/utility programs. These five models represent the range of ways funding is found for school-based solar PV projects, and as mentioned above, combinations of the models are possible to fund individual projects.

The “renting school roof-space” model involves the renting or leasing school roof-space to a developer, who would develop the solar PV project on a for-profit basis. Developers are typically private companies, but utilities can also develop projects under this model. This funding arrangement is relatively uncommon for school projects, but is gaining recognition as a viable way to fund and develop solar PV developments. For example, in March 2008, ProLogis, the world’s largest owner, manager and developer of distribution facilities entered into an agreement to lease roof space to Southern California Edison (SCE), the largest electric utility in California, for the purpose of installing 250 MW of solar PV technology (PR Newswire, 2008).

With the "corporate sponsorship" model, project funding is obtained from a corporate partner. This corporate partner can either be a local small business or a large corporation. The business donates funding for the Solar School project, and in return, the company receives recognition for participating in the project. For example, Cochrane High School in Cochrane, Alberta raised enough money from corporate sponsors to fund a two-phase renewable energy project, including both solar PV and wind technology. The school has raised approximately $80,000 since 2004, and corporate sponsors have been recognized on the school's project website (Cochrane High School, 2006). Additionally, Cochrane High School and the corporate sponsors received a Calgary Educational Partnership Foundation Mayor's Excellence Award in 2006, recognizing successful partnerships between the Calgary-area business and educational communities (Morton, 2006).

The "community fundraising" model involves soliciting private donations from individuals in the community. There are a variety of ways to raise the funds, including door-to-door solicitation, community bake sales, or sponsored events (e.g., a sponsored run). Schools often must raise funds for extra programs, and therefore individual schools have come up with many creative ways to fundraise. Most school boards have foundations specifically charged with raising money for extra-curricular programs and projects. For example, Westbrook School in southern Alberta raised money for a school-based solar project funded primarily from community fundraising. The school has a "Friends of Westbrook" fundraising organization, and a portion of the proceeds of any fundraising activity is earmarked for environmental projects at the school (Friends of Westbrook, 2008).

The "community co-operative" model of project fundraising is similar to the community fundraising model in that the funds for the project are generally generated from the local community. However, this model is distinct in that the community actually owns the solar PV development. The Canadian Cooperative Association defines a cooperative as an "enterprise or organization owned by and operated for the benefit of those using its services – the members" (Canadian Co-operative Association, 2006). All cooperatives worldwide are guided by the following seven principles: voluntary and open membership; democratic member control;

member economic participation; autonomy and independence; education, training, and information; co-operation among co-operatives; and concern for community (Canadian Co-operative Association, 2006). This model has been particularly successful in Europe in encouraging renewable energy development. For example, 80 percent of Denmark's wind turbines were installed by cooperatives, and 10 percent of the overall energy mix is supplied by renewable energy (WindShare, 2006). Generally, membership in an energy cooperative entitles members to purchase energy shares. The investment is returned to co-op members through the profits from the production and sale of electricity. This model has not been used extensively to install solar PV projects or solar school projects. In fact, the Toronto Renewable Energy Co-operative (TREC) released a report in 2007 indicating that solar PV rooftop co-operatives are not profitable in Ontario without a $3500 to $5000/kW reduction in up-front costs, and equivalent subsidy or a substantial increase in the payment for solar PV technology under the ReSOP (Brigham & Gipe, 2007). However, the Power-Up Renewable Energy Co-operative in Ontario spearheaded a solar schools project on the Centre Dufferin District High School in Shelburne, Ontario. The co-operative was the driving entity behind this project; however, government grants and subsidies were used to fund the project. This funding model has potential for future development, but has not often been used for the development of school-based solar PV projects.

The "government/utility" model can have a great deal of variation in the types of programs and incentives offered. However, this is a distinct model for Solar Schools development because many of the existing school-based solar PV projects have been spearheaded and administered through a government or utility programs. Generally, the government and/or utility provide the funding and expertise for the development of the project. The schools may have to apply to participate in the program, and may need to demonstrate that they meet certain criteria to participate. For example, the government of Western Australia contributes up to $13,000 towards school-based solar PV projects on Western Australia State Government schools. Each individual school is required to raise a minimum of $1000 towards the project, and must meet the program's key eligibility requirements in order to participate (Government of Western Australia, no date).

3 Case Study Site

The Halton District School Board (HDSB) and the Halton Catholic District School Board (HCDSB) were chosen as the study site for this research. These two school boards include the municipalities of Burlington, Halton Hills, Milton and Oakville in Ontario, Canada. Both boards have the same physical boundaries, but the HDSB administers the public school system and the HCDSB administers the separate (Catholic) school system. Please see Figure 1 for a map of the study site, which is highlighted in green (site #20).

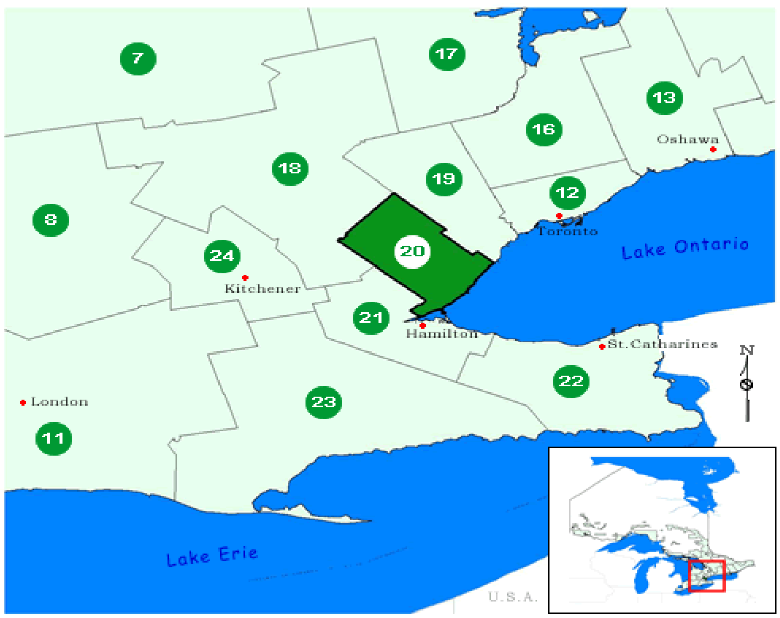

Figure 1 - Map of Halton District School Board and the Halton Catholic District School Board
Source: Ontario Ministry of Education, 2003.

The Halton District School Board and the Halton Catholic Disctrict School Board were selected as the case study site for a variety of reasons. In practical terms, a relationship existed between researchers at the University of Waterloo, Milton Hydro and the Halton District School Boards, which facilitated the researcher's access to schools for data collection. There was a high degree of interest from the HDSB and HCDSB in implementing a school-based solar PV project and these districts were keen to learn how best to implement this kind of project. The district did not yet have any school-based solar PV projects planned or installed, and therefore this represented an opportunity to learn what challenges may impede the development in these school districts, and to potentially mitigate these challenges prior to project implementation. This research has immediate practical implications for the future development of any school-based solar PV project in the two school boards.

Keeping with their interest in progressive, environmental initiatives, Milton Hydro, the Halton District School Board, and the Halton Catholic District School Board expressed an interest in implementing solar PV projects on local schools. This presented a unique opportunity to examine the social acceptance of a proposed solar PV project. The existing connections among the Halton LDCs and the Halton school boards made for a cooperative atmosphere to organize and implement this research project. There was a high degree of stakeholder interest, which facilitated the data collection. As well, there already exists a positive working relationship between Milton Hydro and the Department of Environment and Resource Studies at the University of Waterloo. This research fits into an existing two-year project funded by the Ontario Centre for Energy.

Data for the thesis were collected in two distinct research phases. The data collected in Phase 1 consisted of qualitative data collected in open-ended, semi-structured interviews conducted with individuals in Canada and the United States involved with existing school-based solar PV projects. These data then informed the design of Phase 2, which was a specific case study conducted in the Halton District School Board and the Halton Catholic School Board in Ontario, Canada. The data in Phase 2 were collected through quantitative surveys, complemented by qualitative survey questions and in-person interviews.

Eight schools from both the Halton District School Board and the Halton Catholic District School Board were selected to participate in this research project. The school selected represented the range of schools in the two Halton Boards including: EcoSchools and non-EcoSchools, high schools and elementary schools, and schools from the larger municipalities (Burlington and Oakville) and schools from the smaller municipalities (Milton and Halton Hills).

4 Phase 1 Interview Results

The primary goal of the school-based solar PV projects interviewed for this research was overwhelmingly to educate both students and the wider community. It was identified in the interviews that the solar PV technology could be used in conjunction with the curriculum, but also could be a demonstration project that could help to educate the wider community. Despite this being a major justification for the school-based solar PV projects, it was identified that it was challenging to use the installed solar PV technology effectively as an educational tool. It was a significant challenge to get teachers to use the technology in conjunction with the curriculum. This corresponds to the findings in the literature examining the teacher's acceptance of technology in the classroom. Similarly, some of the interviewees identified that engaging the wider community in the project was often difficult. It was explicitly identified by Interviewee (I03) that once the technology was installed, interest in the project waned and was not used for educational purposes as originally intended.

The individuals who declined to participate in this study provided some unexpected insight into the importance of this thesis project. Seventeen invitations to participate in Phase 1 of the thesis project were sent out. Nine individuals agreed to participate. However, interestingly, three of the eight individuals who declined to participate (all were principals of identified solar schools) declined because they were unaware that there was a solar PV installation on their school. In all three cases, there was documentation to confirm that the installation existed. This indicates that the solar PV projects were paid for and installed, but then basically forgotten about. It was not possible to confirm if the solar PV system was hooked up to the electricity grid, or perhaps was charging a battery. Nevertheless, the installations were not being used for educational purposes (at least to the knowledge of the school principals), and were not effectively raising awareness about environmental or energy issues. Some schools have successfully raised funds and installed a solar PV project on their school only to essentially forget about the installation once the project was complete.

The interviewees who participated in this research identified that the main motivation for the solar school project was to use the technology for educational purposes. However, many are not used effectively for that purpose. In fact, the projects that participated in this research were not specifically planned to maximize the educational benefit of the installation. For example, none of the individual schools that were interviewed for this project had specific plans as to how to use the technology with the curriculum (even after the project had been installed), and none had any educational outreach programs to help educate the wider community. Community and stakeholder education was mentioned by six interviewees as a motivation for pursuing the project, but three identified that placing the solar PV technology in a location that was visible to the community was the extent of the community outreach and education effort.

The fact that the educational aspects of the projects were challenging to implement effectively was recognized by many of the interviewees. Some identified it as an area for improvement for the project. However, others suggested that the early involvement of key stakeholders (identified as the community members, school administration, teachers, and custodial staff) could help to create 'buy-in' and a sense of ownership for the project. This could improve both the likelihood of successfully installing the solar PV technology, and it was acknowledged, could potentially improve the educational impact of the project. In fact, the solar school organizations did recognize that it was very important to couple solar school projects with educational programs specifically designed to take advantage of the unique educational opportunity afforded by having solar PV technology installed on school grounds.

Early and broad-based stakeholder involvement was a theme that was apparent in the interviews with both the individual schools and the solar school organizations. The interviewees identified that this was a significant 'best practice' and that key stakeholders should be involved in the planning and implementation of the project as early as possible. As mentioned above, the interviewees identified that early stakeholder involvement can help to create a sense of ownership for the project, and can help to create momentum when first trying to implement a school-based solar PV project. As well, the involvement of many stakeholders helps to ensure the longevity of the project (i.e., the success of the project does not depend on just one person). However, as reported in the interviews, the early involvement of key stakeholders was viewed as a way to facilitate the installation of the project, not as a strategy to improve the educational impact of the project.

The interviewees were also asked to describe how funding was raised for each project. As described in Section 2.1, there are a variety of possible funding models. However, when probed as to *why* a specific funding model was chosen for the project, the interviewees typically did not have specific reasons as to why one funding model was chosen over another. In fact, many interviewees commented that they had not considered other funding models, and simply raised the money in whatever way would raise the capital needed in the least amount of time. Despite this 'path-of-least-resistance' approach to project funding, fundraising was still identified as a significant barrier to project development.

Inherently, some of the funding models allowed for greater stakeholder participation in the planning and implementation of the project than others. For example, the community fundraising model involves community at a minimum through the solicitation of donations, whereas the government or utility program does not require extensive stakeholder participation to raise the necessary funds. The early involvement of stakeholders was emphasized as a critical way to improve the chance of project success. However, it is very interesting that how the projects were funded was not considered by the interviewees as an aspect of the project that could affect the level of stakeholder involvement.

The discovery of solar PV installations that have been installed and ostensibly forgotten (that is, are not producing electricity or used as an educational tool) demonstrates that simply successfully installing a project on a school roof-top does not guarantee that the solar PV technology will be used for educational purposes, let alone to produce electricity. To achieve the educational goals identified by project organizers, school-based solar PV installations must be used to produce electricity and to educate students and community members long after the excitement of the initial installation has passed. This reinforces the idea that how a school-based solar PV project is funded and implemented, and what role key stakeholders play in the planning, installation and maintenance of the project can drastically affect the success of the project.

5 Phase 2 HDSB and HCDSB Case Study Results

The key stakeholders selected to participate in the study were: school administration (including both the principal and vice principal), teachers, custodial staff, parents and community members. Respondents were asked to fill out a one-page (double-sided) survey. The principal, vice principal, teachers and custodial staff were asked to complete the survey as the first part of an approximately 30-minute interview (subsequently referred to as "stakeholder interviews"). Due to time and resource constraints, this same method could not be undertaken with parents and community members. Therefore, the researcher attended School Council meetings and asked the members of the School Councils to fill out the same one-page (double-sided) survey administered during the interviews. Then, School Council members completed 11 open-ended survey questions, which covered similar themes to the questions asked during the stakeholder interviews. The qualitative data were used to provide context and depth to the quantitative answers presented in this chapter, and will be more extensively used for discussion.

A total of 79 surveys were included for analysis: 30 stakeholder interviews and 49 School Council surveys. Figure 2 identifies the distribution of respondents among the stakeholder groups. The respondents that make up the "School Council Members" include parents and community members. Teachers and administrative staff who were in attendance at the School Council meeting did not complete the stakeholder survey, as this cohort of respondents completed a survey during the stakeholder interviews. The data from the 79 valid respondents will now be presented below.

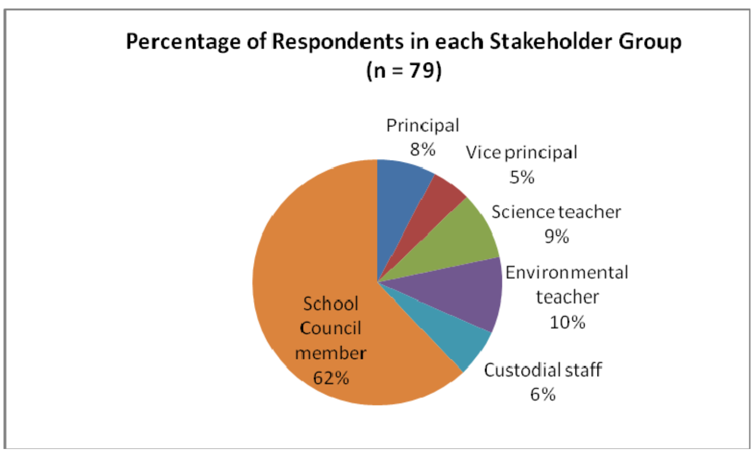

Figure 2 - Percentage of Respondents in each Stakeholder Group (n=79)

Eight schools were selected from across the HDSB and HCDSB to provide a cross-section of the range of the schools in the two districts. Schools were selected to ensure a particular range of schools in the study sample. The study sample included both: EcoSchools and non-EcoSchools; Catholic schools and public schools; high schools and elementary schools; and schools from both large municipalities (population > 100,000) and small municipalities (population < 100,000) in the HDSB and HCDSB. Figure 3 represents the eight schools that participated in the thesis research.

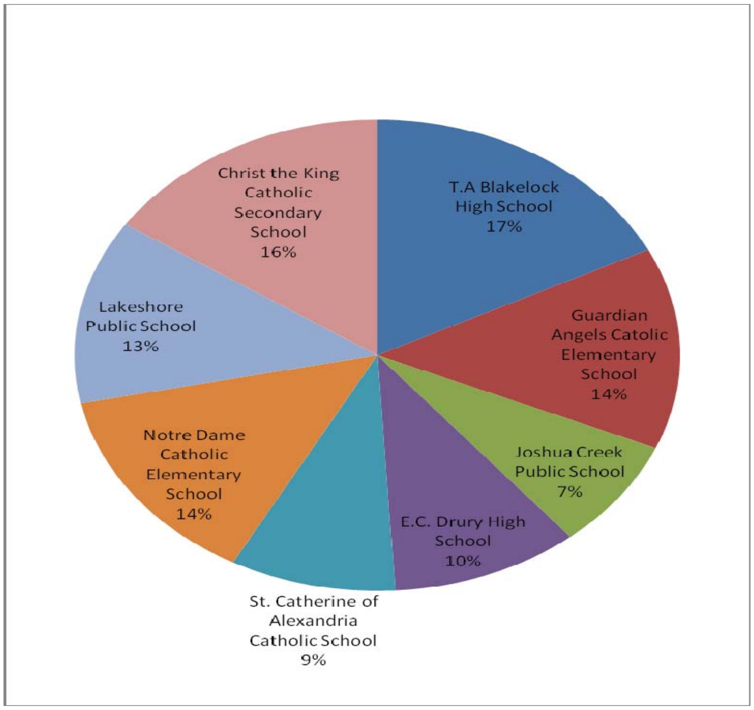

Figure 3 - Percentage of Respondents from each Participant School (n=79)

The respondents within each of the categories identified above were also asked to report demographic data as part of the one-page survey. The demographic data that they were asked to identify were: age; gender; income; highest level of education achieved; whether the respondent has children who attend (or who have attended) school in the HDSB or the HCDSB; distance respondent lives from the school; and length of time living in the area.

	All respondents	Interview respondents	School Council respondents
What decade were you born?	Total valid responses: 75 1940s – 2.6% (2) 1950s – 28.2% (22) 1960s – 48.7% (37) 1970s – 15.4% (13) 1980s – 1.3% (1)	Total valid responses: 28 1940s – 0% (0) 1950s – 28.6% (8) 1960s – 50.0% (14) 1970s – 17.9% (5) 1980s – 3.6% (1)	Total valid responses: 47 1940s – 4.3% (2) 1950s – 29.8% (14) 1960s – 48.9% (23) 1970s – 17.0% (8) 1980s – 0% (0)
Are you female or male?	Total valid responses: 78 Male – 34.6% (27) Female – 65.4% (51)	Total valid responses: 30 Male – 53.3% (16) Female – 46.7 (14)	Total valid responses: 48 Male – 22.9% (11) Female – 77.1% (37)
What is the highest level of education that you have completed?	Total valid responses: 77 High School – 10.3% (8) College/University – 56.4% (44) Post-graduate degree – 32.1% (25)	Total valid responses: 29 High School – 3.4% (1) College/University – 48.3% (14) Post-graduate degree – 48.3% (14)	Total valid responses: 48 High School – 14.6% (7) College/University – 62.5% (30) Post-graduate degree – 22.9% (11)
What was your household's income last year?	Total valid responses: 67 Less than $40K – 3.8% (3) $40K - $60K – 5.1% (4) $60K - $80K – 11.5% (9) $80K - $100K – 14.1% (11) $100K - $120K – 10.3% (8) More than $120K – 41.0% (32)	Total valid responses: 26 Less than $40K – 3.8% (1) $40K - $60K – 7.7% (2) $60K - $80K – 23.1% (6) $80K - $100K – 11.5% (3) $100K - $120K – 11.5% (3) More than $120K – 42.3% (11)	Total valid responses: 41 Less than $40K – 4.9% (2) $40K - $60K – 4.9% (2) $60K - $80K – 7.3% (3) $80K - $100K – 19.5% (8) $100K - $120K – 12.2% (5) More than $120K – 52.2% (21)
Do you have children who attend (or who have ever attended) schools in the HDSB or HCDSB?	Total valid responses: 78 Yes – 74.4% (59) No – 24.4% (19)	Total valid responses: 29 Yes – 48.3 (14) No – 51.7% (15)	Total valid responses: 49 Yes – 91.8% (45) No – 8.2% (4)
How far away do you live from [name of specific school]?[1]	Total valid responses: 78 < 1km – 19.2% (16) 2-3km – 29.5% (23) 4-5km – 7.7% (6) > 5km – 42.3% (33)	Total valid responses: 29 < 1km – 0.0% (0) 2-3km – 13.8% (4) 4-5km – 10.3% (3) > 5km – 75.9% (22)	Total valid responses: 49 < 1km – 32.7% (16) 2-3km – 38.8% (19) 4-5km – 6.1% (3) > 5km – 22.4% (11)
How long have you lived in this area?	Total valid responses: 78 < 1yr – 2.6% (2) 1yr – 3yrs – 7.7% (6) 3yrs – 5yrs – 15.4% (12) > 5 yrs – 73.1% (57)	Total valid responses: 29 < 1yr – 3.4% (1) 1yr – 3yrs – 6.9% (2) 3yrs – 5yrs – 6.9% (2) > 5 yrs – 82.8% (24)	Total valid responses: 49 < 1yr – 2.0% (1) 1yr – 3yrs – 8.3% (4) 3yrs – 5yrs – 20.4% (10) > 5 yrs – 67.3% (33)

Table 1 - Demographic Characteristics of Respondents[2]

[1] An error was noticed on the surveys after the data collection had taken place. The ranges of 1km-2km and 3km-4km were not represented as possible response options. However, the response rate for this question was very high (98.7%), and therefore it is assumed that respondents selected the response option that *most closely* represented the distance they live from the particular school.

[2] Percentages are reported as a percentage of the total valid respondents in each category and were rounded to one decimal point. This rounding may mean that the percentages do not add up to 100%. The frequency of each specific response is included in brackets following the percentage. In the 'interview respondents' and 'school council respondents' columns, the percentages are reported as a percentage of *total valid interview respondents* and *total valid school council respondents* respectively.

5.1 Perceptions of Solar PV Technology

Section 2 of the survey was designed to evaluate respondents' knowledge (Section 2(A)), attitudes (Section 2(B)) and opinions (Section 2(C)) about solar PV technology in general. School-based projects were not mentioned as the researcher wanted to focus on respondents' knowledge, attitudes, and opinions about solar PV technology itself, regardless of the application. A Likert scale was given for each question, and respondents were asked to circle the appropriate response. Table 2 below identifies the possible Likert scale responses for each question.

Theme	Possible responses
Section 2(A) – Knowledge	1 – None; 2 – Below Average; 3 – Average; 4 – Above Average; 5 – Expert
Section 2(B) – Attitudes and Perceptions	1 – Strongly Negative; 2 – Negative; 3 – Neutral/No opinion; 4 – Positive; 5 – Strongly Positive
Section 2(C) – Opinions and Concerns	1 – Strongly Disagree; 2 – Disagree; 3 – Agree; 4 – Strongly Agree

Table 2 - Possible Likert Scale Responses for Section 2 of Survey

The data collected in Section 2 of the survey will now be reported in Tables 3, 4 and 5 below. The results are reported as a percentage of the total number of responses (i.e., 79 respondents). The frequency of each response is reported in brackets following the percentage.

In addition to the three sections of Likert scale responses described above, survey respondents were given space to provide additional comments about solar PV technology; interviewees were asked to comment further on solar PV technology. The comments from the qualitative data collected by these two means largely revolved around three themes: the (expensive) cost of solar PV technology and its economic viability; education and lack of information on solar PV technology; and general positive comments to support the future development of solar PV technology.

Section 2(A) – Knowledge

Please **CIRCLE** the number indicating your level of knowledge of the following topics:

	1 (None)	2 (Below average)	3 (Average)	4 (Above average)	5 (Expert)	Mean	Median
Global climate change (n = 79)	0.0% (0)	6.3% (5)	54.4% (43)	39.2% (31)	0.0% (0)	3.33	3
Energy issues (e.g., supply, demand, production, conservation) (n = 79)	0.0% (0)	10.1% (8)	53.2% (42)	34.2% (27)	2.5% (2)	3.29	3
Energy system issues (e.g., grid reliability, peak energy demand) (n = 79)	2.5% (2)	24.1% (19)	54.4% (43)	17.7% (14)	1.3% (1)	2.91	3
Conventional energy technologies (i.e., coal, nuclear, hydro) (n = 79)	2.5% (2)	12.7% (10)	60.8% (48)	22.8% (18)	1.3% (1)	3.08	3
Solar photovoltaic (i.e., solar electric) (n = 79)	7.6% (6)	29.1% (23)	49.4% (39)	12.7% (10)	1.3% (1)	2.70	3
Wind energy technology (n = 79)	3.8% (3)	31.6% (25)	46.8% (37)	16.5% (13)	1.3% (1)	2.80	3
Biomass energy technology (n = 79)	24.1% (19)	40.5% (32)	31.6% (25)	3.8% (3)	0.0% (0)	2.15	2

Table 3 - Section 2(A) Responses

Section 2(B) – Attitudes and Perceptions

Please **CIRCLE** the number indicating your perception of the use of the following technology:

	1 (Strongly Negative)	2 (Negative)	3 (Neutral/No opinion)	4 (Positive)	5 (Strongly Positive)	Mean	Median
New technology in general (n = 79)	0.0% (0)	0.0% (0)	19.0% (15)	58.2% (46)	22.8% (18)	4.04	4
Conventional energy technology in general (n = 79)	1.3% (1)	17.7% (14)	45.6% (36)	35.4% (28)	0.0% (0)	3.15	3
Nuclear power plants (n = 79)	3.8% (3)	24.1% (19)	34.2% (27)	34.2% (27)	3.8% (3)	3.10	3
Coal power plants (n = 79)	22.8% (18)	50.6% (40)	24.1% (19)	2.5% (2)	0.0% (0)	2.06	2
Hydro dams (n = 78)	1.3% (1)	11.5% (9)	33.3% (26)	46.2% (36)	7.7% (6)	3.47	4
Wind turbines (n = 79)	0.0% (0)	0.0% (0)	10.1% (8)	49.4% (39)	40.5% (32)	4.30	4
Solar photovoltaic panels (n = 79)	0.0% (0)	0.0% (0)	12.7% (10)	49.4% (39)	38.0 (30)	4.25	4
Biomass energy technology (n = 77)	0.0% (0)	0.0% (0)	67.5% (52)	20.8% (16)	11.7% (9)	3.44	3

Table 4 - Section 2(B) Responses

Section 2(C) – Opinions and Concerns

Please **CIRCLE** the number that indicates your level of agreement with the following statements:

	1 (Strongly disagree)	**2 (Disagree)**	**3 (Agree)**	**4 (Strongly Agree)**	**Mean**	**Median**
I am supportive of developing and implementing new renewable energy technologies. (n = 78)	0.0% (0)	0.0% (0)	37.2% (29)	62.8% (49)	3.63	4
I prefer conventional sources of electricity to renewable sources of electricity. (n = 74)	28.4% (21)	59.5% (44)	10.8% (8)	1.4% (1)	1.85	2
I think that solar photovoltaic (PV) technology is a good idea, and would like to see it implemented on a large scale. (n = 73)	0.0% (0)	4.1% (3)	50.7% (37)	45.2% (33)	3.41	3
I think that more research is needed before solar PV technology should be implemented on a large scale. (n = 74)	4.1% (3)	37.8% (28)	43.2% (32)	14.9% (11)	2.69	3
I think solar PV technology should be integrated into new and existing building designs. (n = 71)	0.0% (0)	2.8% (2)	62.0% (44)	35.2% (25)	3.32	3
I am concerned that solar PV technology is not safe for birds or other animals. (n = 72)	15.3% (11)	75.0% (54)	9.7% (7)	0.0% (0)	1.94	2
I think solar PV technology is very safe compared to other energy technologies. (n = 73)	1.4% (1)	0.0% (0)	56.2% (41)	42.5% (31)	3.40	3
I think solar PV technology is too expensive. (n = 64)	6.3% (4)	32.8% (21)	39.1% (25)	21.9% (14)	2.78	3
I would be willing to purchase solar PV technology. (n = 69)	5.8% (4)	21.7% (15)	56.5% (39)	15.9% (11)	2.83	3
I would ***not*** like to see solar PV technology on a building near my home. (n = 72)	33.3% (24)	59.7% (43)	5.6% (4)	1.4% (1)	1.75	2
I think solar PV technology enhances the look of a building. (n = 72)	2.8% (2)	69.4% (50)	20.8% (15)	6.9% (5)	2.39	2
I think solar PV technology installed in my neighbourhood may negatively affect my property value. (n = 74)	25.7% (19)	66.2% (49)	6.8% (5)	1.4% (1)	1.84	2
I would actively support (financially or by volunteering) a solar PV project in my neighbourhood. (n = 74)	1.4% (1)	16.2% (12)	66.2% (49)	16.2% (12)	2.97	3
I would ***not*** like to see solar PV technology installed on my home or in my neighbourhood. (n = 72)	34.7% (25)	62.5% (45)	2.8% (2)	0.0% (0)	1.68	2

Table 5 - Section 2(C) Responses

5.2 Perceptions of Funding Models

Section 3 of the survey was designed to gauge respondents' perceptions about various funding models that could be used to fund school-based solar PV projects. The respondents were asked to evaluate five funding models in two different ways. First, respondents were asked to indicate on a Likert scale how their overall level of support for a school-based solar PV project would change if the project was implemented with each of the five funding models. The Likert scale was: (1) dramatically decrease; (2) decrease; (3) no change in support; (4) increase; (5) dramatically increase. Second, respondents were asked to rank the five models on a scale from (1) "most desirable for [insert specific school name]", to (5) "least desirable for [insert specific school name]". The respondents were asked to evaluate the funding models in two different ways in order to give more context and depth to the analysis of the data. The data in Table 6 help to understand how (if at all) the funding models will affect respondents' social acceptance of the school-based solar PV project as a whole. Table 7 indicates respondents' preference for each of the five funding models. Both the interview respondents and the School Council survey respondents were introduced to the five funding models by the researcher through a brief presentation prior to responding to these questions.

Please see Table 6 below for the results of the Likert scale responses.

Funding Models	**Likert Scale**						
	1 Dramatically decrease support	**2 Decrease support**	**3 No change in support**	**4 Increase support**	**5 Dramatically increase support**	**Mean**	**Median**
Renting School Roof Space (n = 72)	4.2% (3)	13.9% (10)	38.9% (28)	33.3% (24)	9.7% (7)	3.31	3
Corporate Sponsorship (n = 72)	2.8% (2)	11.1% (8)	33.3% (24)	36.1% (26)	16.7% (12)	3.53	4
Community Fundraising (n = 73)	9.6% (7)	23.3% (17)	38.4% (28)	23.3% (17)	5.5% (4)	2.92	3
Community Co-operative (n = 71)	5.6% (4)	9.9% (7)	49.3% (35)	28.2% (20)	7.0% (5)	3.21	3
Government / Utility Program (n = 71)	1.4% (1)	2.8% (2)	32.4% (23)	38.0% (27)	25.4% (18)	3.83	4

Table 6 - Likert Scale Responses for Section 3 of Survey

Table 6 gives the percentage of total respondents who indicated how their support would change (i.e., increase, decrease, or no change) given a specific funding model. The column indicating "no change in support" has the highest frequency of responses for all funding models except corporate sponsorship and government/utility program. With both corporate sponsorship and government/utility programs, "no change in support" has the second highest frequency of responses. However, 78.1% of respondents reported that at least one of the five models would cause their support for the project to either increase or decrease. This is true because there were many respondents who indicated that some models would cause no change in their support of the project, while other models would either increase or decrease their support. Only 21.9% of respondents indicated the same level of support regardless of the funding model chosen.

Table 7 presents the results of how the survey respondents ranked each of the five funding models. The results are reported as a percentage of total respondents, and the frequency of each response is indicated in brackets next to the percentage.

Funding Model	**Rank**						
	1	**2**	**3**	**4**	**5**	**Mean**	**Median**
Renting School Roof Space (n = 65)	20.0% (13)	12.3% (8)	20.0% (13)	20.0% (13)	27.7% (18)	3.23	3
Corporate Sponsorship (n=67)	26.9% (18)	34.3% (23)	13.4% (9)	14.9% (10)	10.4% (7)	2.48	2
Community Fundraising (n = 68)	8.8% (6)	8.8% (6)	14.7% (10)	23.5% (16)	44.1% (30)	3.85	4
Community Co-operative (n = 65)	6.2% (4)	23.1% (15)	23.1% (15)	35.4% (23)	12.3% (8)	3.25	3
Government / Utility Program (n = 66)	42.4% (28)	19.7% (13)	27.3% (18)	6.1% (4)	4.5% (3)	2.56	3

Table 7 - Ranking the Funding Models

6 Discussion

This section begins with Section 5.1, which contains an analysis of the statistical tests performed on the results examining the perceptions of solar PV technology. Section 5.2 follows with an analysis of the perceptions of the five funding models. Section 5.1 and Section 5.2 will both contain a discussion of the significant results, and will suggest factors that most significantly affect the social acceptance of a school-based solar PV project.

6.1 Perceptions of Solar PV Technology

Before the analysis is presented, it should be noted that the chi-square test for independence was performed on the data. However, it was found that in all cases, the data were too sparsely distributed across the Likert responses to make appropriate inferences from the tests with any confidence. When performing the chi-square test, appropriate inferences from the results cannot be made if "more than 20 percent of the expected frequencies are less than 5 or when any expected frequency is less than 1" (Siegel & Castellan Jr., 1988, p. 49). If this occurs, then "expected frequencies sometimes can be increased by combining adjacent categories into a single pooled category" (Siegel & Castellan Jr., ,1988, p. 49).   Therefore, the Likert scale responses were collapsed to improve the results from the chi-square tests. Similarly, the data were too sparsely distributed across some of the demographic categories, and therefore, some demographic categories were also collapsed to facilitate statistical analysis. Table 8 below describes how the categories were collapsed.

It also should be noted that when the frequency data are discussed, the original (expanded) demographic and Likert scale responses are used. However, the chi-square tests for independence are performed using the collapsed categories. Using collapsed categories reduces the strength of the conclusions because the data set is less differentiated. However, this was necessary to perform any statistical tests beyond simple frequencies.

The data were analyzed using four school characteristic categories: EcoSchool vs. Non-EcoSchool; Catholic School vs. Public School; Elementary School vs. High School; large municipality vs. small municipality. Demographic data were also used for analysis. Using the school characteristics and the demographic information, the chi-square test was run on the qualitative responses from sections 2(A), 2(B), 2(C), 3(A) and 3(B) of the survey. Table 9 presents a summary of the chi-square test results for Sections 2(A), 2(B), and 2(C), and Table 10 (in Section 6.2) presents the chi-square results for Sections 3(A) and 3(B).

Survey Section	Original responses	Collapsed responses
Section 1 – Age	1 – 1930s (0) 2 – 1940s (2) 3 – 1950s (22) 4 – 1960s (37) 5 – 1970s (13) 6 – 1980s (1)	1 – 1950s or earlier (24) 2 – 1960s or later (51)
Section 1 – Education	1 – Some high school (0) 2 – Complete high school (8) 3 – College or University (44) 4 – Post-graduate degree (25)	1 – High school (some or completed) (8) 2 – College, University or Post-graduate (69)
Section 1 – Household income	1 – Less than $40K (3) 2 – $40K - $60K (4) 3 – $60K - $80K (9) 4 – $80K - $100K (11) 5 – $100K - $120K (8) 6 – More than $120K (32)	1 – Less than $80K (16) 2 – $80K - $120K (19) 3 – More than $120K (32)
Section 1 – Distance from school	1 – Less than 1km (16) 2 – 2-3km (23) 3 – 4-5km (6) 4 – More than 5km (33)	1 – Less than 1km (16) 2 – 2-5km (29) 3 – More than 5km (33)
Section 1 – Time living in the area	1 – Less than 1yr (2) 2 – 1yr – 3yrs (6) 3 – 3yrs – 5yrs (12) 4 – Greater than 5 yrs (57)	1 – Less than 1yr (2) 2 – 1yr – 5yrs (18) 3 – Greater than 5yrs (57)
Section 2(A) – Knowledge	1 – None 2 – Below Average 3 – Average 4 – Above Average 5 – Expert	1 – Below Average 2 – Average 3 – Above Average
Section 2(B) – Attitudes and Perceptions	1 – Strongly Negative 2 – Negative 3 – Neutral/No opinion 4 – Positive 5 – Strongly positive	1 – Negative 2 – Neutral/No opinion 3 – Positive
Section 2(C) – Opinions and Concerns	1 – Strongly Disagree 2 – Disagree 3 – Agree 4 – Strongly Agree	1 – Disagree 2 – Agree

Table 8 - Original and Collapsed Demographic and Likert Scale Responses

The null hypothesis for the chi-square test for independence states that the variables compared are independent, and that any observed differences are due to chance. If no significant results are found using the chi-square test, then the null hypothesis is not rejected. If the chi square result is significant for a survey question, it means that the variables used for comparison are not independent and therefore influence how the respondents answer the survey question. For example, in Table 9 below, household income is significant when answering the question: I think that more research is needed before solar PV technology is implemented on a large scale. Therefore, it can be interpreted that household income has an influence on how respondents answer this question.

As a reminder to help interpret Tables 9 and 10, the chi-square test results "should not be used if more than 20 percent of the expected frequencies are less than 5" (Siegel & Castellan, Jr., 1988, p. 49). If this occurred even when the chi-square test was performed on the data after it had been collapsed into fewer categories, it is indicated in Table 9 and 10 as 'data too sparse. Chi-square result invalid'. Please see Table 9 for a complete list of chi-square results for Sections 2(A), 2(B), and 2(C), and Table 10 for a complete list of chi-square results for Sections 3(A) and 3(B).

The significant results from the chi-square test for independence from each category in Table 9 will now be discussed in detail in the paragraphs below.

There were no statistically significant differences between the responses given by EcoSchools as compared to Non-EcoSchools. This result is not entirely surprising because due to the stringent ethics requirements, it is likely that schools that have 'environmental leanings' – even if they were not (yet) EcoSchools – participated in this thesis project. Similarly, there were no statistically significant differences in the responses given by Catholic Schools as compared to Public Schools. The lack of significant findings in these two comparative categories indicate that these school characteristics do not affect how individuals associated with these schools responded to the survey questions.

Variable for Comparison	Result of Chi-square tests[3]
EcoSchool vs. Non EcoSchool	No statistical significance. The null hypothesis is not rejected.
Catholic School vs. Public School	No statistical significance. The null hypothesis is not rejected.
Elementary vs. High School	Significant questions: S2-B-Q5: Please indicate your perception of the use of hydro dams to produce electricity. S2-C-Q13: I would actively (financially or by volunteering) support a solar PV project in my neighbourhood.
Small municipality vs. Large municipality	Significant question: S2-C-Q6: I am concerned that solar PV technology is not safe for birds or other animals
Interview respondents vs. School Council respondents	Significant questions: S2-A-Q2: Please indicate your level of knowledge of energy issues (supply, demand, production, conservation). S2-B-Q7: Please indicate your perception of the use of solar PV technology to produce electricity. S2-C-Q9: I would be willing to purchase solar PV technology
Title of respondents	Data too sparse. Chi-square result invalid.
Age	Data too sparse. Chi-square result invalid.
Gender	Significant questions: S2-A-Q3: Please indicate your level of knowledge of energy system issues (e.g., grid reliability, peak energy demand). S2-A-Q4: Please indicate your level of knowledge of conventional energy technologies (e.g., coal, nuclear, hydro). S2-A-Q5: Please indicate your level of knowledge of solar PV technology S2-A-Q6: Please indicate your level of knowledge of wind energy technology. S2-B-Q5: Please indicate your perception of the use of hydro dams to produce electricity
Level of education	Data too sparse. Chi-square result invalid.
Household income	Significant question: S2-C-Q4: I think that more research is needed before solar PV technology is implemented on a large scale.
Children attending HDSB or HCDSB schools	Significant question: S2-A-Q6: Please indicate your level of knowledge about wind energy technology.
Distance from school	Data too sparse. Chi-square result invalid.
Time living in the area	Data too sparse. Chi-square result invalid.

Table 9 - Results of Chi-square Analysis for Section 2 of the Survey

[3] For a complete table of the calculations performed, please see (Beckstead, 2008).

The responses from elementary schools as compared to high schools yielded two significant results, indicating that respondents' responses to the following questions were significantly correlated with their association with either an elementary school or a high school. The first significant result was the perception of the use of hydro dams to produce electricity. High school respondents were more likely to be polarized (either a positive or negative view of the use of the technology), and elementary school respondents were more likely to have a neutral opinion when asked the same question. The second significant result was the response to the question: would you actively support a solar PV installation in your neighbourhood? Respondents from the high schools were more likely to respond 'no' to this question. However, the majority of both the high school and elementary school respondents indicated that they would actively support a solar PV installation in their neighbourhood. This indicates that there is fairly widespread support for solar PV installations, but that project proponents in high schools may find that stakeholders are less willing to actively participate in the project (as compared to stakeholders in elementary schools). Six percent (6.3%) of elementary school respondents indicated that they would not actively support a solar PV installation in their neighbourhood as compared to 26.2% of high school respondents who responded in the same way. Previous studies have found that individuals with families with children less than 16 years of age are less willing to donate time to environmental projects (e.g., Zhang, Yaoqi, Hussain, Anwar, Deng, & Letson, 2007), presumably because of the additional time-commitment of having young children. It is thus interesting that the elementary school respondents indicate that they are *more* willing to donate time and/or money to a school-based solar PV project than high school respondents. The qualitative data provide some insight into this result. Many stakeholders from high schools indicated that there were already many school-related activities and projects that they actively supported. High schools generally offer more extra-curricular activities than elementary schools, and therefore high school stakeholders likely have greater demands on their time and money. This may be why they are more hesitant about actively supporting a school-based solar PV project. Nevertheless, it is worth noting that 73.8% of high school respondents still reported that they would actively support a solar PV installation given these additional demands.

The responses from large municipalities compared to those from small municipalities yielded only one significant result. The data indicate that responses to the question "I am concerned that solar PV technology is not safe for birds or other animals" is significantly correlated to whether the respondent's school is located in a small municipality or a large municipality. Respondents from both the large municipalities and the small municipalities overwhelmingly disagreed with the statement. However, 17.6% of respondents from the small municipalities indicated that they were concerned that solar PV technology was not safe for birds or other animals, while only 2.6% of the respondents from the large municipalities indicated the same response. This perhaps indicates that some education may need to take place with projects implemented in the smaller municipalities in the HDSB and HCDSB to reassure stakeholders of the safety of solar PV technology. In response to the open-ended questions, the safety of birds and animals was not generally discussed, although some stakeholders were concerned about children's safety if they were to climb up on the roof to examine the solar panels. Still other respondents were concerned about the "safety" of the solar PV technology, as they mentioned vandalism as a potential concern.

The data were also analyzed to discover if there were significant differences in responses between information collected during the stakeholder interviews as compared to stakeholder surveys. This comparison was done for two reasons. First, the individuals who participated in the stakeholder interviews were stakeholders from "inside" the schools (i.e., administrators, teachers, and custodial staff). It is possible that their perspective on a school-based solar PV installation may differ from respondents not directly involved in the day-to-day operation of the school. Respondents who completed the School Council survey (parents and community members) have a stake in the operation of the school, but are not involved on a day-to-day basis. Second, the method used for data collection was different with each group, and therefore this may have also resulted in differences in the respondents' answers. In fact, in a comparison between stakeholder interview respondents and School Council survey respondents, three questions were found to be significant. They were:

- knowledge about energy issues (e.g., supply, demand, production, conservation);
- perceptions of the use of solar PV technology; and
- opinion about whether the respondent would be willing to purchase solar PV technology.

It is likely that the method of data collection affected the respondents' answers for the three questions listed above. For the knowledge of energy issues, the majority of stakeholder interview respondents (56.7%) indicated above-average knowledge of energy issues, as compared to the majority of School Council respondents (67.3%) who indicated an average knowledge of energy issues. In this case, two explanations are possible for the differences in responses. It is possible that the interview respondents are genuinely more educated about energy issues. However, because this measure of knowledge is self-reported, it is possible that interview respondents wished to demonstrate a certain (higher) level of knowledge to the interviewer.

For the perceptions of the use of solar PV technology, 100% of stakeholder interview respondents indicated that they had a positive perception of the technology, as compared to 79.6% of School Council respondents. Similarly, 88.9% of stakeholder interview respondents indicated that they would be willing to purchase solar PV technology, compared to 61.9% of School Council respondents. In both cases, the majority response from both groups of respondents was the same. Both groups had a generally positive perception of the use of solar PV technology, and the majority of respondents from both groups were willing to purchase solar PV technology. However, the statistically significant difference was possibly due to the fact that the interview respondents were aware that the researcher was conducting solar PV technology-related research and perhaps felt obliged to convey a ‘pro-solar’ attitude. As Palys (2003, p. 160) notes, “most people are used to the idea that researchers are experts in their field who have some particular thing in mind when they seek participants for a study.” Further, research participants look for cues that they are “doing well” as participants; thus the stakeholder interview respondents may have attempted to convey a “pro-solar” attitude to receive approval from the interviewer (Palys, 2003, p. 160).

The demographic data were also used for analysis. The three demographic characteristics that yielded significant results were: gender, income, and respondents having children who attend (or who have attended) school in the HDSB or the HCDSB.

Gender was found to be significant for five questions. They were:

- level of knowledge pertaining to energy system issues (i.e., grid reliability, peak energy demand);

- level of knowledge pertaining to conventional energy technologies (i.e., coal, nuclear, hydro);
- level of knowledge pertaining to solar photovoltaic technology;
- level of knowledge pertaining to wind energy technology; and
- perception of the use of hydro dams to produce electricity.

The first four questions pertain to the level of knowledge respondents have about each of the listed technologies. In each case, men were more likely to report a higher level of knowledge than women. However, this level of knowledge was self-reported, and there were no corresponding questions on the survey to evaluate if the self-reported level of knowledge corresponded with the actual level of respondent knowledge. As Slevin et al. (1993) also note in their study of gender differences in self-evaluations, this thesis research would have benefited from an impartial evaluation of respondents' actual level of knowledge to compare to the reported level of knowledge. It is possible that the differences found in the reported level of knowledge are due to differences in how men and women self-evaluate. As the psychology literature has found, women often underestimate their knowledge and abilities, while men engage in a self-enhancing bias (Berg, Stephan, & Dodson, 1981; Slevin & Aday., 1993). In a 1997 study which examined the accuracy of self-evaluations, it was found that women's self-evaluation of performance were inaccurately low (Bayer & Bowden, 1997). The researcher also noticed that during the stakeholder interviews, women interviewees often looked for confirmation that their responses were 'acceptable' to the researcher. It was noticed that women often prefaced their responses with self-deprecating comments about their level of knowledge and expertise regarding solar PV technology. One female interview respondent elected to halt the interview half-way through because she felt so uncomfortable with her perceived lack of knowledge. This is notable because the questions the researcher was asking related to the respondents' perceptions, attitudes and opinions about school-based solar PV technology; level of knowledge has an effect on responses, but does not preclude an answer.

The fifth and final question that is significantly correlated to gender is the reported perception of the use of hydro dams to produce electricity. Women are more likely to report a neutral perception of hydro dams, whereas men are more likely to report a positive perception. It is interesting to note that of all the technologies presented on the survey, gender was only found to be significant for hydro electricity. None of the respondents who participated in the study commented (either in the interviews or on the surveys) further on their perceptions of hydro electricity; therefore, suggestions as to why this significant result exist are somewhat speculative. However, it is possible that the same phenomenon that caused women to under-estimate their level of knowledge also affected their response for this question. As Slevin et al. (1993) discuss, women are hesitant to participate in discussions that are typically viewed as “stereotypically male in orientation” (Slevin & Aday, David P. Jr., 1993). Traditionally, men are the individuals responsible for paying the ‘hydro bill’ (Ontario colloquialism for the electricity bill), and therefore this may have caused some women to be hesitant about offering a non-neutral perception of the technology. However, gender was not found to be significant with other energy technologies on the survey, and therefore it is suggested that more research would be necessary to explain this finding.

Ultimately, the statistically significant results pertaining to gender do not indicate a difference in how men and women perceive solar PV technology. However, they do suggest that future research should be conducted with the response style of different genders in mind. Specifically, as mentioned, self-evaluations should be coupled with impartial measures of actual knowledge to determine if the disparity between the genders’ stated knowledge is also present in the level of actual knowledge. If future research reveals that women do in fact possess a lower level of knowledge about energy systems and technologies, then targeted education programs should be developed.

Income was also found to be statistically significant for one question. Respondents were asked to agree or disagree with the following statement: “I think that more research is needed before solar PV technology should be implemented on a large scale.” It was found that respondents with an annual household income of greater than $120,000 were more likely to disagree with the statement above. This is consistent with the literature that indicates that individuals with higher income are more likely to have positive perceptions (and higher usage) of technology in general (Porter & Donthu, 2006), and also the literature that indicates that income is positively related to an individual’s perception of ‘green electricity’ (Batley, Colbourne, Fleming, & Urwin, 2001; Roe, Teisl, Levy, & Russell, 2001). However, it is somewhat surprising to find a statistically significant result for income in this data set. The HDSB and the HCDSB are in a wealthy part of Canada, and most respondents would be considered wealthy, even for the area. However, solar PV technology is still perceived as relatively expensive as compared to other energy technologies, and this may contribute to the fact that only the wealthiest respondents believe that more research is not necessary before solar PV should be implemented on a large scale. It is possible that, for the wealthiest respondents, the economic considerations do not influence their opinion as dramatically as for other respondents.

The last demographic characteristic that yielded some significant results was if respondents had children who attend school in the HDSB or the HCDSB. Only one question was significant for this variable. The question was about respondents' self-reported level of knowledge about wind energy technology. Those respondents who had children in the HDSB or HCDSB were more likely to report "below average knowledge" as compared to those without children who attend school in either of the two districts. This result is likely due to a combination of factors discussed above. Respondents who did not have children in the school system were more likely to participate in this thesis project by completing a stakeholder interview. This is true because although School Council meetings are open to all members of the community, members were generally parents of children in the school. Therefore, non-parents were more likely to be a teacher, administrator, or member of the custodial staff at the school. As mentioned above, stakeholder interview respondents were more likely to overstate their level of knowledge in order to please the interviewer. Stakeholder interview respondents, therefore, may have felt that their responses were not as anonymous as School Council respondents, because the stakeholder interviews were conducted one-on-one. As well, respondents who completed the School Council surveys were more likely to be women. As discussed in the paragraphs above, women may have been more likely to underestimate their level of knowledge. This also demonstrates that, given the modest size of the dataset, it is difficult to control for other variables when looking at a specific variable. However, as was true for the hydro dams, respondents did not elaborate on wind energy technology in the open-ended sections of the interviews and surveys. Therefore, more research would be necessary to further explore this research finding.

The other demographic data collected (including age, education, distance respondent lives from school, and length of time living in the area) were not able to be analyzed using the chi-square test for independence, as the sample size collected was not large enough to interpret the results of the statistical tests with confidence. However, the frequency data for these variables (and the others already discussed) provide some interesting results, which will be discussed in the paragraphs below.

In Section 2(A) of the survey, respondents were asked their level of knowledge about solar PV technology, as well as their level of knowledge about other conventional and renewable energy technologies. As discussed previously, because the level of knowledge is self-reported, this indicator is not very useful in evaluating actual levels of respondent knowledge. However, in analyzing the frequencies, at least one piece of useful knowledge can be extracted. Respondents report a lower level of knowledge for solar PV technology as compared to all other energy technologies listed on the survey, except for biomass energy technology. A frequent comment on the qualitative portion of both the stakeholder interviews and the School Council surveys was that respondents did not feel like they had enough information to properly evaluate both solar PV technology and school-based solar PV projects. This suggests that some of the perceptions and opinions indicated on the survey may be based on misinformation. However, despite this lower level of knowledge as compared to other energy technologies, the aggregated responses were positive about the use of solar PV technology to generate electricity. In fact, respondents rated solar PV technology second only to wind energy technology when indicating their positive perceptions of different energy technologies. This finding is supported by the literature that states that positive attitudes are not necessarily indicative of high levels of knowledge (Diamantopoulos, Schlegelmilch, Sinkovics, & Bohlen, 2003). This finding also demonstrates that a lack of knowledge does not necessarily lead to negative perceptions of a technology as argued by some authors (e.g., Bosley & Bosley, 1992).

In general, positive perceptions and opinions of solar PV technology were reflected throughout the survey. Respondents preferred renewable energy technologies to conventional energy technologies, and were strongly supportive of implementing solar PV technology on a large scale. Interestingly, respondents indicated that they did not think solar PV technology enhances the look of a building; however, respondents also indicated that they did not think that a solar PV installation in their neighborhood would negatively affect their property value. This indicates that, on average, respondents do not necessarily *like* the look of solar PV technology, but also do not *dislike* it enough to believe that it would have a negative effect on their neighbourhood (and by extension, property value). On average, respondents indicated that they would be supportive of a solar PV installation in their neighbourhood. Aesthetic considerations have been mentioned in the literature as a possible barrier to the uptake of solar PV technology (A. Faiers & Neame, 2006). Therefore, the research findings indicate that aesthetic considerations can play a role in stakeholders' evaluation of a project, but do not, at this point, appear significant enough to oppose the implementation of a school-based solar PV project. Instead, respondents seem willing to at least passively accept the technology in their neighbourhood (Sauter & Watson, 2007).

The cost and economic viability of solar PV technology was one of the most frequent written-in comments about the technology. In the quantitative responses, 60.9% of respondents either agreed or strongly agreed with the statement "I think solar PV technology is too expensive". Interestingly, 72.5% of respondents would still be willing to purchase solar PV technology. The results from the evaluation of the perception of the solar PV technology itself generally agree with the findings in the literature that indicate that people generally have a positive perception of solar PV technology, but are nevertheless still deterred (at least to some extent) by the financial cost of the technology (A. Faiers & Neame, 2006; Jager, 2006).

Overall, characteristics of the technology itself seem to be relatively positively evaluated by study respondents. The characteristics of the technology that provoked the greatest response in the qualitative portion of the survey were the cost and economic viability of the technology and the school-based solar PV project itself. However, despite the stated concerns, the technology itself (besides the cost) does not appear to significantly impede the implementation of a school-based solar PV project.

6.2 Perceptions of Funding Models

The funding models were evaluated by respondents in two ways: first, by indicating how their support of the project would change given each of the five funding models; second, by ranking the five models. For each variable listed in Table 10 below, a chi-square was calculated for the Likert scale response (how support for the project would change), and how the respondents ranked each of the models. The null hypothesis states that the two variables compared are independent, and that any observed differences are due to chance. As a reminder, if there is a significant chi-square result for a survey question, the null hypothesis is rejected and it can be interpreted that the variables used for comparison are not independent and had an effect on the way respondents answered the significant questions. For example, in Table 10 below, a significant result was found when responses from elementary school respondents were compared to high school respondents for the question: please indicate how your support of a solar PV project at (insert name of school) would change if implemented using a corporate sponsorship funding model. This indicates that whether a respondent was affiliated with an elementary school as compared to a high school had an affect on how they answered this question. All significant chi-square results are indicated in Table 10 below. Similar to Table 9, if the data were to sparse to use the chi-square results, it is indicated in the table by: 'Data too sparse. Chi-square result invalid'. The results of the chi-square test for independence for Sections 3(A) and 3(B) are presented in Table 10.

The only variable associated with school characteristics that resulted in a significant chi-square result was high school respondents', as compared to elementary school respondents', indication of how their support for a school-based solar PV project would change if a corporate sponsorship funding model was used. See Figure 4 for a comparison of the responses.

The corporate sponsorship model was more polarizing for respondents associated with the high schools. Seventy-eight percent of high school respondents indicated that the corporate sponsorship model would cause their support for a school-based solar PV project to either increase or decrease. In comparison, 51.6% of elementary school respondents indicated that a corporate sponsorship model would cause a change in their support for the project (either positively or negatively). High school respondents were also more likely to report that the corporate sponsorship model would have a negative effect on their support: 19.5% of high school respondents reported that a corporate sponsorship model would cause their support to decrease, as compared to 6.5% of elementary school respondents. Based on these results, the corporate sponsorship model is more likely to cause greater controversy, but potentially also greater support, if implemented in a high school.

Variable for Comparison	Result of Chi-square tests[4]
EcoSchool vs. Non EcoSchool	No statistical significance. The null hypothesis is not rejected.
Catholic School vs. Public School	No statistical significance. The null hypothesis is not rejected.
Elementary vs. High School	Question S3-A-Q2: Please indicate how your support of a solar PV project at (insert name of school) would change if implemented using a Corporate Sponsorship funding model.
Small municipality vs. Large municipality	No statistical significance. The null hypothesis is not rejected.
Interview respondents vs. School Council respondents	Question S3-A-Q4: Please indicate how your support of a solar PV project at (insert name of school) would change if implemented using a Community Co-operative funding model.
Title of respondents	Data too sparse. Chi-square result invalid.
Age	Data too sparse. Chi-square result invalid.
Gender	No statistical significance. The null hypothesis is not rejected.
Level of education	Data too sparse. Chi-square result invalid.
Household income	No statistical significance. The null hypothesis is not rejected.
Children attending HDSB or HCDSB schools	No statistical significance. The null hypothesis is not rejected.
Distance from school	Data too sparse. Chi-square result invalid.
Time living in the area	Data too sparse. Chi-square result invalid.

Table 10 - Results of Chi-square Analysis for Section 3 of the Survey

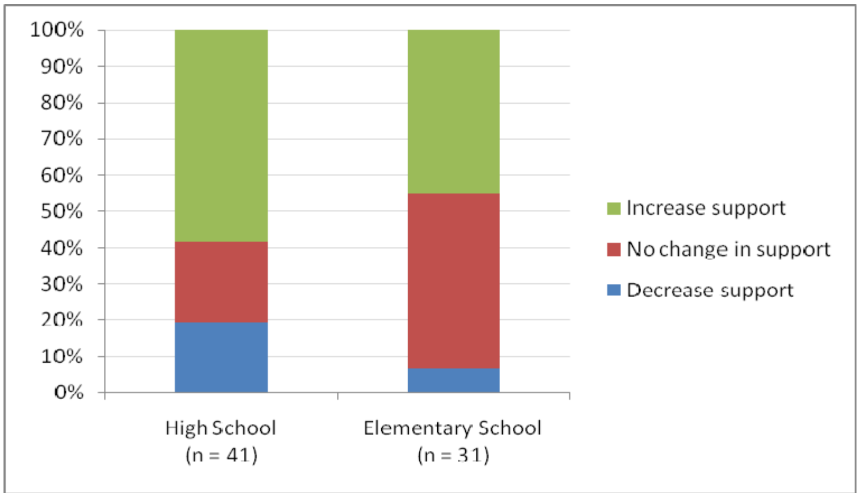

Figure 4 - High Schoool vs. Elementary School: Change in Support based on the Corporate Sponsorship Model (n=72)

[4] For a complete table of the calculations performed, please see (Beckstead, 2008).

The other significant finding in this section is found in a comparison between the stakeholder interview respondents', as compared to School Council respondents', indication of how their support for a school-based solar PV project would change if a community co-operative funding model was used. Please see Figure 5 for a comparison of the results.

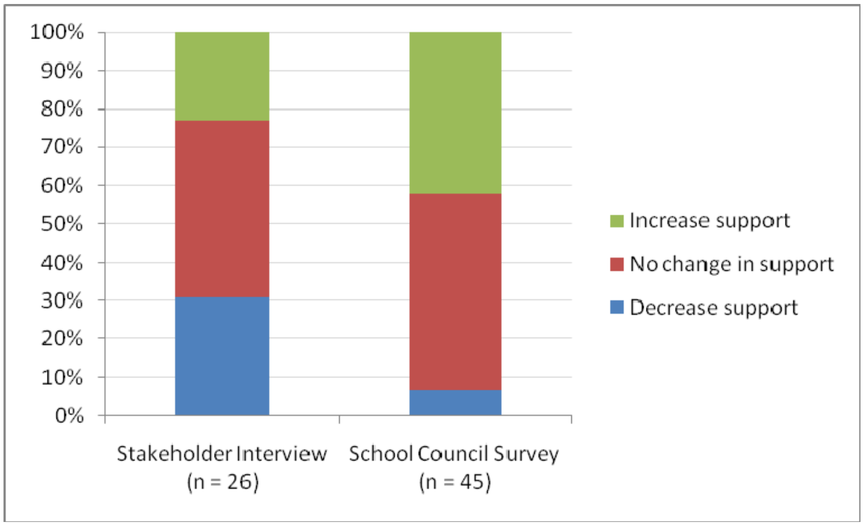

Figure 5 - Stakeholder Interviews vs. School Council Survey: Change in Support based in the Community Co-operative Funding Model (n=71)

Stakeholder interview respondents were much more likely to report that the community co-operative model would cause a decrease in their level of support for the project. Conversely, School Council respondents were more likely to report that this funding model would cause an increase in their level of support for the project. A potential explanation for this result is that the School Councils are made up of parents and members of the community who participate in the School Council as a way to have an influence in the operation of the school. These stakeholders would not necessarily have influence on day-to-day operations of the school without their participation in the School Council. The Community Co-operative model is the model that allows for the greatest amount of community influence in the funding and control of the school-based solar PV project. Therefore, this is a potential reason why School Council members may view this model more positively. Conversely, stakeholders from 'within' the school (administrators, teachers, and custodial staff) may view this model in a negative as it may be seen as a loss of influence and control over the project. For example, one stakeholder interviewee indicated that he would not be in favour of any model that allowed greater community access and influence in the operation of the school.

The lack of significant findings for the other school variables (i.e., EcoSchool vs. Non-EcoSchool, Catholic School vs. Public School, and large municipality vs. small municipality) indicates that these school variables did not significantly affect respondents’ evaluation of the funding models. Although the results of this study cannot claim to be representative, the schools in this study were selected to represent the range of schools in the HDSB and HCDSB; therefore, it is possible to suggest that any differences in social acceptance for a particular funding model in the HDSB and HCDSB are not likely to be dependent on these three school characteristics.

Gender, income, and whether respondents had children who attend (or who attended) school in the HDSB and HCDSB were not found to be statistically significant in how respondents evaluated the funding models. Unfortunately, it was not possible to calculate the significance of age, level of education, distance from the school, and length of time in the area on the evaluation of the five funding models. The data for these four demographic variables, even when collapsed into smaller categories, were too sparsely distributed to interpret the chi-square with confidence. However, the descriptive frequencies, which will be discussed below, provide some interesting insights.

For each funding model, respondents were asked to indicate how their support would change given the implementation of the school-based solar PV project. Please see Figure 6 for the results across the five-point Likert scale for all five funding models.

No funding model had the majority of respondents (i.e., greater than 50%) indicate no change in support. Only 21.9% of respondents indicated that they would have no change in support when asked about each of the five funding models. In other words, for 78.1% of respondents, *at least* one of the funding models would cause a change (either positive or negative) in their overall support of the project.

It is also useful for this discussion to examine how respondents ranked each of the five funding models. It is interesting to note that no model was preferred (i.e., rank 1) by the majority of respondents. See Figure 7 for full details.

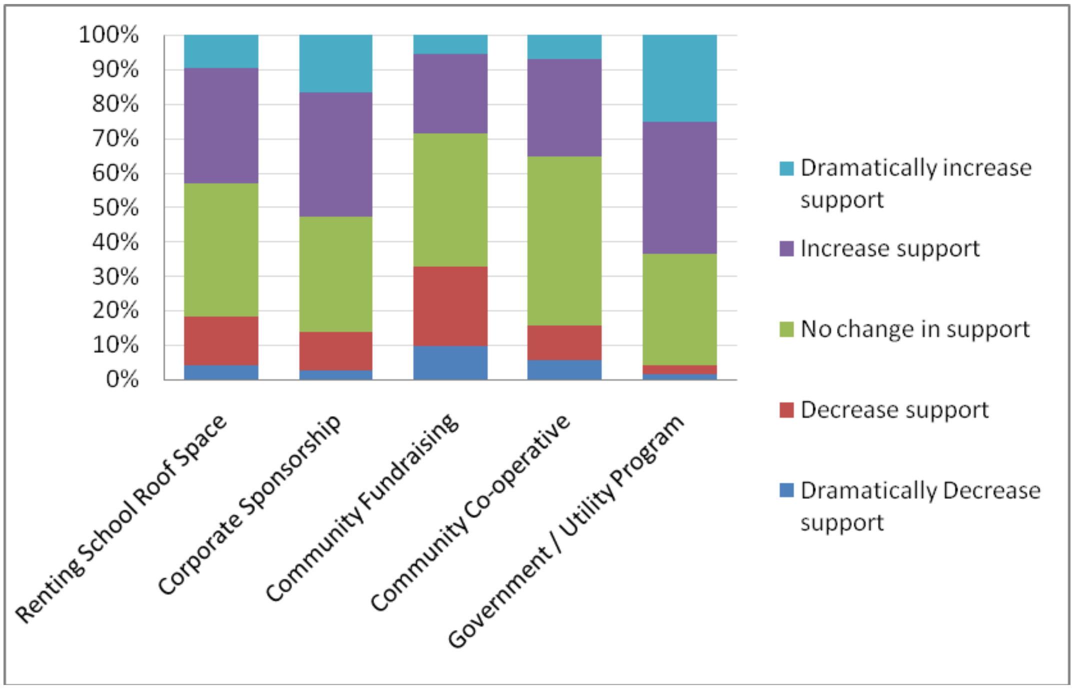

Figure 6 - Likert Scale Responses for the Five Funding Models

Starting with the most striking result, it is apparent that the government/ utility program is most popular among respondents. More than 60% of respondents indicated that government or utility funding would increase or dramatically increase their support of the project, with 25.4% of respondents indicating a dramatic increase of support for the project with the use of this funding model. Only 4.2% of respondents indicated that government/utility program would either decrease or dramatically decrease their support of the project. This is further reflected in Figure 7, as 42.4% of respondents ranked government/utility program as their number one choice.

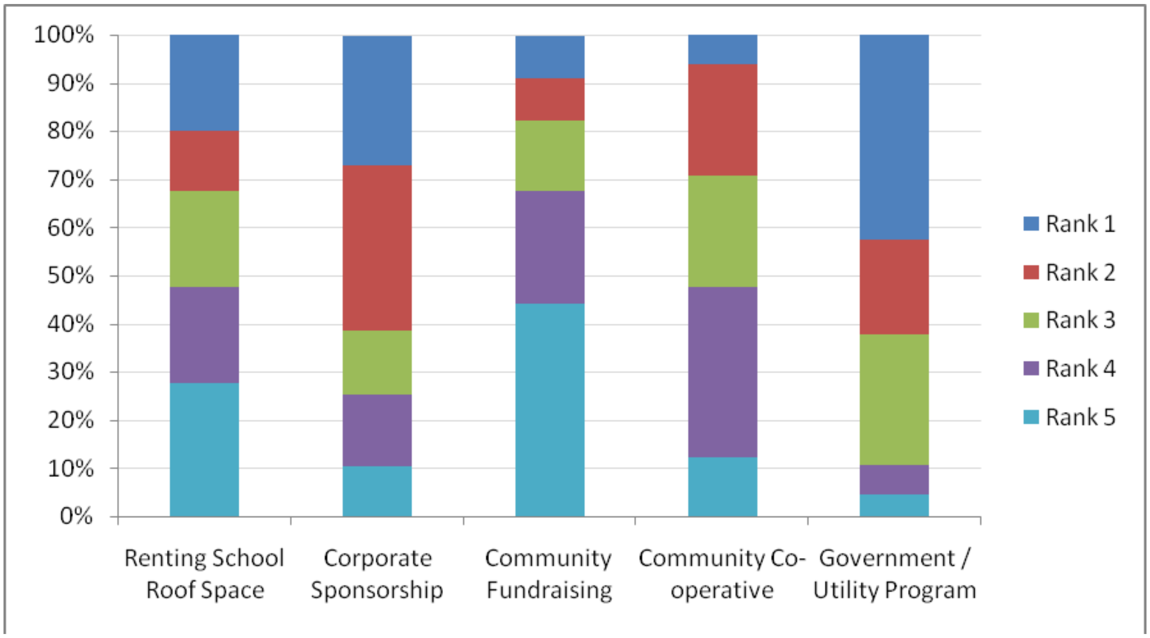

Figure 7 - Ranking the Funding Models

Conversely, the community fundraising model was clearly identified in Figure 7 as the least favorite funding option. Forty-four percent (44.1%) of respondents ranked ommunity fundraising as the last (i.e., number 5) choice. Thirty-three (32.9%) of respondents indicated that a community fundraising model would decrease or dramatically decrease their support of the project. At first glance, the corporate sponsorship model seems to be relatively popular, with 52.8% of respondents indicating that this model would cause their support of the project to increase or dramatically increase (Figure 6). As well, many respondents ranked corporate sponsorship as either their first or second choice of model (Figure 7). However, some qualitative comments about corporate sponsorship were cautious or concerned about this model. For example, one School Council respondent commented, “I don’t think corporations have the best interests of the community in mind”, and another commented that they “dislike corporate advertising in schools.” Compared to the other five models, it was the model that raised the most concern and discussion in the qualitative portion of the data collection. Many people indicated that they would be concerned about potential advertising in the school, and they were also concerned about the level of influence the company would be able to exert on the school and on the students. There were those who recognized however that the corporate funding model is already used to fund programs at schools. Respondents (even those in favour of the model) seemed to express a lower level of trust with the corporate actors, and were cautious about this model. This perception was also expressed, though to a lesser extent, about the renting school roof-space model. Respondents liked that this model would allow an outside entity to fund and manage the solar PV installation, but were cautious about how much influence the company would exert in the school. As one respondent noted, “I like a corporation paying the cost, but I think the school should still have control.” This finding is consistent with the literature that indicates that there is concern about corporate influence and involvement in the education system (Bell McKenzie & Joseph Scheurich, 2004; Feuerstein, 2001).

Taking the evaluation of the five funding models as a whole, it seems clear that the funding model selected for a school-based solar PV project does affect the social acceptance of the project. However, no one model is inherently preferred or inherently disliked by most respondents. This indicates that any funding model *could* be implemented successfully, and that it is *how* and *by whom* the project is implemented that is important.

Based on the qualitative responses, generally, the government/utility funding model was preferred because the money would come from a source perceived as reliable and trust-worthy, and the funding was seen as stable. As one School Council respondent noted, “if the money is coming from the government, it is an easier sell to the community.” Another respondent from the same school also noted that with government funding, “stakeholders would have a greater degree of confidence in the operation.” Several respondents noted that schools already have many responsibilities, and therefore governments/utilities should fund and promote school-based solar PV projects if they are a worthwhile project. “If the government wants to decrease greenhouse gases, it should be willing to assist with the funding of such initiatives.” Conversely, for community fundraising, many respondents indicated that schools already have many priorities, and already have to fundraise for essential items such as textbooks and computers. “Community fundraising is a lot of work for a community already involved in many activities”. Another respondent noted that it would be difficult to get community support for community fundraising. “Most parents would want their money going towards materials for the classrooms.” Respondents from both the interviews and school council meetings indicated that there is little appetite or energy for additional school fundraising. Despite the unwillingness to take on more fundraising responsibilities, there were respondents who recognized the value of involving the community in the project. Indeed, many of the comments about both the community fundraising model and the community co-operative model indicated that involving the community in the school-based solar PV project was a good idea, echoing the Phase 1 interview respondents. The conclusion that the funding model (i.e., how a project is implemented) affects the social acceptance of a project corroborates the conclusions from the wind energy literature that indicate that how a project is implemented can significantly affect the social acceptance of the project at the community scale (Devine-Wright, 2005; Gross, 2007; Jobert, Laborgne, & Mimler, 2007; Mallett, 2007; Ornetzeder & Rohracher, 2006; van der Horst, 2007; Wolsink, 2007a; Wolsink, 2007b; Wustenhagen, Wolsink, & Burer, 2007).

7 Conclusions

This research demonstrates that respondents generally have a positive perception of solar PV technology. The cost and economic viability of the technology is a frequently-cited concern, but nonetheless respondents generally indicate that they would be willing to purchase solar PV technology themselves, or would actively participate in a solar PV project in their neighbourhood. However, funding models that place much of the fundraising burden on the individual schools (and thus the school stakeholders) are less well-received than corporate or government/utility-run programs. Schools are already required to fundraise for many of their extra-curricular activities, and in some cases fundraise to cover some of their basic operating costs. High school stakeholders in particular are less likely to actively support a school-based solar PV project simply because their time and resources are already in short supply. Stakeholders recognize that a school-based solar PV project is potentially environmentally and educationally valuable, but they argue that school funds are already stretched, and that a solar PV project should not take priority over other existing financial commitments.

The government/utility funding model was the most popular funding model, as it was seen to take the financial and planning burden off the schools. There were fewer reservations about relinquishing project control to the government or utility, and stakeholders seemed to have greater trust for the reliability of government funding, as compared to corporate sources (either through the corporate sponsorship or renting school roof-space models). The corporate sponsorship model was the second-most popular funding model, but was also shown to be the most controversial. Stakeholders were concerned with corporate advertising and corporate influence in the education system. Despite wanting assistance in funding the school-based solar PV projects, stakeholders were wary of relinquishing their input and control of the project to a corporate entity. Some stakeholders were quite adamant about preventing corporate influence in the school system, and therefore this funding model for school-based solar PV projects should be untaken with caution. Stakeholder input and participation in the planning and implementation of a project can help to build trust between the school stakeholders and the corporate sponsor (and between the different stakeholder groups), which could help alleviate some of the concerns about this funding model. This stakeholder involvement and communication can also improve the educational impact of the project.

For the HDSB and HCDSB case study, the data collection itself was a participatory process. Stakeholders that would not have necessarily been asked to participate in the implementation of a school-based solar PV project were asked their opinion of the technology itself, and the funding models for implementation. Although there was less support among stakeholders for funding models that required the school itself to take the lead in funding and implementing the project, stakeholder participation in the project was still important for knowledge transfer and education. Simply raising the necessary funds is not the end of the story in terms of maximizing the benefits of a school-based solar PV project. Stakeholders (particularly administrators and teachers) need to be actively involved in the project to ensure that the solar PV technology is used in an effective, educational way. As demonstrated, stakeholders generally do have a positive perception of solar PV technology, but tend to prefer funding models that limit to some extent stakeholder responsibility for the project. Time and resources need to be dedicated to developing corresponding educational materials to ensure that once the solar PV technology is installed it can be used effectively for educational purposes.

7.1 Implications and Recommendations

This research demonstrates that in order to minimize the barriers and maximize the benefits of a school-based solar PV project, aspects of the project that may affect the social acceptance of the project should be considered. The factors that may impede development from the perspective of social acceptance include stakeholder perceptions of the technology itself, and perceptions of the way the project is implemented. This research has shown that respondents in the HDSB and HCDSB districts generally have a positive perception of solar PV technology, but are concerned to some extent about the cost and economic viability of implementing this kind of project. Because schools have challenges funding existing elementary and secondary programs and activities, school-based solar PV projects must be implemented in a way that maximizes the potential benefits of the project, in order to justify the economic cost. Therefore, it is very important to consider stakeholder perception of how (and by whom) a project is implemented.

In the HDSB and HCDSB, ideally, a project could be implemented using the government and utility model. Provincial funding does exist in Ontario for community-based projects (through, for example, the Ontario Community Power Fund); however, there is not currently specific funding for school-based solar PV projects. Creating a government-run funding program for school-based solar PV projects would be one way to encourage the development of these kinds of projects, particularly because this is the model that is most positively viewed by project stakeholders.

The corporate sponsorship model is still a viable option for funding school-based solar PV projects in the HDSB and the HCDSB. This model is certainly the most controversial of the five funding models, but still could be used to fund a project. Critical to the success of projects using this model would be a high level of stakeholder involvement and communication. This may help to alleviate some of the concerns that stakeholders may have about the corporate involvement in schools by building trust between the stakeholders.

Regardless of the funding model, communication among project stakeholders is key. As mentioned, communication helps to build trust among stakeholders; however, communication also helps to facilitate education and knowledge transfer. The more project stakeholders (including students and community members) are involved in the development process, the greater the educational impact of the project (which aids to maximize the benefit of the project). Perhaps most importantly, to maximize the benefits of a school-based solar PV project (particularly the educational benefits), the social acceptance of teachers and administrators is paramount. If teachers are not willing (or able) to incorporate the solar PV technology into the classroom, then the primary goal and benefit of this kind of project cannot be realized. Resources and support to teachers must be made available in order to help them learn about the technology themselves, and thus be able to integrate the technology into the classroom.

With any of the funding models, this thesis recommends that concurrent to any implementation of school-based solar PV projects, educational funding and materials also need to be explicitly developed. The educational use of the technology is one of the key benefits to this kind of project, and therefore support and materials need to be planned and made available, particularly to teachers, in order to maximize this project benefit.

School-based solar PV projects have the potential to combine environmentally-positive energy technology, youth and community engagement and education, and potential economic gains. These projects can help to find sustainable energy solutions for Ontario, while at the same time engaging students to think about (and find solutions to) the world's environmental and energy challenges. School-based solar PV projects are only a small part of the solution, but if implemented properly, can contribute to creating a more sustainable world.

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