

Consumer's Perceptions of Recycled and Remanufactured PV Solar Panels in Nova Scotia:
Basis for the Development of a new Market

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ABSTRACT

The possibilities of recycled and remanufactured solar panels, if integrated into the market properly, could create an economic, environmental, and political opportunity in Nova Scotia and other regions across the world. Previous research is limited pertaining to the recycled or remanufactured solar panel market due to it being a recent concept. Most research focuses on the science of solar panel composition and the expected production of solar energy, not the implementation of more environmentally friendly panel options in the market. Due to this lack

of research, there is no foundational research to determine if there exists a market for recycled and remanufactured solar panels in the first place which is the gap this study aims to fill. This study uses a two-part method composed of a quantitative anonymous questionnaire followed by a qualitative analysis of the data gathered. The goal of this study is to determine if there is a possible market for, and gather consumers' perceptions of recycled and remanufactured solar panels in comparison to newly manufactured solar panels. The findings of this study conclude that the majority of consumers would rather purchase recycled or remanufactured solar panels but have expectations to pay less for them as opposed to newly manufactured solar panels. This research sets the foundation for future studies by determining that a possible market exists and allows for future research on how this possible market could be directed and implemented.

INTRODUCTION

Assuming no future incentives beyond 2019, 140MW (approx. 17,500 solar homes) are expected to be installed in Nova Scotia by 2030 (Dunsky Energy Consulting). This is evidence of Nova Scotia Power's goal to have energy sourced from 80% renewable sources by 2030 and being net zero by 2050 ("Clean Energy"). There has been immense growth in the renewable energy industry in Nova Scotia, and one of the most prominent forms of renewable energy being installed is solar power. Due to its feasibility and economic possibilities, solar power is one of the most profitable forms of renewable energy. Solar power is the only renewable energy source that is commercially viable and able to be installed in individual homes and businesses rather than be funded by the government. Other forms of renewable energy such as wind power use funding from the government to be installed, whereas solar does not require this and the installation costs can be covered by an individual. This allows for more solar energy to be produced as solar panels take up less space and consumers pay the initial installation costs often with the help of government rebates. Due to solar panels being commercially sold, individuals reap the benefits of paying less to power their homes and the government benefits by reaching sustainability goals and pushing installation costs onto consumers thus saving them money.

The aim of this study is to analyze consumer's perceptions of the only commercially viable renewable energy source available: solar panels. The solar panel industry will benefit the overall economy and environment as it grows. The creation of jobs, dispersal of costs among consumers, sustainability goal completion and the investment in the future of their province, country, etc. are just some reasons the solar panel industry is important for governments,

businesses, and individuals alike. To maximize the benefits of solar energy, encouraging recycled and remanufactured panels will decrease the marginal cost of producing each panel by decreasing its impact on the environment and the cost of the materials required to produce them therefore increasing the profit that could be made per panel. This makes recycled and remanufactured solar panels an exciting direction for the solar panel market that with further research on how it would be brought into the market could lead to making a previously environmentally friendly industry even more sustainable than it already is whilst increasing its economic benefits for numerous parties.

The research question for this study is: What are consumer's perceptions of recycled and remanufactured PV solar panels in Nova Scotia and is there a possible market for them? The hypothesis is that consumers will be more likely to purchase and willing to pay more for newly manufactured solar panels. Although this hypothesis is derived as a result of the modern consumerist society, where individuals often prefer to purchase newer or branded products, even if the hypothesis is proven to be true it could still lead to future research into what incentives will make consumers more favorable to recycled and remanufactured PV panels.

LITERATURE REVIEW

Purpose and Search Strategies

All sources in this literature review have been analyzed to meet the currency (published date recency), relevance (connection to the topic), authority (authors and publisher's credibility), accuracy (how truthful the information contained is) and purpose (reasoning for why the source was created) of the given topic. The information contained within this literature review has been organized thematically (in a way that relates to the topic) within the categories of *Green Marketing*, *Marketing of PV Solar Panels*, and *PV Solar Panel and Renewable Energy Industry in Nova Scotia*.

1. Green Marketing

1.1- Environmental Awareness of Consumers, Organizations, Companies, and Governments

Climate change, pollution, and ecosystem diversity among others are some of the many global issues currently being faced. Many organizations, companies, governments, and even consumers have taken action to mitigate these issues. As time goes on, more environmental awareness can be identified throughout society due to educational efforts made by a variety of

government, organization, and individual educational efforts. In a survey conducted by researchers at Southern Cross University, 93% of the 913 respondents from the United States of America and Australia indicated a general concern for the environment and 77% were interested in furthering their education on how to live a sustainable lifestyle (“Going Green”).

The 2017 Carbon Majors Report asserts that 71% of all global GHG emissions since 1988 can be traced to just 100 fossil fuel producers, including ExxonMobil Corp, Aramco (Saudi Arabian Oil Company), and Chevron Corp, among others; however, many other large companies throughout a variety of industries have made huge advances towards becoming more environmentally aware (Griffin 8, 14-15). The Honda Sustainability Report outlined details of Honda’s initiatives to lower CO2 emissions from their vehicle, motorcycle, and power products by 30% in the year 2020 (57). McDonald’s supports the UN Sustainable Development Goals movement and has already begun making advances to reduce their environmental impact; 80% of guest packaging sourced for McDonald’s restaurants was made of fiber sources as opposed to plastic, just one of the advances they have made to date. Even in the clothing industries, companies such as NIKE have made the switch to using 100% renewable energy in the U.S. and Canada (14). These are just a few of the many companies that are demonstrating environmental awareness and aspiring for sustainable changes.

Governments around the world have been major motivators for the environmental movement. Organizations such as the United Nations which has 193 member nations have laid out collaborative plans to solve environmental issues. The UN’s Sustainable Development Goals and Agenda have been major contributors to action taken around the world and has caused many governments to reduce the environmental impact within their countries (Department of Economic and Social Affairs).

1.2- Green Marketing Trends

“Green,” “Eco-Friendly,” “Sustainable,” and “Net Zero ” are among the most searched environmentally friendly keywords on Google (Green Buzzwords Online Search Edition, 2016). Words like these are common marketing strategies used to let consumers know that a product is more environmentally friendly than its competitors who do not use these keywords. Many producers have been known to use these words on their packaging and in marketing without any real basis to support their use. Labels have been created to help consumers identify genuinely environmentally friendly products that have specific requirements in order to qualify for the use

of each one. In Canada, EcoLogo, Energy Star, Forest Stewardship Council, Fairtrade, and the Mobius Loop (recyclable symbol), are all examples of labels created by organizations that have specific requirements in order for companies to obtain permission to use their logo on product packaging (Hahnel, et al.). These labels and buzzwords make products more desirable and increase sales; however, many consumers have become skeptical due to a lack of consistency in the qualifications to use certain words and labels on products that differ by organization (Duquesne University).

1.3- Predicted and Actual Success of Green Marketing

MECLABS, the world's largest marketing research institute found that green marketing had a 46% relative increase in conversion. They claim that the success of green marketing is determined by four factors: 1. Tangibility, 2. Relevance, 3. Uniqueness of Claim, and 4. Believability. If a green marketing claim meets these four criteria, it is expected that the product will see increased sales. These trends carry across all markets and success is directly related to the alignment of the claim with the four criteria mentioned above (McGlaughlin).

Researchers at NYU's Stern Center for Sustainable Business found that products marked as sustainable grew 5.6% faster than those not marked as sustainable. It was also determined that products marked as sustainable were responsible for 51.6% of packaged goods market growth from 2013-2018, despite only making up 16.6% of the total market. This study did not consider products with recyclable packaging or natural products with no other sustainable identification as sustainable products. By not including these products in the study, the actual growth can be assumed as larger than indicated (Kronthal-Sacco, Randi and Tansi Whelen).

2. Marketing of PV Solar Panels

The information contained within section 2. *Marketing of PV Solar Panels* contains non-academically sourced data. The rest of this report is academically sourced but due to the nature of this section of the literature review it was necessary to include non-academic sources as no academic sources are currently available at the time this report was written. When researching current marketing strategies for PV solar panels, the data was retrieved by using a Google search engine and searching for "Solar marketing strategies." The first five results were then analyzed to determine what strategies are commonly used as there is no academic compilation of this data available. The non-academic sources contained within this section are cited in the subsection of the works cited labeled "Works Cited for Literature Review Section

2”.

2.1- Common Marketing Strategies Implemented with PV Solar Panels

The first five results from a Google search engine when “Solar marketing strategies” is researched are Webfx.com, aurosolar.com, creativenurds.com, reonomy.com, and cleangroup.org. The common strategies these websites listed for marketing solar panels include: search engine optimization (SEO), social media marketing, conversion rate optimization (CRO), paid social and search ads, infographics, payback and size calculators, market affordability, reducing complexity, and increasing visibility. SEO was the most commonly mentioned marketing strategy. SEO refers to using keywords to increase traffic on their website by making their website come up as results for a variety of searches. Paid ads, advertisements that the company pays another organization to make public, were also commonly mentioned. The trending overall theme that was recognized was website improvement which includes nearly all of the marketing strategies found on the five search results in one way or another. There was no research found on the effectiveness of these strategies which could be a direction for future research.

3. PV Solar Panel and Renewable Energy Industry in Nova Scotia

3.1- Nova Scotia’s Renewable Energy Industry in Comparison to Other Provinces in Canada

In 2018, Nova Scotia generated 55.8% of its energy and produced 2319MW of energy from renewable sources. In comparison to the other Atlantic provinces, Nova Scotia is ranked 3rd in both total renewable energy production and the percentage of their energy production that is renewable. New Brunswick is the only Atlantic province below Nova Scotia in terms of the percentage of energy production that is renewable as only 30.6% of its energy comes from renewable sources (2018). Prince Edward Island ranks lowest in total renewable energy production having produced only 642MW of energy from renewable sources in 2018. However, the 642MW of energy covers 99.2% of PEI’s total energy consumption. Looking outside the Atlantic provinces, 99.9% of Manitoba’s energy comes from renewable sources, making it the highest in the country followed by Quebec, Prince Edward Island, and then British Columbia. The lowest percentages across the country are in Alberta (9.1%), Saskatchewan (16.8%), New Brunswick (30.6%) and Ontario (34.8%). The Canadian territories were not included in this

comparison because of their low populations which makes any comparison with a populated province draw an irrelevant conclusion (CER).

Nova Scotia is sixth in Canada for the percentage of their energy production that comes from renewable sources and 9th in terms of total renewable energy production, followed only by PEI (Canada Energy Regulator, Data and Analysis Division, 19 Mar. 2021. www.cer-rec.gc.ca/en/data-analysis/energy-commodities/electricity/report/canadas-renewable-power/canadas-renewable-power/provinces/renewable-power-canada-nova-scotia.html). Nova Scotia is one of the least advanced provinces in the renewable energy sector, meaning there is plenty of room for development. This helps to show the importance of this study as Nova Scotia is rapidly progressing in its development of renewable energy and solar energy in particular. In a Nova Scotia Natural Resources and Renewables News Release, Jean Habel, the director of the Canadian Renewable Energy Association for Quebec and Atlantic Canada stated that “the wind and solar industries are uniquely positioned to deliver clean, low-cost, reliable, flexible and scalable solutions to meet Nova Scotia’s energy needs.” (Natural Resources and Renewables, 11 Feb. 2022. novascotia.ca/news/release/?id=20220211004). Nova Scotia Power has continued to show its confidence in the solar industry for fulfilling its energy demand by investing in numerous solar projects such as the *Community Solar Garden Pilot* (Nova Scotia Power. Community Solar Garden Project).

3.2- The Role of PV Solar Panels Within Nova Scotia’s Renewable Energy Industry

Nova Scotia Power reports that they have decreased carbon emissions by 34%, reduced the use of coal by 43%, and are on track to be using 60% renewable energy sources by the end of 2022 (Nova Scotia Power. Clean Energy). Nova Scotia’s largest renewable energy sources are hydroelectricity, wind, and biomass/geothermal; however, all of these are mainly government supported projects and their purchase is not feasible for individual consumers. Solar makes up roughly 1.0% of Nova Scotia’s total energy production, but it is growing rapidly and is the only renewable energy source that is available for individual consumers to purchase that is economically viable (Canada Energy Regulator, Data and Analysis Division, 19 Mar. 2021. www.cer-rec.gc.ca/en/data-analysis/energy-commodities/electricity/report/canadas-renewable-power/canadas-renewable-power/provinces/renewable-power-canada-nova-scotia.html).

GAP IN THE RESEARCH

After having completed a literature review, the gap identified in the research was a lack of data pertaining to if a market for recycled and remanufactured PV solar panels exists. There is an abundance of research developing the science behind solar panels and the marketing of recycled and remanufactured products; however, there exists very small amounts of data combining the two, pertaining to the recycled and remanufactured PV solar panel market which this report aims to resolve. Filling this gap in the research and determining if a market for recycled and remanufactured solar panels exists is just the first step in developing the market and provides direction for future research.

RESEARCH DESIGN AND METHODOLOGY

Study Design

This study explores the market viability of recycled and remanufactured solar panels in Nova Scotia. The goal of this study is to determine if there is a possible market for and gather consumers' perceptions of recycled and remanufactured solar panels in comparison to newly manufactured solar panels. This is important because the PV solar panel industry is growing rapidly in Nova Scotia and is the only renewable energy source that is feasible for commercial sale. Making this industry more sustainable is important so the environmental consequences of producing newly manufactured solar panels as a main energy source do not need to be resolved in the future.

A quantitative anonymous questionnaire followed by a qualitative analysis was the method of this study and was conducted throughout January and February of 2022. This approach allowed the accurate representation of a large subject pool with little to no bias or factors that could lead to untruthful responses. This method of study was chosen due to the goal of the research. When analyzing consumers' perceptions, an experiment would not provide relevant data, and interviews would have limited my subject selection to a few individuals and thus limited my results. Other study methods have similar flaws when examining this topic of research. The method chosen provided both quantitative and qualitative data as a result of the types of questions being asked and the conclusions that can be obtained from them. The quantitative values were derived from the division among respondents' perceptions as will be found using the questionnaire method and the qualitative data will be inferred from the quantitative data using an analysis method.

Respondent Selection

Respondents for this study were gathered openly and by the respondent's own personal will. The questionnaire was distributed via a variety of social media platforms where it could be easily accessed and shared. This method of open respondent selection was chosen in order to reach the largest number of respondents within Nova Scotia from a variety of locations across the province. The use of social media opened the opportunity for a larger region to be analyzed rather than, for example, my local county. Respondents were encouraged to share the questionnaire once they had completed it in order to expand my respondent group and create a wider range of diversity in age, gender and location amongst the respondents. This was done in hopes of obtaining the most accurate representation of Nova Scotia's population as possible. Being a Nova Scotia resident over the age of 13 was the only requirement to respond to the questionnaire which allowed a larger group of respondents to be eligible. Age 13 was chosen as the minimum response age as it was assumed an elementary level education would be required to have a full understanding of the questions within the questionnaire. In Nova Scotia, by age 13, all children should have completed their elementary education and therefore 13 was chosen as the minimum respondent age. Nova Scotia was selected as the area of concentration because of the accessibility to respondents as well as the fact that Nova Scotia is the #1 ranked province in Canada for installing solar panel systems as of May 1st, 2021 according to Energy Hub, a legally licensed social enterprise that offers free resources pertaining to the solar energy industry (*Solar Power Nova Scotia (Complete Guide 2021)*) making it a prime location to analyze consumers perceptions of a new solar panel market.

Ethics

This research meets the ethics requirements laid out by the Health Canada and Public Health Agency of Canada Research Ethics Board (REB). The four main criteria of ethics as determined by the REB are as follows: "The research is scientifically sound; The potential benefit significantly outweighs the potential for harm; There is an adequate process for informed consent, and assent where applicable; and There is justice or fairness in the selection of participants." (Health Canada, Health Science and Research, 13 Jan. 2022.

www.canada.ca/en/health-canada/

services/science-research/science-advice-decision-making/research-ethics-board/policy-guidelines-resources.html#a2) The *Tri-Council Policy Statement: Ethical Conduct for Research*

Involving Humans - TCPS 2 (2018) is the most recent detailed ethics regulations that the Health

Canada and Public Health Agency of Canada REB has published on the government of Canada website. This research meets all of the four main requirements and has been reviewed to ensure compliance with the full ethics requirements contained in the Tri-Council Policy Statement.

This research is scientifically sound because it uses a common and reliable process for gathering data; a questionnaire. There are records of the data collected and all of the data collected was relevant to the research question being asked because it was designed with the analysis and implications of the research in mind. The potential benefit outweighs the potential for harm when completing an anonymous questionnaire because there is no harm to the respondent. The only personal information being collected is the individual's age group and general residence location; however, the form used to distribute the survey does not retain respondents' email or IP addresses and therefore leaves no identifying information linked to the individual that could be used to cause harm. The benefit of the information when applied as outlined in the *Implications and Future Research* portion of this report significantly outweighs any harm that could occur. Consent is given at the beginning of the questionnaire and outlines the details of the research and how their responses will be used which meets the ethical consent requirements (see *figure 1*). This research meets the requirements for justice and fairness in the selection of participants using the methods described in the *Respondent Selection* portion of this report.

AP Research 12 survey

The following survey is being used to help provide data for a research study on the marketing of solar panels. For the purpose of this study we are looking at just Photovoltaic (PV) solar panels.

Please read and make sure you understand the following definitions before completing the survey:

Remanufactured solar panel: Used solar panels that have been repaired or certain parts have been replaced in order to return it to working standards.

Recycled solar panel: Solar panels made from materials that have been reused and placed through treatments and processes to return them to standards.

Newly manufactured solar panel: Solar panels made from new materials.

THIS SURVEY IS ANONYMOUS

By submitting your response you are consenting for the information you provide to be included in the report

Figure 1: Screenshot of briefing displayed to respondents before beginning of the questionnaire

RESULTS

The questionnaire was completed by 131 respondents across Nova Scotia. The respondents were asked to identify their age group; the results found that 15.3% of respondents

were ages 13-18, 6.1% of respondents were ages 19-25, 14.5% of respondents were ages 26-40, 50.4% of respondents were ages 41-60, 12.2% of respondents were ages 61-75, and 1.5% of respondents were ages 75+. The group with the most respondents were the ages 41-60 and the lowest group being ages 75+ (*see figure 2*), this is similar to the population age distribution in Nova Scotia as of 2021, the most recent Nova Scotia demographics statistics official publication (Finance Department, Statistics, 1995. novascotia.ca/finance/stats.div/papers/demograf/demo4.htm.) The relationship between the age demographics of the study's respondents and the age demographics of Nova Scotia helps affirm that the data collected is a relatively accurate representation of Nova Scotia as a whole.

| Age Groups | Respondents |
|------------|-------------|
| 13-18 | 20 |
| 19-25 | 8 |
| 26-40 | 19 |
| 41-60 | 66 |
| 61-75 | 16 |
| 76+ | 2 |

Figure 2: Respondents Age Group Demographics; Number of respondents per group
 Respondents were also asked to identify the gender they most associate with and the results found that 71.8% of respondents identify as female, 26.7% of the respondents identify as male, and 1.5% of respondents identify as 'other' (*see figure 3*). These responses may be slightly biased towards a female perspective as there is a higher percentage of female respondents than the actual percentage of the female population in Nova Scotia. According to the 2018 Nova Scotia Finance Statics Report, 51.1%of the population in Nova Scotia is female and 48.9% is male (Finance Department, Statistics. 25 Jan 2019. [novascotia.ca/finance/statistics/news.asp?id=14515#:~:text=This%20illustrates%20a%20continuing%20ageing,51.1%25%20\(490%2C377\)%20female.](http://novascotia.ca/finance/statistics/news.asp?id=14515#:~:text=This%20illustrates%20a%20continuing%20ageing,51.1%25%20(490%2C377)%20female.))

| Gender Identity | Respondents |
|-----------------|-------------|
| Female | 94 |
| Male | 35 |
| Other | 2 |

Figure 3: Respondent Gender Identity Demographics; Number of Respondents per Group

The first question respondents answered on the questionnaire was 'Disregarding prices, which of these three solar panels would you be more likely to purchase,' the options were: Recycled Solar Panels, Remanufactured Solar Panels, or Newly Manufactured Solar Panels.

49.62% of respondents said that disregarding price they are more likely to purchase Newly Manufactured Solar Panels, 42.75% said they are most likely to purchase Recycled Solar Panels, and 7.63% of respondents indicated that they are most likely to purchase Remanufactured Solar Panels (*see figure 4*). If recycled and remanufactured PV solar panels are grouped together as being the environmentally friendly option, then this data shows that 50.38% of respondents when disregarding price are most likely to purchase a more environmentally friendly PV solar panel. Although the groups are nearly split evenly when grouped this way, it is important to note that this data shows more of an interest for a market in recycled PV solar panels over the market for remanufactured PV solar panels. The goal of this question was to determine if, disregarding prices, there is a potential market for recycled and remanufactured PV solar panels.

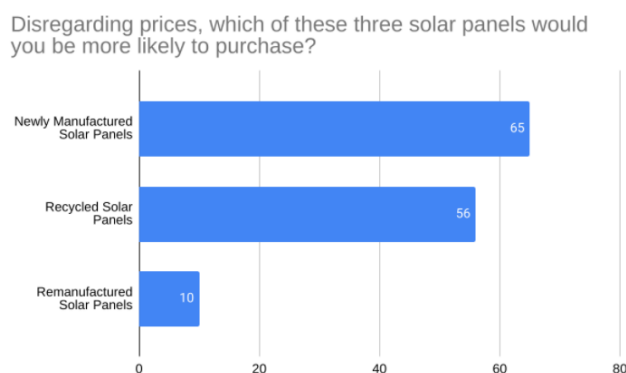


Figure 4: Number of Respondents who each of Selected Newly Manufactured Solar Panels, Recycled Solar Panels or Remanufactured Solar Panels

This raises questions as to if prices are the sole reason for why environmentally friendly solar panels or even other products are purchased less frequently which could be an area for future research.

When asked which factor is most important for an individual when shopping for solar panels, 36.2% responded environmental impact and 63.8% responded price (*see figure 5*). This shows that although a market exists for recycled and remanufactured PV solar panels, price is an crucial factor on if they would be successful or not.

Which of the following is most important to you when shopping for solar panels
 130 responses

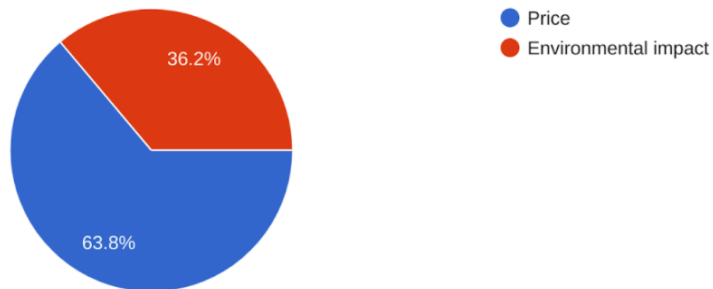


Figure 5: Respondent Percentage Distribution- Personal Importance of Price and Environmental Impact

This leads into the following question where respondents were asked which of the three solar panel options from the first question they would be willing to pay the most for. The data resulting from the first question was relatively evenly divided, indicating that if the market were to be introduced, the purchasing trends when disregarding prices would align accordingly; however, the responses to the second question are drastically different. When prices are factored in, 79.8% of respondents said they expect to pay the most for Newly Manufactured Solar Panels whereas 2.3% responded that they would expect to pay the most for Remanufactured Solar Panels, and 17.8% responded they would expect to pay the most for Recycled Solar Panels (see figure 6). This data shows that consumers expect to pay more for newly manufactured PV solar panels and therefore expect to see discounted prices on recycled and remanufactured PV solar panels in comparison.

Which of the following options would you be willing to pay the most for?

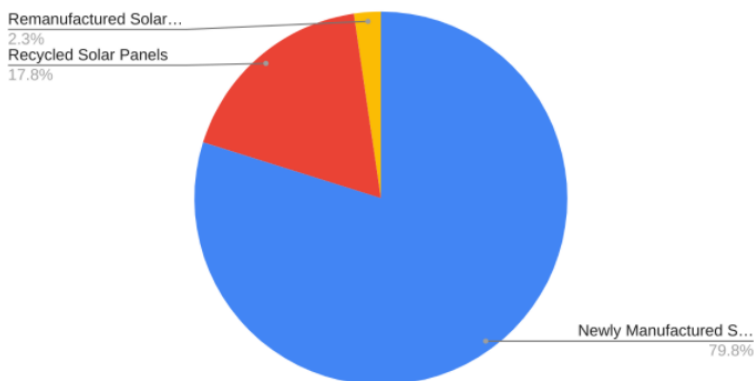


Figure 6: Respondent Percentage Distribution- Are Respondents Willing to Pay More for Recycled, Remanufactured or Newly Manufactured PV Solar Panels?

When asked how much more respondents would be willing to pay for the option they chose in the previous question, 18.5% responded \$0-50CAD, 29.2% responded \$51-100CAD, 30.8% responded \$101-150CAD, and 21.5% responded they are willing to pay upwards of \$151CAD for the option they chose (*see figure 7*).

| How much more would you be willing to pay for the option you chose in the previous question (Per panel)? (This is in comparison to the other two panel options) | Respondents (%) |
|---|-----------------|
| 0-50 canadian dollars | 18.5 |
| 51-100 canadian dollars | 29.2 |
| 101-150 canadian dollars | 30.8 |
| 151+ canadian dollars | 21.5 |

Figure 7: Respondent Percentage Distribution- How Much More are Respondents Willing to Pay for the Panel Option They Would be Willing to pay the Most for?

13.7% of respondents said they have previously purchased solar panels and 64.9% intended on buying solar panels in the future. This data shows that a large portion of Nova Scotians intend on buying PV solar panels in the future further reinforcing why it is so important to develop a market for the most sustainable solar panel options available.

The data has found trends that a large percentage of the population is willing to purchase environmentally friendly solar panels, however, they expect to pay less for them in comparison to newly manufactured PV solar panels. This indicates that in order for a recycled and remanufactured PV solar panel market to be successful in Nova Scotia, the market prices will have to be lowered to increase interest due to the fact that Nova Scotians weigh price higher than environmental impact when purchasing solar panels. Due to the current demand, these solar panels have the opportunity to create large amounts of revenue even with decreased prices and will help reach government environmental impact goals by creating a more sustainable market than the one that currently exists.

On everyday products, 48.9% of respondents said they are willing to pay more for a recycled or remanufactured product (*see figure 8*).

On everyday products (groceries, clothing, toiletries, etc.) are you willing to pay more for a recycled or remanufactured product?

131 responses

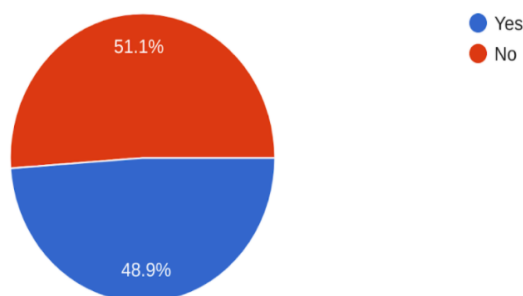


Figure 8: Respondent Percentage Distribution- Willingness to Pay More for Recycled or Remanufactured Everyday Products

This differs from the data obtained when asked if respondents are willing to pay more for recycled or remanufactured solar panels, where much less of respondents were willing to pay increased prices and most expected discounted prices. This shows that in the solar panel market, where the purchase requires a larger investment, consumers in Nova Scotia are extremely willing to purchase environmentally friendly products but hesitate due to increased prices. This research also determined that for products that require less of an investment: ‘everyday products (groceries, clothing, toiletries, etc.)’ consumers are willing to pay more. The conclusions of this research go against the hypothesis that consumers would be more likely to purchase and willing to pay more for newly manufactured products and instead proves that consumers are more likely to purchase recycled or remanufactured PV solar panels but expect discounted prices in comparison to newly manufactured PV solar panels when doing so.

LIMITATIONS

Limitations to this research include the geographic region of Nova Scotia due to a limited time frame, and the duration of the response collection which endured throughout January and February, 2022. Other limitations include the resources available to complete this study including lack of funding and limited exposure to receive more questionnaire responses.

IMPLICATIONS AND FUTURE RESEARCH

The implications of this research are that there is economic opportunity in the environmentally produced solar panel industry where demand for lower prices is not being met

and if met could lead to economic growth for both governments, businesses and individuals. Governments would be inclined to support the production of these products through funding in order to help attain their environmental goals set out in the Nova Scotia Legislatures', *BILL NO.57, Environmental Goals and Climate Change Reduction Act*, where they state their goal of being net zero by 2050 among other goals (Nova Scotia Legislature, Legislative Business, 28 Oct. 2021. [nslegislature.ca/legc/bills/64th_1st/1st_read/b057.htm](https://www.nslegislature.ca/legc/bills/64th_1st/1st_read/b057.htm).) This research provides the foundation for further research on consumers attitudes towards recycled and remanufactured products in other industries, specifically products that require larger investments. It also allows for further research on how the recycled and remanufactured PV solar panel industry can be integrated into the Nova Scotia economy and produce the most economic and environmental benefit. The results from this research could also be used to aid in developing marketing strategies to reap the benefits of the recycled and remanufactured solar panel industry. Another gap found while conducting the literature review is an overall lack of academic sources containing data on commonly used marketing strategies for solar panels and their effectiveness.

CONCLUSION

This research aimed to answer the research question: What are consumer's perceptions of recycled and remanufactured PV solar panels in Nova Scotia and is there a possible market for them? The results disproved the hypothesis by finding that consumers are more likely to purchase recycled and remanufactured solar panels but expect discounted prices for them in comparison to newly manufactured PV solar panels. This research provides the foundation for future research and can be implemented by governments and solar panel companies to develop marketing strategies for recycled and remanufactured products in order to increase profits and have less of an environmental impact.

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