Here Comes the Sun: The Effect of Solar Panel Placement on Perception of Houses

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Abstract

Greenhouse gases plague Earth's atmosphere, and by switching to solar power, humans can help to negate their effects. Many believe that people do not like the aesthetics of solar panels. This experiment tested how the presence and placement of solar panels affected perceptions of a house. To conduct the experiment, over 100 participants were recruited online. Participants were randomly assigned to view one of three sets of photographs of the back and front of a house: one that had solar panels in front, one that had solar panels in back, and one that did not have solar panels. Then, the participants were asked if they would consider buying the house, how attractive they thought the house was, and how much they thought the house was worth. The placement of solar panels on the house did not affect the perceived attractiveness or the likelihood of participants to consider buying the house, but a house with solar panels was rated as significantly less valuable than a house without solar panels. This study suggests that homeowners considering installing solar panels do not have to be so concerned about how the panels will affect their home's appearance. However, while solar panels will save money on electricity and help the environment, they may also lower the perceived value of a home. People may not object to the appearance of solar panels but also may not appreciate their financial benefit.

Keywords: solar panels, attractiveness, perceptions

Introduction

Solar panels are a green and sustainable source of energy (Solar explained, 2020). Currently, most household electricity is created by burning fossil fuels, which are in limited supply on Earth. In addition, burning those materials releases greenhouse gases and fuels global warming, slowly raising Earth's temperature (Maslin, 2008). So long as the sun shines on the Earth, solar panels will be able to produce energy. Solar panels also do not fuel global warming because they do not release any harmful greenhouse gases into our atmosphere (Chandler, 2012). Despite all the potential benefits of solar panels, an article by Kennedy and Thigpen (2019) tells us that only 6% of American homes have solar panels. This small percentage is due, in part, to many people thinking solar panels are unattractive (Dana, 2016). The purpose of this study was to examine how the addition and placement of solar panels affect perceptions of a home.

In addition to being a sustainable and green source of energy, solar panels can be a good financial investment. Solar panels save money on homeowners' electric bills (Truini, 2019). In addition, solar panels increase the value of a house. According to Shaina Mishkin (2019), a Zillow analysis compared similar homes with and without solar panels and discovered that "On average, solar panels raise a home's value by 4.1% across the U.S." This value may differ based on where you

live. The addition of solar panels to homes in the metropolitan areas of New York City, NY and Orlando, FL resulted in the greatest boost to a home's value at 5.4 and 4.6%, respectively (Mishkin, 2019).

Despite all of the benefits associated with using solar panels, many believe that solar panels are unattractive. A set of rules in Vermont prohibits many large solar projects because people think they interfere with the "aesthetics" and "scenic beauty" of the area (Dana, 2016). Many people are concerned that by buying solar panels they will diminish their home's "curb appeal" (how attractive the house looks from the curb) (Dana, 2016). A recent study found that certain features on solar panels are much preferred over others. This survey showed that people liked black frames and panels the most and liked solar panels with round cells more than other shapes such as squares (Bao, Ferik, Honda, & Shaukat, 2017).

The way that solar panels look is, in fact, very important when analyzing how much a house is worth. A study described in The Wall Street Journal found that homes with "excellent curb appeal" (e.g., having well maintained lawns and/or attractive landscaping) were bought for 7% more than similar houses located in the same area (Bonislawski, 2020). An additional study showed that houses that appeared to have a good atmosphere and architecture sold for higher prices than houses that did not have a good atmosphere and architecture (Freybote, Simon, & Beitelspacher, 2016).

Changing the direction solar panels face can have an effect on how much energy is produced. For homes in the Northern Hemisphere, most people say that you should always face your solar panels to the south which, unfortunately for some people, is their street-facing side. West-facing solar panels, however, can be even better because they produce the most energy during the late afternoon and evening when people are using the most energy (Cost of Solar, 2013). Another source argued that for homes above the equator solar panels can face any direction but north (Clendaniel, 2011). Moving solar panels to a spot invisible to people on the street may improve curb appeal, and curb appeal is believed to raise property value (Bonislawski, 2020).

While people have attributed the low number of American homes with solar panels to people's concerns with the panels' appearance, no studies were found that actually tested the effect of solar panels on perceptions of houses. Another gap in the existing research on solar panels is the lack of knowledge about how the placement of solar panels (front v. back) affects curb appeal. This study sought to address these unanswered questions. It was hypothesized that 1) Compared to people who see a house without solar panels, people who see a house with solar panels will rate the house A) more valuable but B) less attractive, and they will rate themselves C) less likely to consider buying the house. 2) Compared to people who see a house with solar panels in the front, people who see a house with solar panels in the back will rate the house A) of similar value but B) more attractive, and they will rate themselves C) more likely to consider buying the house.

Method

Participants

Participants were recruited through Amazon's Mechanical Turk to access a diverse population. Participants were invited to be in a study "to look at people's views of houses based on their external appearance." People who were interested clicked on a link to a survey created on Qualtrics. The first page of the survey was a consent form; participants who agreed to take part in the study were then randomly assigned to see one of three photos of a house: A house with solar panels in the front, a house with solar panels in the back, and a house without any solar panels. Participants ranged from 19 to 74 years of age with a median age of 36. Over half (56.7%) of the participants were male, and 43.3% of the participants were female. Around three-quarters

(77.8%) of participants self-identified as White, 7.8% of participants self-identified as Asian or Asian American, 5.6% of the participants self-identified as Black or African American, 5.6% of participants self-identified as Native American, 1.1% of the participants self-identified as Hispanic or Latino, 1.1% of participants self-identified as multiracial, and 1.1% of participants identified as "other." Participants came from 27 different states with 40% of participants coming from California, New York, and Texas. Among the participants, 73.3% had owned a home in the past and 24.4% of participants had not owned a home in the past.

Materials

The first step in creating the experimental stimulus was to find a house that could be manipulated so that it would appear to have solar panels on its front and back. A photograph was taken of a house with a roof that was visible from about 100 yards away from ground level on both sides of the home. An online photograph of a blue, square solar panel with silver edges so that it would not match the generic solar panel (Marsh, 2017) was found. Then, an app called Superimpose was used to edit the solar panel picture onto the house to create three versions of the house. One version had no solar panels, another version had solar panels on the back, and one last version had solar panels on the front; the images can be found in Figure 1. The participants were randomly assigned to see one of the three pictures.

After viewing the photo of the house, the participants were given a survey. The survey included an attractiveness scale with 8 items on a 6-point Likert-type scale that asked about various aspects of the house's appearance found in a previous study (Freybote et al., 2016). To measure perceptions of value, participants reported how much they thought the house was worth in USD. Participants were also asked whether or not they would consider buying the house, also using a 6-point Likert-type scale. At the end of the survey, participants were asked to complete several demographic questions and a manipulation check to make sure that participants were aware of the presence and placement of the solar panels.

Figure 1. House Images

The hypothesis dictating that houses with solar panels would be rated as more valuable was not supported. As shown in Figure 2, the opposite result occurred. The perceived value of a house with solar panels was significantly less than the perceived value of either house without solar panels $F(2, 58) = 3.44$, $p < .05$.

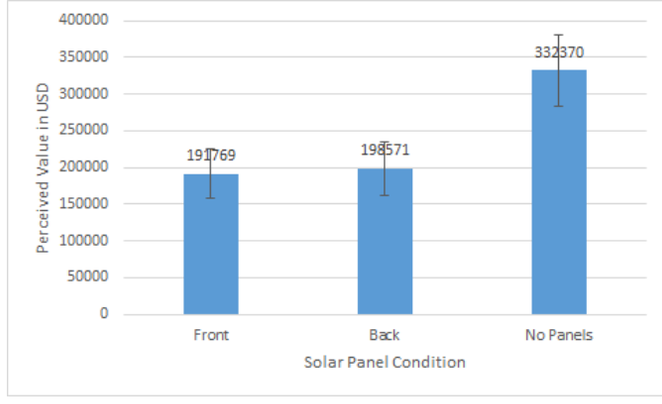

Figure 2. The Effect of Solar Panels on the Perceived Value of a House in USD

Contrary to the hypothesis that solar panels on the front of a house would reduce perceptions of the house's attractiveness, the ratings in all three conditions were statistically equivalent, $F(2, 87) = 0.74$, p=.48. The means and standard I The means and standard error of each condition are shown in Figure 3.

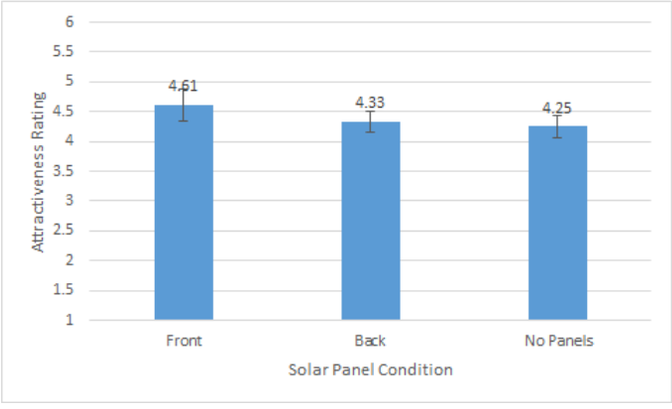

Figure 3. The Effect of Solar Panel Placement on Perceptions of House Attractiveness

Neither the presence nor placement of the solar panels affected whether or not people would consider buying the house, $F(2, 87) = 0.14$, p=.87. Figure 4 displays the means of each condition.

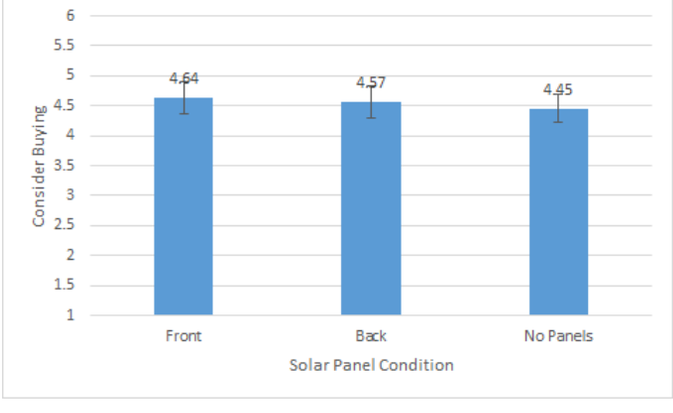

Figure 4. The Effect of Solar Panels on Whether or not People Would Consider Buying a House

Discussion

Houses with solar panels were not rated less attractive than the control house. In fact, the house with solar panels in the front actually received the highest attractiveness ratings, although the difference was insignificant. This unexpected finding may be caused by the particular questions on the attractiveness scale. For example, one item asked if the house was unique while another asked if it had any "interesting architectural features." A solar panel may not be pretty, but it may make a house appear more interesting (Why Solar Panels Can Actually Look Great, 2017). Another possibility may be that, when asked what they think about solar panels' attractiveness, people report that they are unappealing, but, when shown a picture of a house with solar panels, their perceptions are not actually affected. Past research has shown that people say they especially dislike solar panels that are colorful or have oddly shaped cells (Bao et al., 2017). It should be noted that the solar panels used in this study were dark blue and had square cells, which might not have matched people's negative image of solar panels.

D-19 caused a dramatic shift in the school experience for both students and teachers. Students were forced to change the way in which they learned. The new and rapid changes impacted the responsibilities of students. Not only is it important to recognize what students went through during the pandemic, but teachers need to know how to approach a similar situation in the future. On top of that, the administration can take note for future school policies which would incorporate positives and negatives to support the students. The research question this study aims to answer is: How does online, hybrid, and face-to-face learning affect high school students' academic motivation level during the 2020-2021 school year compared to prior years? This study seeks to look into two different hypotheses.

Contrary to the hypothesis that solar panels would increase the value of a home, houses without solar panels were rated more valuable than houses that had solar panels, regardless of the direction they faced. It had been thought that solar panels would be seen as a bonus that could save one a lot of money (Truini, 2019). Even though

people in this study did not rate houses with solar panels as less attractive, they may have thought that other people would not like the solar panels, which would drag down the home's resale value. Many people who sell solar panels fear that homeowners believe solar panels are both aesthetically displeasing and will appear out of place on their homes (Why Solar Panels Can Actually Look Great, 2017). The finding that the presence and placement of solar panels did not affect the perceived attractiveness of the house suggests that while widespread, this belief may be false. Nonetheless, if people think that others find solar panels unattractive, they may be led to think that a house with solar panels is less valuable.

It was hypothesized that solar panels would make someone less likely to consider buying a house, but, in fact, the results suggest that people did not care whether or not a house had solar panels. The house shown to participants is a fairly typical-looking house. It is in good condition and has a yard. Solar panels may not make such a huge difference that they would prevent people from even considering the house. Just because people thought the house with solar panels was worth less, did not mean they would not consider buying it.

It is important to note that this study was done on one specific house with one type and color of solar panel. To determine the effect of a variety of different panels on a variety of different types of houses more experimentation would need to be done. It also would be interesting to test how the results might differ between people in different parts of the country; people in places that are sunnier may have more positive perceptions of solar panels. Given that the present study showed that people thought solar panels decreased the value of a house, it would be worthwhile to explore whether highlighting the monetary benefits of solar panels could change this negative view.

While solar panels may lower the perceived value of a home, they do not seem to have an effect on the attractiveness of a house or how likely one is to consider buying that house. People who are looking to invest in solar panels should not be afraid of how the house will look. Not only will the panels save money on electricity, they will help to save the environment as a clean source of energy.

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