Investing in Household Solar Energy: A Financial Windfall or a Mistake?

Sarah Rogers

A World View of Math and Data Analysis

Dr. John R. Taylor, Mrs. Desire Taylor and

Mrs. Christina L. Turner

17 July 2010

Abstract

Ever since it was discovered that the suns energy could be put towards providing a future that fossil fuels could not, the race has been on to discover new technologies to make harvesting this energy possible and more affordable. Everyday new technologies are discovered and putting a piece of this ever new and fascinating future on one's roof seems to be the ideal goal that we all try to achieve, but is it ideal for every American household? A closer look at the basic prices of solar will show one that it cannot be achieved simply because one wants it to. Everyone must decide whether they are willing to make the financial commitment that installing residential solar comes with. As always, solar is not right for everyone and it must be taken into consideration that it isn't always financially wise for a family to install these panels.

Background

With Solar Energy being one of the most reliable alternative energy resources out on the market today, why is it that this market isn't growing at a more rapid pace? Shouldn't we all be taking these motives to provide a more substantial future for ourselves instead of relying on traditional resources that are slowly drying up? (www.mnn.com) Looking at the financial commitment and expectations of installing a standard 4 kWh solar panel might explain why some are hesitant to move in that direction. The basic installation cost of a panel system considered large enough to support a 2,000 square foot house is on average $18,000 (www.thesolarguide.com). Especially in the economic system that we are in today, not many households have the upfront cost ready to pay, so the household will have to get a loan with interest and monthly payments that people will find out don't always amount to less than the average monthly electric bill for normal electricity. Isn't this also assuming that one has "optimum" conditions at their home? On average solar panels said to be able to handle the size of a home end up needing to be backed up by power for a few minutes every day ("Investing in Solar Stocks"- McGraw Hill). The total minutes that had to be bought, at the end of the month add up to a total of $22.14, this sounds like a small electric bill but not so small when making a monthly loan payment on top of the $22.14.

Research Question

To try and make the monthly payments on a loan lower than the average Americans electric bill, how much of a down payment would be needed to avoid high interest costs making the total interest paid a higher number than necessary.

Method

Last year the average American household used 920 kWh per month in electricity, amounting to an average 11,040 kWh per year. With 1 kWh costing $.07 it may be assumed that solar is a wise decision, and it may for some in the appropriate financial position. Take your standard solar panel that, according to manufacturer's instructions, collects and provides enough power to illuminate a 2,000 square foot house, this panel system costs on average $18,000 after including installation and materials purchase, for the standard household to be able to pay this up front a loan is going to be needed to support this.

To take out a five year loan (five years is the average number of years before the average American household relocates) assuming that the interest rate is not going to change from 3%, although it is unlikely that the rate will remain the same. Assuming the household has no down payment to make the loan would be $18,000 with 3% interest bringing the total paid to $20,700. Now consider those who may have a down payment but must still take out a loan, the total interest paid is going to be lower than those who had no down payment to make. Two approaches can be made to figure what the down payment made must be on the loan; Approach #1: Using a guess and check method or Approach #2: Graphing to find the point of intersection.

Method continued

Approach #1:

To figure the total, plus interest, that would be paid on different variations of down payments use the following formulas:

Formula 1A: $18,000-*D*=*LA*

Formula 1B: *LA* x .03 % x 5 years= *I*

Formula 1C: *I*+*LA*=*T*

Let *D* stand for the down payment and *LA* equal the loan amount. Then multiply the loan amount by the interest of 3% by 5 years, representing the amount of time taken to pay off the loan. When calculated, one will get the total interest paid over a period of 5 years; now add that with the loan amount to get the total paid on the loan. To determine what your down payment would need to be to make the total paid every month under $179.62 (the standard amount the American household pays every month for electricity), you will need to include the loan payment (*LA)* + interest (*I*) and the $22.14 that covers the power in the situation that solar panels do not produce enough power to cover the household for that day. One would need to make a down payment of $3,000, resulting in a loan amount of $15,000, adding in 3% interest of $2,250, bringing the total paid to $17,250 to keep your interest and loan total just under your initial solar power costs of $18,000. (See data table #1)

Method continued

Approach #2:

Calculate Y= values and find the points of intersection. To calculate use the following formulas:

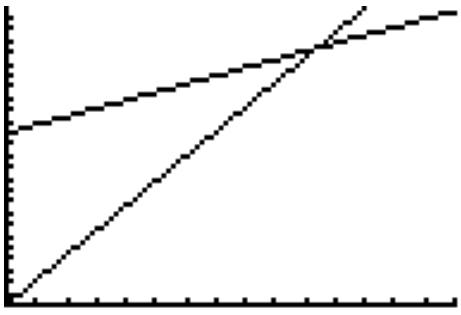
Formula 2A: Y= $15,000+$59.24X

Formula 2B: Y=$179.67X

To find formula 2A use $15,000 to represent the loan amount you would need to take out if you are going to keep you total amount paid under $18,000. Where $59.24 represents the total calculated after you multiply $18,000 by 3% interest to receive a total of $540, then multiply by the amount of years the loan will take to be paid back which is 5, and divide by 12 to translate into months, next add the $22.14 for standard backup electricity thus resulting in, the formula.

To find formula 2B one would multiply the average monthly electric bill by X to get the line that represents standard electricity.

The resulting lines look as follows:



The intersection occurs at y=11

Formula 2A is going to result in a line that begins very high, has a weak positive slope. Formula 2B is going to result in a line that starts lower than the line from Formula 2B but increases steadily until it eventually surpasses line 1. The intersection of the lines from Formula 2A and 2B is what needs to be found to figure how many years it's going to take for solar bills to become less and less than electricity bills.

Results

The values discovered from Approach #1 showed that one would need to make a down payment of at least $3,000, to take out a loan of $15,000, so as not to end up paying more than $18,000 at the end of 5 years.(See calculations from data table #1)

The values discovered in Approach #2 found that the intersection where the lines of Formula 2A and 2B met represented the number of years, 11, it will take for the monthly solar bills to become less than the monthly standard electric bills, including the $3,000 down payment at the very beginning of the solar power line.

Conclusion

In conclusion, solar energy would be a good investment if you have at least $3,000 to invest up front in a solar energy system, financially. Different aspects must be considered such as the conditions at the home, which could increase the number of kWh's that one has to purchase from the power company and thus increase the monthly electrical bill possibly making your bills quite higher than before expected. Keeping in mind that most panels are only

guaranteed for 20 years (www.smud.org), some would see buying insurance for these panels a good decision therefore adding another cost to the monthly payment. If one is planning to stay in the home for longer than 5 years it would not be a bad choice financially to get solar panel systems and begin cutting back on electric bills but solar panels are not short term investments with quick payback, they take time and money that many people are not willing to invest. Fossil Fuel powered electricity is a dwindling source and we need to take care but they can't be completely replaced, we must have them to rely on when solar is not an option.

References

Berwind, Joseph, 2009, "Investing in Solar Stocks: An investor's guide to winning in the global renewable energy market", McGraw-Hill

California Energy Commission, September 2009 "How does a solar electric system work?" www.smud.org/en/community-environment/solar/Pages/solarFAQs.aspx

Cashey, Bill, 12 July 2010 "Go Green with Solar Energy" Community Blogs http://www.mnn.com/search/apachesolr_search/solar%20energy

Coughlin, Jason, 2009, "Solar Photovoltaic Financing" National Renewable Energy Laboratory

Editor, The Solar Guide, 04 June 2010 "Solar Cost FAQ" http://www.thesolarguide.com/solar-power-uses/cost-faq.aspx

"Steps to a solar home", www.solarenergy.com, Solar Energy Initiatives

Stevensburg, Andy, "Solar Financial payback on solar electric systems". On-grid Solar Financial Analysis,www.ongrid.net/PVPayback.html

Tables/Data/Graphs

Down Payment	Loan Amount	3% Interest	Total Paid
$0	$18000	$2700	$20700
$1000	$17000	$2550	$19550
$2000	$16000	$2400	$18400
$3000	$15000	$2250	$17250
$4000	$14000	$2100	$16100
$5000	$13000	$1950	$14950
$6000	$12000	$1800	$13800
$7000	$11000	$1650	$12650
$8000	$10000	$1500	$11500
$9000	$9000	$1350	$10300
$10000	$8000	$1200	$9200
$11000	$7000	$1050	$8050

Data Table #1