

The Scope of Solar Energy

Michael DiCamillo, SBE 498 Capstone Research

Professor: Joey Iulliano

Introduction:

This study provides an overview of techniques and solar energy strategies that can be used in conjunction with solar panels. With the threat of climate change becoming more of an issue with every passing day, actions need to be taken. Solar Energy is one of the most widespread ways that everyone can take advantage of to combat climate change. In addition, this study contains an overview of cost data related to solar panels, and the use of other building techniques and materials in the Sunbelt states within the United States of America.

Methodology:

This study uses two forms of analysis:

- descriptive analysis of the Solar Energy methods, and
- observational analysis of the techniques being applied on a house in New Mexico and in southern California.



Literature Review:

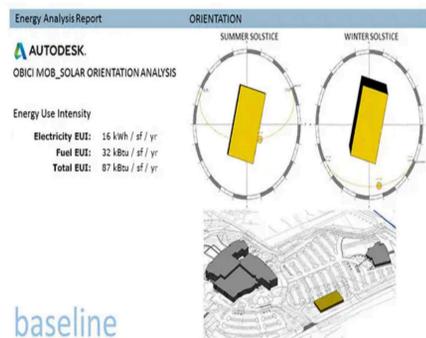


Figure 1 displays the baseline orientation of the building and the initial energy costs.

Building Techniques

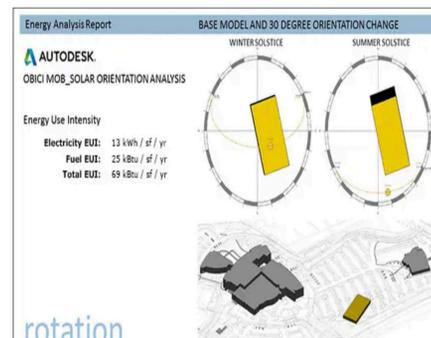


Figure 2 displays the rotated building with the listed energy savings.

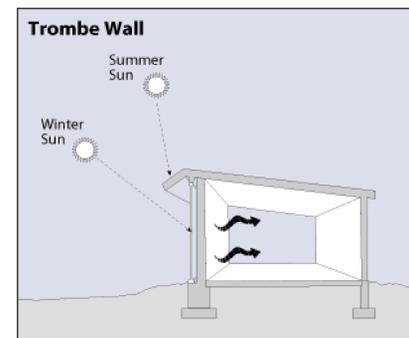


Figure 3 displays a model Trombe Wall.

Energy cost of Adobe

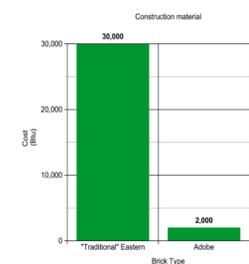


Figure 4 shows the energy cost of Adobe compared to conventional materials.

Data:

Solar Energy Costs

Sunbelt States	Starting Cost for a 6-KW system	September 2020 Energy rate (cents/kWh)
Alabama	\$13,706	13.18
Arizona	\$13,680	12.53
Arkansas	\$14,713	10.8
California	\$15,240	21.23
Florida	\$13,920	11.97
Georgia	\$15,840	12.11
Louisiana	\$15,660	9.76
Mississippi	\$14,763	10.84
Nevada	\$14,760	11.97
New Mexico	\$16,680	14.33
North Carolina	\$14,040	12.15
Oklahoma	\$14,667	10.87
South Carolina	\$16,500	12.91
Tennessee	\$13,909	10.6
Texas	\$14,820	12.01

Table 1 displays the costs of a solar panel array and the price of electricity in each of the states.

System Size	Average Solar Panel System Cost (Before Tax Credit)	Average Solar Panel System Cost (After Tax Credit)	Total Savings
2 KW	\$5,920	\$4,381	\$1,539
3 KW	\$8,880	\$6,571	\$2,309
4 KW	\$11,840	\$8,762	\$3,078
5 KW	\$14,800	\$10,952	\$3,848
6 KW	\$17,760	\$13,142	\$4,618
7 KW	\$20,720	\$15,333	\$5,387
8 KW	\$23,680	\$17,523	\$6,157
10 KW	\$29,600	\$21,904	\$7,696
12 KW	\$35,520	\$26,285	\$9,235
15 KW	\$44,400	\$32,856	\$11,544
20 KW	\$59,200	\$43,808	\$15,392
25 KW	\$74,000	\$54,760	\$19,240

Table 2 displays the costs of solar panel arrays and the potential savings from the ITC tax cut

Observations



Figure 5 displays an overview of the New Mexico home with the Solar Energy methods present.



Figure 6 shows the solar thermal energy tubes in the back of the home.



Figure 7 shows an enlarged view of the Trombe Wall.



Figure 8 displays the exterior of the La Mesa home.



Figure 9 shows the interior of the home and the natural light.



Figure 10 shows the another interior of the La Mesa home with the lights on.

Findings:

This study found affordable and effective methods to utilize solar energy:

- Solar Panels are consistently efficient and cost effective across all of the sunbelt states.
- Proper building orientation can save thousands of kWh per year.
- It is possible to implement at least some of these techniques on already constructed homes.
- Adobe is durable and cost efficient in the drier regions of the Sunbelt.

Future Topics:

- Exploring the use of batteries to store energy outside of the sunbelt.
- Applications of Solar Thermal energy to supply additional hot water to homes during the day.
- Alternate forms of Solar Power in solar powered water boilers.