Living off the Grid with Renewable Energy: A Case Study

Abstract

In this project, the benefits of renewable energy and consumer preferences were analyzed and applied to off-grid living in the form of a case study. The data on consumer preferences (Figure 2) spurred the need for a detailed assessment of the feasibility of sustainable off-grid living. After conducting extensive research, overview guidelines for living off the grid were provided which include expert experience and cost data. These guidelines were exemplified in the real-life success story of the Auerbach's off-grid home on Lasqueti Island in Canada. They were successful in creating an off-grid home which showcased several of the components discussed in the research-based guidelines. This research paper benefits the reader with a general outlook into the feasibility of off-grid living and/or ideas for implementing renewable energy sources into one's home.

Key Words: Off-Grid, Solar, Power Generation, Renewable Energy, Sustainability

Figure 1 (Auerbach 2018)

The Auerbach's off-grid home, located on Lasqueti Island in British Columbia, showcases strategically placed solar panels and a well thought out battery system that allows them to live comfortably. As you can see in Figure 1, their home is located on an island and is able to catch a lot of direct sunlight which makes solar panels a great option for their primary source of power. This is exactly what the Auerbachs did, along with a generator for back up power. For their panels, they use 2 kW Phonos modules on their shop and 2 kW Sharp modules on the house itself. They also use 1.2 kW Mitsubishi modules which are pole mounted on the roof as you can see above. Their backup generator covers the PV deficit in the Winter months, supplementing a 6-10 kWh daily load. The generator that they elected for is the 8 kW Kubota (1800 rpm).

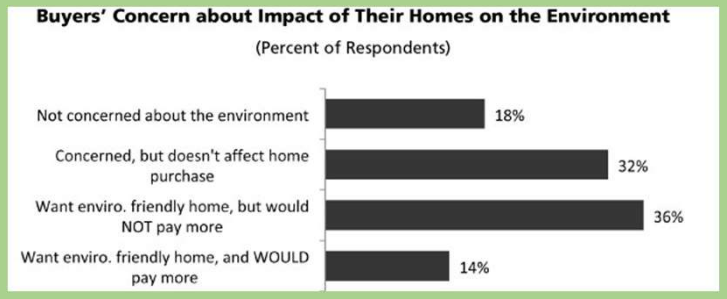

Figure 2 (NAHB 2019)

The National Association of Home Builders (NAHB) questioned recent and prospective homebuyers on if they would be willing to spend more money based on their concern for the environment. As shown in Figure 1, only 14% of respondents would pay more and the most common response was that the individual does want an environmentally friendly home but is not willing to pay more.

Off-Grid Preparation Guidelines:

1. Land Selection
2. Power Generation System
3. Power Storage System
4. Water System

Figure 3 (Auerbach 2018)

The power storage system is the focus of the Auerbach's Off-Grid home and it is something they have researched extensively through trial and error. They recently installed a 390 A/h Discover AES Battery bank which replaced their 750 A/h flooded lead acid battery. After making the switch to a lithium-ion battery system, they noticed drastic improvements in charging efficiency and a more stable operating voltage range. This preference for lithium batteries in off-grid applications was highlighted in the *Power Storage System* section. The system is also serviced by Sunny Boy 2000 inverters and MS MPPT 60/600TR(150) charge controllers.

Jake O'Balle / joballe@calpoly.edu / 925-849-7555