Overall Cost and Viability Analysis of a Solar Energy Installation at Foursquare Rum Factory

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Background During the past 2 years, the international price of oil has seen enormous fluctuations. Many companies worldwide are now turning to invest in renewable energy sources in order to increase their energy security. Solar energy is a proven resource on the island of Barbados. An initiative founded in the 1970s prepared Barbados to have the highest number - both per capita and overall - of solar hot water systems (SHWS) in the Caribbean (Haraksingh 2001). Barbados enjoys year-round dependable sunlight with a high insolation range of 4.8 – 6.2 kWh/m²/day (Headley 1999).

A model similar to the SWHS prominent on Barbadians' rooftops.
[Photo from SolarWorld Ltd]

Foursquare Rum Factory, located in St. Phillip, Barbados, has weathered the most recent spikes in energy prices, but wishes to reduce both their dependence on unstable foreign oil (Barbados is a net importer of oil), and their negative impacts on the environment.

Mr. Richard Seale, Foursquare's owner, has already established the environment as a priority through the use of a carbon dioxide capturing system, which reduces the amount of this greenhouse gas released into the atmosphere. The aim of the solar panel installation will be to further minimize overall greenhouse gas emissions by replacing some of their traditional energy sources (both from the grid and from a diesel generator) with zero-emission solar energy.

Demand Profile The energy demand of the rum distillery fluctuates daily depending on which processes are running and which stage of each process is underway. The peak demand, which occurs when the fermentor, pot stills, and column stills are running simultaneously reaches 11,000 kWh over a 3-day period. Demand reaches a minimum on non-production days with electricity required for minor activities such as office air-conditioning and maintenance tasks on equipment. The bottling plant – in a separate building from the distillery – runs on a more consistent schedule, with fairly steady demand limited to the daytime hours of 8:30 am to 4:30 pm. This is an optimal schedule for providing solar energy, as batteries (which bring a sharp increase in cost and maintenance) will not be required. The cost analysis of a proposed solar panel installation was therefore restricted to focusing on replacing the bottling plant's energy needs.

Design A surveyor was contracted to obtain a blueprint of the surfaces available on the factory's property (both roof and ground-sites) as well as the angles of the roofs. An optimal angle of 13.5º was desired as this matches the latitude of the island. With the results from the surveyor, it was decided that the panels would be best mounted on the southern-facing, 14.1º sloped roofs of the bottling plant. An overflow of one-third of the panels would also need to be mounted on the ground as the optimal power supply cannot be matched with the limited space available on the roof.

South-facing roofs of the bottling plant with proposed open ground area. June, 2009. [Photo by E. Michaux]

The first step of the design process was to evaluate different solar panels in terms of cost, efficiency, warranty, and surface area. The model chosen for its optimization of this combination of factors was a Kyocera KD210GX-LP 210 W panel, with a cost of $580.90 US per panel (Kyocera… 2009). An inverter is also required as the solar panel produces DC current, while the bottling plant runs off AC current. The inverter capable of handling the solar power load within the required voltage and ampacity range chosen was the GT100E Grid-Tie Solar Inverter with a cost of $60 000 US. The remaining components of the system contribute approximately 3% of the cost; these include electrical equipment such as the DC and AC fuse switchboxes and wiring. Mounting materials will add approximately $88 500 US to the project cost. Rough estimates have been made for these specifications as the exact quantities will be known once the implementation or installation phase is undertaken.

Final Cost Estimate To fulfill an almost 80% offset of the bottling plant's energy demand - 68.8 kW of AC power - 510 solar panels are required. These, along with the additional components, bring the final cost estimate to $490 550 US. A grant of an estimated 50% of the overall cost from the European Union's Integrated Development Program for the ACP Caribbean Rum Sector will bring the payback period down to 6 years. Even without the grant, over the 20 year lifetime of the panels and based on a current price of electricity of $0.25 US per kWh, the payback period is estimated to be 11.5 years (The Research and Planning… 2008).

Conclusion and Recommendations With the final cost of the solar panel installation estimated at $490 550 US, and a maximum payback period of 11.5 years, a solar panel installation is sound both economically and environmentally.

Foursquare Rum Factory can also use the solar panels to enhance their heritage park by providing information to tourists on the benefits of solar energy, especially in the Caribbean. Through this initiative the company can set a precedent for other similar industries, both in the region and globally.

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