

Scoping the Feasibility of Solar Photovoltaics for Applications in Northern Peru

Masterthesis

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Abstract

The aim and objectives of this project have been developed in partnership with Ecoswell, a nongovernmental organisation based in Lobitos Peru. Ecoswell supported through translation and assistance in field data capture and subsequent review of the project.

The overall aim of this project is to: develop detailed design and financial analysis for the most promising solar energy application in Lobitos in sufficient detail to underpin a financial analysis and potential application for funding.

Primary evidence was collected through field work during spring 2014 including 20 interviews conducted with local politicians, residents, schools, the security services and the local electricity distribution company (ENOSA). These interviews were conducted with a view to understanding issues relating to electricity in Lobitos and identify potential applications that could benefit from being powered by solar Photovoltaic (PV) systems. A desktop study on the energy policy and projects in Peru and global trends in PV formed the secondary evidence for the report.

The results of the interviews fed into the identification of 8 applications that were taken through a scoping assessment. This included a description of the application, a literature and case study review, a load analysis, equipment analysis, estimated costs of each system and a Strengths Weaknesses Opportunities and Threats (SWOT)

analysis for each application. The resulting cost estimate for each application is presented in Table 1.

The lighting of the football court was taken through for detailed design due to the number of other potential lighting applications that a system such as this could be applied to (e.g., street lighting, fish quay lighting). 4 modes of operation were considered under the detailed design namely: 12V DC, 24V DC, 220V AC with 3days of battery supplied autonomy and 220V AC with no battery autonomy.

Optimisation of the battery bank, PV panel, cable sizing and ancillaries was then undertaken to assess costs over a 10 year life. The analysis also showed that there was minimal variation in cost for this application between 12V, 24V and 220V 3 days' autonomy operating modes with a variation of \$292.91 with the cheapest capital cost being \$6,311.13.

A financial analysis was then undertaken to investigate the viability of funding the detailed design through either a loan agreement or an upfront investment. The results of the loan analysis showed that a monthly saving could be accrued from a loan option but only with a 40% upfront deposit (\$2,627.60). This option would provide a monthly saving of \$6.99 based on a 10 year loan at 10% interest. A discounted payback analysis showed that, at a discount rate of 7.5%, payback on an investment would not be achieved until year 18 with only \$604.73 return on investment over 20 years. This analysis takes into account the extra investment required to extend the life of the system to 20 years.

In conclusion, there are a number of applications for solar PV in Lobitos that make sense from a technical perspective. However, the financial case is more complex. The application to light the football court detailed in Section 8 will not provide the savings or returns on investment to justify the initial cost and risk inherent in financing. This conclusion is expected to be common when assessing similar applications to convert grid connected loads to PV with the Peruvian wholesale electricity market suppressed by natural gas subsidies and the lack of a feed-in- tariff for small scale renewable energy generators.

In order to address these financial constraints, it is recommended that Ecoswell:

1. Focus applications where there is no existing grid connection removing the need to disconnect from the grid,
2. Lobby government to introduce a feed-in- tariff for small scale renewables to improve the business case for projects,
3. Look for opportunities to supply low interest rate finance for renewable energy projects reducing the levels of interest paid for financing projects,

4. Look for grants to act as up front deposits to reduce the interest paid over the lifetime of projects.