UNSWERV – Engineering Students Helping Out while Learning through Practice.

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UNSW School of Photovoltaic and Renewable Energy Engineering, through *UNSW Énergie Renouvelable Vanuatu* (UNSWERV), has been undertaking renewable energy education/development projects in Tanna Island, Vanuatu since 2007 (Matich 2020). The projects have ranged from tiny stand-alone photovoltaic (PV) DC lighting and phone charging in village aid posts through lighting in schools and a village water supply to a hydro-powered village AC minigrid. Tanna (40km long, 19km wide, pop. 29,000) is a tropical island with a small diesel/PV public grid, operated on behalf of the Government, in the concession area comprising the provincial capital of Lenakel/Isangel, the airport, a secondary college, west-coast resorts and nearby villages (134 customers).

There is only a single hospital for the island, located in the same town and the outlying villages are served by about seven dispensaries, with a trained nurse and operated by the Department of Health, and about twenty aid posts, owned and operated by the host village communities. Prior to UNSWERV, almost none of the dispensaries or aid posts had even basic lighting but most now have at least 100-200W PV and a small 12VDC power supply, a handful of low-power LED lights and a USB phone charger. Three schools, two (one secondary and one primary) in Imaki village and one (secondary) in Lamlu village have had minimal electricity supplies provided by UNSWERV but the UNSWERV-installed pico-hydro minigrid for Imaki was destroyed by Cyclone Pam in 2015 (Connors 2016).

While most of the people of Tanna are energy-poor, the island is rich in solar and geothermal energy resources, being located only 19˚ south of the equator and hosting the constantly-active Mt. Yasur volcano (McCoy-West et al. 2009). UNSWERV's current, active but caronavirus-delayed, design projects include

- PV power supply for a 15 computers, currently supplied by a petrol generator, in a new laboratory at Lamlu School;
- PV water pumping for the Iquaramanu community to the south and west of the volcano;
- PV power for Iquaramanu village;
- PV lighting and phone charging for proposed HQ for South Tanna Area Council of Chiefs;
- Centralised versus distributed power supply comparison for Tanna;
- PV water pumped groundwater supply for Lowanatom village, West Tanna;
- Revival of the Imaki hydro minigrid with PV (Fig. 2);
- Geothermal electricity supply for Tanna island, including electrification of transport.

Just two are expounded below but the presentation will touch on all active projects.

Figure 1. The first of two racks of modules is installed at Imaki

The destruction wrought by Cyclone Pam in 2015 destroyed the pico-hydro power supply for the Imaki minigrid, leaving the Monday – Friday boarding school to revert to expensive diesel-fuelled electricity supply and solar lanterns. UNSWERV was subsequently able to install a small PV lighting system for the regional dispensary but the revival of the minigrid has been a slow and halting project, still unfinished. PV minigrids are one of the solutions proposed by Johnston and Wade (2016) for Vanuatu islands. Fear of caronavirus has now caused Vanuatu to close its borders and UNSWERV has been unable to return to finish the project. One of two racks of modules that will replace the original hydro turbine supply is installed (Fig. 1), as is a new 24V battery and a PV inverter to convert the direct current of the PV array to alternating current and feeds it to the original hydro-powered minigrid. In January 2020 the original inverter remote controller, necessary for commissioning, was found to have been damaged in the cyclone and will be replaced at the next opportunity. Fourteen of the mounted modules will then be series-connected in one string to one maximum power point tracking (MPPT) input of the PV inverter for system commissioning and testing. All going well, that will be followed by construction of the second rack and connection of two more strings.

Figure 2. Fumerole at Port Resolution, east of the volcano

Geothermal energy (Fig. 2) has not been significantly exploited in Vanuatu and not at all for electricity production, although significant preparatory work was undertaken for a proposed 4 MW geothermal power station on the “main” island of Efate (Geodynamics 2014). Construction of a similar, or larger, power station on Tanna will need sufficient reliable, committed load to justify the large investment and engagement of international specialists. To that end, UNSWERV is considering a range of potential future loads that could improve the lives of the Tanna people, if they chose to follow such a path. In particular, we are interested in investigating:

- Reversal of an earlier plan, to provide diesel/PV grid electricity from the existing concession area on the west coast across the mountainous interior to the volcano area on the east coast (Utilities Regulatory Authority 2011), to generate geothermal electricity in the west and supply the existing grid concession area, the proposed extension area and, potentially, the other parts of the island;
- Health services;
- Potential expansion and enhancement of energy services for tourism;
- Communications services;
- Water desalination, purification and waste water treatment

- Electrification of ground transport, including EV utilities (Schmidt 2020);
- Electrification of coastal and inter-island water transport;
- Culturally and environmentally appropriate entrepreneurial export businesses;
- Geothermal heat applications for food preservation (Fig. 3).

Figure 3. Preserving chillis in an UNSWERV solar dryer in Port Vila, Vanuatu

The presentation will provide an update on this multifaceted group of projects, linked by location, context and outstanding educational experiences.

References

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