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Sustainable Energy for Manus Province

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Abstract

The aim of this paper is to explore sustainable business opportunities designed to revive and maintain the local economy of Manus province following the closure of the Australian Asylum Seekers Processing Facility on Los Negros Island in Manus province, Papua New Guinea. The eventual closure in late 2017 has left a legacy of severe local unemployment, environmental degradation, waste management issues and social dislocation.

The authors consider that Manus has the means to become self-sufficient in energy. However, the present escalating cost of diesel fuel for the island's power generator is one of the greatest expenses confronting the Manus's mainly subsistence economy. From an energy sustainability perspective, the island has a large commercial coconut crusher currently located in the provincial capital Lorengau, and 24 under-utilised coastal copra plantations easily accessible by barge (Manus DPI, 2012). It has substantial deep-water wharf facilities at Lombrum Naval Base conveniently close to the island's existing power generators, which are in dire need of replacement. In addition, solar will be considered in the mix of renewable energy options for the province.

The Manus economy can be expanded through practical hands-on training and mentoring to Australian standards to regenerate existing copra plantations with the ability to supply long term bio-fuel operations to power the island economy. We propose to give the people of Manus capacity to expand their economy in a sustainable way, led by the Manus community in partnership with the Australian Government, The Cairns Institute, the PNG educational institutions such as University of Papua New Guinea and University of Technology, and the Manus Local Level and Provincial Governments. Furthermore, Manus Province has great natural beauty with considerable potential as an eco-tourism destination.

This proposed program will provide regional social, economic and environmental development opportunities underpinned energy security. This will enable villagers to recover from the closure of the Australian Asylum Seekers Processing Facility by providing ongoing meaningful training and employment in a range of sectors including energy, engineering, health and tourism.

Background

Within Papua New Guinea a lack of access to energy services is a persistent and ongoing challenge for the PNG government and its citizens. The shortage of base load energy services alternatively referred to as energy poverty, is discussed in the Sustainable Development Goals as a global development challenge (UN, 2015). Numerous reports have highlighted a number of issues hindering development in PNG, amongst the most serious of these constraints is energy infrastructure and access to modern energy services (ADB, 2014; Sovacool et al., 2011). As a result, the PNG government its desire to implement a national electrification program with the objective of increasing its citizen's access to power by 2025 (Medium Term Development Plan Goals, PNG, 2015; PNG Vision 2050, 2010). The current energy situation in the Manus Islands, much like the rest of rural and remote PNG, mimics these national energy challenges.

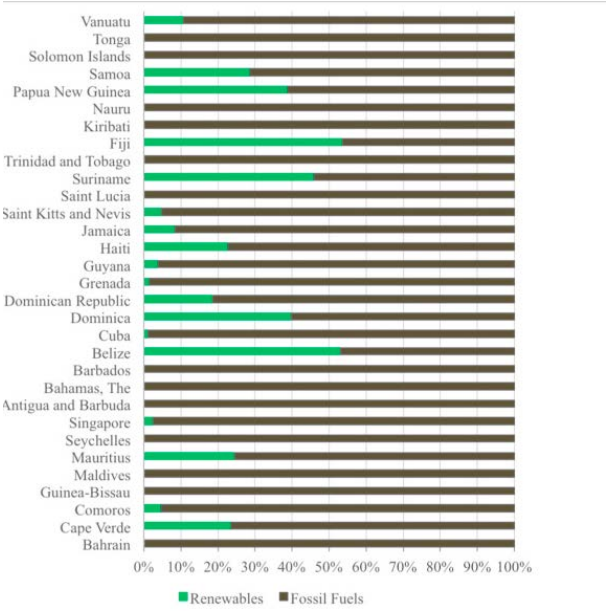
A lack of access to and an insecure supply substantially hinders a countries capacity to develop (Bayer & Ozel, 2014). Access to energy is a significant contributing factor which has flow on effects for a number of SDG's such as improved livelihoods, education, healthcare provisions, gender equality and poverty reduction (UN, 2010). As evidenced in a number of Human Development Reports, socio-economic development in rural and remotes areas of PNG

Current base load energy power in Manus is highly dependent on diesel generators which only operate on the main island of Manus and Los Negros, where the Australian Asylum Seeker Processing Facility is located. Consistent access to electricity is a daily issue for residents and business owners. On the outer islands electricity is purely run on small diesel generators. This research paper suggests that energy poverty can be significantly alleviated by establishing a coconut biofuel operation and solar as alternative sources for the region's base load power. The paper proposes to rejuvenate the 24 existing copra plantations to supply long term sustainable bio-fuel to enhance energy security by moving to a predominantly renewable energy source for base load energy generation. Currently these underutilised coconut plantations produce between 2-300 tons of copra annually, with potential ramp up capacity of up to 20 thousand tons per annum (DPI, 2012). The current diesel generation system would then revert to emergency supply for essential services when required.

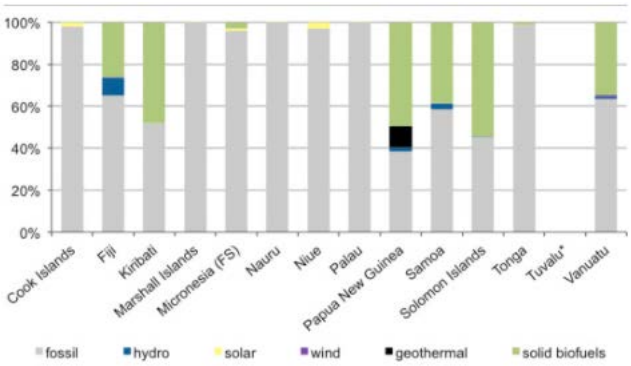
The supply and generation of electricity on small islands in developing countries such as Manus is a significant challenge with respect to development. Issues such as isolation from the mainland of PNG means that Manus depends on imported of fossil fuels and as a result are vulnerable to fluctuating fuel prices. Furthermore, island provinces such as Manus are more vulnerable to the impacts and effects of climate change, as they are severely affected by natural calamities and sea level rises. Feinstein (2014) discusses the high energy vulnerability experienced by small islands, identifying that islands in Pacific countries as being some of 'the most vulnerable' as they experiences oil price shock and have to cope with an inconsistent supply (2014, p4). Despite this a number of Pacific Island nations such as Tonga and Samoa have renewable energy programmes and targets with objectives such as 100% renewable energy by 2020 (Doran, 2015), PNG included indicating that is seeks to reduces greenhouse emissions by 1990 and provide '100 per cent power generation from renewable energy sources (Vision 2050, 2010, p10).

Renewable energy sector in PNG and the South Pacific

The renewable energy sector offers a great opportunity for PNG and other South Pacific countries to reduce their greenhouse gasses and push for more sustainable base load power generation. Papua New Guinea's tropical location providing access to sunlight, frequent precipitation and vast mountainous regions with dozen of rivers and over 600 coconut rich atolls facilitates a smooth transition into the renewable energy sector. Consequently, like many other South Pacific countries PNG has forecast aggressive renewable energy goals in regard to their electrification and base load power estimates, with some countries aspiring to almost 100% renewable energy within the next 10 to 20 years (Betzold, 2015; Cole & Banks 2017; Vision 2050). The reality on the ground however is that the majority of base load power and individual electricity sources in PNG are heavily reliant on fossil fuels particularly - diesel generators. In fact an estimated 78% of energy in remote and rural are in many South Pacific nations still rely on diesel generators (Isaka et al., 2013). In comparison with other South Pacific nations PNG has a wide availability of renewable sources with biofuels and hydro power contributing considerably to power generation.



(Source: Adapted from Timilsina & Shah, 2016)



(Source: Adapted from Betzold, 2016)

While hydropower contributes to a significant percentage of energy on the mainland of PNG, individual households, transport and base load power in coastal and island regions are still dominated by fossil fuels and diesel generators. Reliance on diesel in these relatively remote regions presents many difficulties as remoteness and volatile market prices greatly increases operational cost for power supply. Thus, the chief driver for investing in renewable energy in PNG as in many South pacific countries is to reduce the dependency and cost of relying on diesel fuel. The cost and efficiency of renewable energy production depends on a number of factors – resource availability, output capacity, and technological maturity (IRENA, 2013). Additionally and in particular for this project an emphasis needs to be placed on the fact that the research team seeks to facilitate a sustainable local and provincial market of coconut bio-fuel.

Renewable options for Manus

Solar Power

According to the IRENA 2013 for Pacific Nations the most popular source for renewable energy is solar power as all islands have an excellent solar resource and primarily because as a technology it is readily available and cost effective in many regions.

Wind Power

Islands such as New Caledonia and Fiji present reliable data on the feasibility of wind power however most wind turbine manufacturers are increasingly focused on larger turbines which do not suit smaller islands; as well as increased risk to infrastructure due to tropical storm wind speeds and highly seasonal wind climates.

Geothermal

Lihir is the only well know tapped geothermal resource in PNG with a privately owned 50 MW plant operating at the Lihir Gold Mine. However reports from Vanuatu and Fiji suggest that the cost of drilling for geothermal potential hinders its uptake as a renewable energy source.

Coconut oil biofuel

Manus has great potential for producing coconut oil biofuel. Coconuts grow abundantly in the region and have been previously utilised in the copra industry as well as a traditional source for food and oil. Coconut oil is the most economically feasible path forward for the Manus region

- As it can be utilised in conjunction with or as a replacement for diesel fuel
- Coconut biofuels creates a local industry in itself fostering socio-environmental outcomes
- Reduces foreign exchange expenditures on energy
- Produces lower levels of pollution
- Existing experience in harvesting coconuts for production

There are however a number technological issues that need to be addressed before a reliable power source can be secured. Critical issues for coconut oil production such as obtaining sufficient coconuts, extracting premium grade oil and the age of the coconut trees are all factors that must be take into account when considering a coconut biofuel operation.

Estimated Costs

Cole and Banks (2017) provide a review of renewable energy generation and policy on Pacific Island countries, arguing that there is a missed opportunity when considering the high potential for operational and technical costs of coconut oil energy production. Levelised cost of electricity (LCOE) is a commonly used measure which asses the feasibility of renewable electricity generation and can also be utilised to calculate the average minimum cost at which electricity can be sold. *The LCOE considers lifetime costs to electricity generation such as maintenance, servicing, replacement of parts, fuel and initial capital investment costs* (Cole & Banks, 2017:506). A review of literature discussing renewable energy costs in Pacific Island nations estimated LCOE figures ranging between $0.36 per kWh to $0.55 per kWh for solar power-diesel and wind power-diesel hybrid power generation, with PNG calculated to be in a similar range at $0.56 per kWh (ARE, 2014; Cole, 2015).

Specific cost analysis for coconut biofuels are not as readily available in comparison to solar and wind, however a detailed study of coconut fuel in Fiji estimates LCOE of electricity generated using coconut oil to be $0.40 per kWh compared with $0.47 per kWh using solar technology alone. Data from literature focusing on the Pacific suggests that on small Pacific islands coconut fuel could be produced at approximately 10 cents per litre cheaper than diesel.

It must be noted that LCOE calculations are estimations as figures are based on a range of variables which would change depending on context and site-specific natural conditions such as isolation, wind speed, coconut ton capacity. Poor operation and maintenance costs and additional transport and capital costs must also be taken into account. Additionally, the fluctuating diesel prices must also be considered as this is where small islands are most vulnerable. However, the literature suggests that in practice renewable energy technology, coupled with adequate technical training & support produces cheaper electricity generation than a diesel (Dornan, 2016; Kuang, 2016; Cole & Banks, 2017).

A thousand mature coconuts weighing approximately 1,440 kilograms yield around 170 kilograms of copra from which around 70 litres of coconut oil can be extracted (Bourke & Harwood, 2009). Referring to these figures, 70/170 = 0.14 litres of oil per kilo of copra, latest DPI estimates suggest that 200 tonnes of copra is currently being purchased on Manus Island, potential past figures estimate that with operational plantations and small holding plots a median figure of 20,000 tonnes of copra be produced annually. 20, 000 tonnes = 820, 000 litres which is equal to 4,100, 200 litre barrels of coconut oil per annum

Ongoing research

Journal papers are being advanced, arising from the learnings and feedback emanating from the UPNG/JCU Twinning Project, PNG Impact Conference. In addition, additional PNG island provinces will be incorporated in the research project.

Summary

The key elements of the Sustainable Power for Manus Program are:

- To provide sustainable electricity to Manus Island using a combination of coconut biofuel and solar.
- To improve solid waste management throughout Manus Island through provision of waste collection and processing facilities, monitoring, and exploration and development of markets for waste.
- To improve water quality on Manus Island by identifying and remediating sources of contamination.
- To provide research and community development opportunities for University of Papua New Guinea, University of Technology and James Cook University staff and students to work collaboratively with the Manus Island Provincial and Local Level Governments particularly in the fields of science and engineering, education and health.
- To provide opportunities for training and qualifications for Manus Island people to Australian Standards.
- To generate sustainable employment for Manus Island people through provision of sustainable energy, training, education, improved health and employment outcomes.

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