Prospective Impacts of Improved Energy on Income Generating Activities in Rural Vanuatu

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Author’s Note

This paper is intended as an initial research study into the potential application of new sources of energy for increasing incomes in rural Vanuatu. It was completed in a limited time frame of only a few weeks and was restricted to interviews in the capital of Port Vila, and it is not an exhaustive inventory of income-generating activities or technologies. Further study of this topic will be conducted by the Government’s Energy Unit in developing its Vanuatu Energy for Rural Development (VERD) program in collaboration with public and private stakeholders.
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Introduction

As the Government of Vanuatu increasingly focuses on electrification for rural areas, which accounts for around 70% of the country’s population and where approximately 90% do not have access to electricity, it is posed with a complex and vast challenge. The Government’s Energy Unit, with support from the Utilities Regulatory Authority and the AusAID’s Governance for Growth program, is developing a Vanuatu Energy for Rural Development (VERD) program. This program is currently evaluating multiple approaches for the development of a strategic rural energy investment plan that will result in sustainable energy outcomes for rural communities.

This paper will focus on how improved energy provision could benefit Vanuatu’s rural industries and therefore generate additional income for rural communities. Specifically, it will document promising technology enhancements that could increase revenue for rural enterprises but that require a new or improved energy source. It will also document key existing programs that are focused on rural livelihood development and which could serve as strategic partners in a targeted rural energy plan. Finally, the paper will conclude with recommendations on how Vanuatu’s rural energy program should integrate income-generating activities into its approach in order to realize positive rural development outcomes.

The objective of this paper is to provide an initial assessment on how targeted energy investments toward income-generating activities could most benefit rural livelihood development. By focusing on development outcomes, rather than just access rates or kilowatt capacities, limited rural energy funding can more likely achieve an improved quality of life in rural communities. Increased income in particular can achieve broader Government of Vanuatu development goals, demonstrate tangible benefits of improved energy to communities, and provide the financial means for communities to pay for and sustain future rural energy systems.

Vanuatu Rural Development

Income generation is clearly a core component of the Vanuatu Government’s development objectives. In the October 2005 Pacific Islands Forum in Papua New Guinea, Vanuatu endorsed the Pacific Plan, a ten-year framework which, among other pillars, focused on Economic Growth (defined as pro-poor and sustainable growth and with the key objective of improved income earnings and livelihoods) and Sustainable Development (defined as the integration and mutual reinforcement between economic development, social development, and environmental conservation for wise use). In the Government of Vanuatu’s Priorities & Action Agenda for 2006-2015, increases in wealth, per capita income, employment, and private sector-led economic growth are all clearly stated in its National Vision. It is in this context that it can be stated that increasing incomes for the rural population is a development outcome that Vanuatu’s rural energy program should support to the extent possible.

Electrification’s Impact on Poverty Alleviation and Rural Development

The current literature reveals a weak connection between increases in rural electrification and poverty alleviation (i.e. increases in per capita income among the most poor). A 2008 World Bank report entitled Welfare Impact of Rural Electrification found the linkage to be “limited” and “less than expected,
except when there has been a specific program to promote productive uses of electricity.”\(^3\) A 2007 United Nations Development Programme presentation to a Pacific workshop concluded that: “Though it is clear that increased wealth increases the use of modern energy forms, it is not clear that the provision of modern energy sources increases wealth (or the equitable distribution of it)...The provision of energy access to low income rural communities by itself is unlikely to result in a reduction in poverty if measured by income alone.”\(^4\)

Common reasons cited for the weak linkage are 1) rural electricity’s primary uses end up being lighting and entertainment (i.e. TV); 2) often the wealthy, who may have already had personal generators, are the most to benefit from rural electrification, while low-income households gain limited access because they cannot afford payments or they are most distant from grid connections; and 3) disposable income levels can even decrease due to cash outflows for fuel/electricity payments and the purchase and maintenance of electric appliances.\(^5\) In sum, as another 2008 World Bank report entitled *Maximizing the Productive Uses of Electricity to Increase the Impact of Rural Electrification Programs* succinctly puts it, “Proactive action is needed to ensure that funding rural electrification is effectively funding rural development and not just the expansion of the electricity sector.”\(^6\)

This paper is intended to be the initial formation of an approach for Vanuatu that increases the likelihood that improved energy services will positively impact income levels through an emphasis on the most promising small-scale income-generating activities.

**Vanuatu’s Rural Economy**

Vanuatu’s rural economy is largely subsistence. According to the most recent Vanuatu Government *Household Income and Expenditure Survey* (2006), 95% of rural households received “income” from their “own account production” – goods produced and consumed in the home (i.e. subsistence). Two thirds of rural households were engaged in the sale of agricultural products, fish, and handicrafts. Wages and salaries accounted for income in only 16% of rural households.\(^7\) The 2006 Government *Priorities & Action Agenda* states that agricultural exports are the main source of cash in rural areas.\(^8\) It also notes that “real GDP per capita is still lower than in the early 1980s, due largely to the lack of significant long-term growth in agriculture and fisheries.”\(^9\)

Therefore, this paper will focus on the largest (but still undeveloped) rural industries: agriculture and fishing. For these production industries, improved energy provision could increase income through gains in quality or quantity, or reductions in cost or time.\(^10\) In addition, this paper will examine tourism, the country’s leading export industry and one of the fastest growing sectors and with untapped potential in rural areas.\(^11\) As tourists continue to discover rural Vanuatu, meeting their needs with amenities that require electricity will be vital for rural tourism growth. This paper will now proceed to examine each of these industries individually and the potential investments in equipment and energy that could generate increased income.
Agriculture

The Asian Development Bank (ADB) / AusAID’s Vanuatu Economic Report 2009 notes that agriculture is fundamental to Vanuatu’s traditional and cash economies and involves all but a small percentage of the population. It not only provides subsistence for most of the population, but it also provides virtually all of the country’s exported goods and is the second-largest contributor to gross domestic product (GDP). However, the report also states that the sector, particularly its commercial component, is “underperforming” and that productivity gains are needed, especially in order to support a growing population.14 Vanuatu’s international business and investment guide, Business Advantage, states in its 2009/2010 report: “The fact is that the nation’s productive sectors remain largely undeveloped.” It particularly notes that this is due to limited onshore processing, which results in the majority of exports taking the form of commodities.15 More advanced agricultural processing in rural Vanuatu, particularly through the use of new or improved energy sources, is a central component of future gains in the agricultural sector.

The agricultural crops that will now be examined are coconuts and kava, which are Vanuatu’s primary exported products (in addition to beef).1

Coconuts

The coconut industry is almost entirely small holder based, it is the largest contributor to rural income generation, and it is central to preventing income disparities between the urban and rural economies from growing wider.16 Over 70% of rural households own coconuts.17 In addition to private use (e.g., for human and animal consumption), a large percentage sell coconuts or copra (the dried inside flesh) to coconut production operations. Coconut production in Vanuatu largely results in copra and crude coconut oil for export.18 Other uses are biofuel (domestic), coconut meal (for livestock feed), and specialty niche products such as virgin/organic coconut oil, coconut cream, soaps, and cosmetics.

A 2007 AusAID study on the Vanuatu coconut industry found that the export market for copra was rapidly disappearing and therefore Vanuatu needed to shift completely away from copra to coconut oil exports.19 It also stated that the global market for coconut oil was shifting from crude to refined and that the price differentiation between copra and crude coconut oil had become low, and it recommended that Vanuatu coconut oil producers (millers) invest in refining capacity (RBD – refined, bleached, and deodorized).20

Vanuatu has one coconut oil miller exporting crude coconut oil, Coconut Oil Production Santo Limited (COPS) in Luganville, Santo.21 This coconut oil mill has frequently struggled since its establishment in 1999, in large part due to volatile world market prices, including shutting down and changing ownership multiple times (it has gone from the Coconut Oil Products Vanuatu (COPV) mill to CL Agencies Copra Crushing (CLA) to now COPS).22 Given the struggles of the Santo oil mill and the energy-intensive nature

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1 Beef production will not be examined in this paper, in large part because it is primarily managed by large operations in Efate and Santo (as of 2006, less than 5% of beef operations were managed by small shareholders), and this paper focuses on existing economic activities in rural areas that most directly benefit rural communities. Bazeley, p.24-5.
of large scale coconut oil production, it is recommended that efforts be focused on improving the operations at this mill, and possibly investing in refining technology at this mill, before considering establishing another oil mill in non-electrified rural areas. Another Vanuatu coconut oil mill, Santo-based Vanuatu Coconut Product Limited (VCPL), processes coconut oil primarily for use as biofuel domestically. COPS and VCPL have the capacity combined to handle all the copra produced in Vanuatu.²³

There also exists a small Santo-based Vanuatu Virgin Coconut Oil (VVCO) mill that has been in operation since around 2007, and it purchases fresh coconuts from farmers and produces high quality virgin coconut oil and various by-products. A World Trade Organization report in 2007 found that “it is too early to predict the sustainability of this operation.”²⁴

Given the uncertain long-term sustainability of these three coconut oil mills and the fact that they are not running at full capacity, it does not appear to be the right time to consider establishing additional coconut oil mills, particularly in non-electrified rural areas. Since the location of all three of Vanuatu’s coconut oil mills are in/near urban and electrified Luganville, specific improvements for them will not be included in this paper since they fall out of the scope of the VERD program. Nevertheless, the success of these coconut oil mills in Vanuatu is important for the incomes of copra farmers, and a more in-depth assessment of these mills and their energy needs would likely be useful for improving rural incomes (through higher and more stable prices for copra farmers) and for possible replication in outer islands (once these mills can be labeled as a model for success and they are running at full capacity).

The components of the coconut industry perhaps most applicable for rural areas, besides the basic task of coconut collection, are copra production and micro-scale virgin coconut oil production, both of which will now be looked at in more detail.

**Copra**

Although the export copra market is diminishing and it is recommended that Vanuatu phase out this export, domestic production of coconut products will still require copra, which rural small holders will continue to provide, especially if Vanuatu’s oil mills can produce refined (for export or domestic biofuel use) oil or virgin coconut oil at higher prices. Although the production of copra has steadily declined and many copra plantations have closed due to low copra prices,²⁵ producing higher quality copra (and with it high quality end products) can reverse this trend by fetching premium prices in the global market.

The production of copra is concentrated around northern Vanuatu, particularly Malakula, Santo/Malo, Ambrym, Epi, Ambae/Maewo, and the Banks and Torres Islands. As mentioned, there is an abundance of coconuts in rural Vanuatu, and copra production is well embedded in the livelihood of rural households, especially since the whole family often participates in the collection of coconuts and the production of copra. The primary value added by copra farmers is the drying of the coconut kernel, which is most commonly done by sun or smoke in Vanuatu. An overview of the different methods follows.
Sun/Solar Drying

Drying in the sun is the simplest and cheapest method, since there are no equipment or fuel costs. This is an appropriate method for producing good quality copra when the weather conditions are suitable. However, it is restricted to the dry season and for small quantities. The right conditions for the production of excellent quality copra are up to 5 consecutive days of sunshine and a moderately humid atmosphere (60-80% relative humidity). Otherwise, copra can be damaged by bacteria and deteriorate. Further study needs to be done on where sun drying can produce high enough quality of copra in Vanuatu, but one local expert believes it can be a sufficient method in many places. However, Vanuatu’s overall humid climate likely precludes this method from ensuring a high enough quality of copra for premium products (e.g., virgin coconut oil) in many rural islands or during the wet season.

Kiln Drying

In the direct method, the fire bed, fueled from discarded coconut shells and husks and/or firewood, is located directly below the copra. Although fuel and equipment cost is minimal, the copra produced is generally low quality (from insufficient drying and from the dark, sooty, and sometimes scorched copra that results). However, if only shells are used as fuel, excellent quality copra can result, although it can take 4-5 days and this method is generally centrally operated by those with high levels of management. Alternatively, in the semi-direct method, the combustion pit (using any type of fuel) is a few feet away and the heat is then funneled through an underground tunnel, preventing the damage done by direct smoke and fire. Compared to solar drying, it can produce a higher quality copra, hold more capacity (around 2,000 nuts), and require a shorter amount of time (about 20-25 hours to dry, and without dependence on weather conditions). Especially since this type of dryer is easy and inexpensive to construct and operate, a Food and Agriculture Organization (FAO) of the United Nations publication labels this semi-direct kiln drying method as “socially adaptable and economically ideal for small coconut farmers.”

Hot Air Drying

In hot air dryers, copra is dried by uncontaminated hot air that passes through the copra bed, resulting in good quality copra that is clean and white. Two common examples of hot air dryers are the Modified Kukum Drier (2,000 nut capacity; drying time of 30 hours over 3 days; high maintenance and repair costs; oil as fuel) and the Cocopugon Hot-Air Brick Copra Dryer (2,000 nut capacity; drying time of 1-2 days; less maintenance, repair, and labor costs than Kukum; husks as fuel). Hot air dryers can produce consistently higher quality copra than other methods and use any type of fuel, but more fuel is needed, maintenance costs are higher, and they are more complex and expensive pieces of equipment than locally-constructed kilns.

Co-Generation

Heat from biomass fueled electricity production can also be used. Heat from a steam boiler, which can run on coconut husks or other biomass, is one option. It can produce high quality copra, and it is a
relatively cheap and well developed technology. Waste heat from a biomass gasifier, which can run on husks or other biomass, is another option. One Vanuatu NGO, Alternative Communities Trade in Vanuatu (ACTIV), plans to pilot the use of a biomass gasifier to dry cocoa in Epi, and this project should be monitored for potential application for drying copra (and possibly nuts and fruit). Although a gasifier is more efficient than a steam engine, Pacific Renewable Energy Expert Dr. Herbert Wade questions the sustainability of biomass gasification projects for crop drying due to the complexity of operating the equipment and associated high maintenance costs. He states that combustion technology (i.e. steam boilers) has been more successful than gasification in the Pacific. The use of biomass fueled electricity generators for drying also has the benefit of producing electricity, which can be used to light copra production facilities or for other beneficial uses. In fact, it may make sense to create electricity from copra drying operations that are currently using kilns, such as the wood-fueled kiln used at the large PRV copra production facility in Malakula.

In Vanuatu, the ideal method will require a more in-depth analysis of individual copra producers and may vary based on geographic location, production capacity, management and technical skills, and other factors. Due to the inconsistent or low quality of sun and smoke dried copra in Vanuatu, further investment in semi-direct kiln driers, hot air driers, or biomass fueled electrification is likely needed in order for the Vanuatu coconut oil industry to shift towards more production of higher quality coconut oil and products.

**Virgin Coconut Oil**

There is potential to develop virgin coconut oil using innovative smallholder production systems designed for rural areas, notably the direct micro expelling (DME) method and the Tinytech cold press mills. As discussed, the greatest promise for Vanuatu’s coconut industry lies in adding more value to the copra, such as producing virgin coconut oil that can be used in many specialty niche products (including for medical purposes, soaps/shampoos/lotions, cooking, and as a dietary supplement) and that can command premium prices (especially if also organic). The more that rural communities can process the coconut, the higher the income they can receive. A 2009 report on the Pacific coconut industry found that exports of virgin coconut oil were growing from several countries and that the product had a retail market value of twice that of copra-derived refined oil. Furthermore, by exporting virgin coconut oil from rural areas, rural coconut oil producers reap the cost savings of shipping a smaller product (i.e. the volume of the oil from a coconut requires much less transport volume than the whole coconut or the copra).

However, the part-owner of a Vila-based virgin coconut oil production facility and retail export business, Barry Roche of Volcanic Earth, warns about the difficult access to markets and the high transport costs to reach those markets. While his business is growing, he notes that demand for virgin coconut oil

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ii A case study of one successful operation is Adrian Tarte’s Wainiyaku Family Estate in Fiji, which produces virgin coconut oil that is certified organic by both Australia and the U.S.

iii The “dilapidated state of copra driers” in Vanuatu, as described in an AusAID 2007 report, also presents an opportunity to invest in the right driers for high quality copra production. AusAID Governance for Growth Program, p.8.
products is currently insufficient to warrant building another oil production factory quite yet.\textsuperscript{iv} A 2007 AusAID report also notes that there are high initial overhead costs associated with market penetration for a new small virgin coconut oil exporter in an isolated location, and lower initial prices may also be necessary at first to attract buyers.\textsuperscript{v} Therefore, a careful market analysis (beyond this paper) should be conducted before decisions are made to invest in a virgin coconut oil production business, especially in isolated rural areas where additional transport costs need to be factored in.

**Direct Micro Expelling (DME)**

The DME method, invented in 1994, is a small-scale system that processes a whole coconut into virgin coconut oil in about one to one-and-a-half hours, or about 500 coconuts a day. Whole coconuts are split, the raw kernel is shredded by a rotating electric grater, the shredded meat is dried on a stainless steel plate heated by burning coconut husks and shells, and finally the oil is extracted with a hand-operated cylinder press. The only power requirements are for two coconut graters, each with a .375 Kw motor, which can be powered by a small generator (run with coconut or diesel fuel) if no central electricity exists.\textsuperscript{v} Alternatively, a manual grater can be used.\textsuperscript{vi} Equipment costs (excluding the cost of a generator) are currently about AUD$6,000 (plus ~AUD$2,000 shipping), and combined with the construction of the factory and other potential costs (e.g., training), total upfront costs of establishing a DME factory are around AUD$15,000-$25,000.\textsuperscript{vii} Based on Volcanic Earth’s organic virgin coconut oil factory in Vila, a Vanuatu DME factory can expect to sell (organic) virgin coconut oil at 400 vatu/liter wholesale.

A 2006 World Bank study found that the operation of DMEs was viable at prevailing prices if they were operated regularly with a high level of throughput, and profitability was enhanced if prices were to increase as expected and organic certification was achieved.\textsuperscript{iv} There have been a proliferation of small DME operations owned by rural households throughout the Pacific Islands, and they have been funded usually by grants from sustainable livelihood programs such as the United Nations Development Program and EU Micro Project programs. Besides the Volcanic Earth factory, two other DME mills have been known to have operated in Vanuatu: a large scale mill outside Luganville that ceased operations after six months due to marketing and cash flow problems, and a small mobile plant owned by an investor on Malakula.\textsuperscript{viii}

TheAusAID 2007 Vanuatu Coconut Industry report evaluates the experience of other Pacific Islands with DME and concludes: “Given the apparent appropriateness of the technology and strong market demand for the product, the general performance of DMEs has been disappointing.” Some of the challenges it cites are: donor focus on community enterprises rather than individual households (the latter being more successful); relatively high cost of equipment and absence of rural finance; difficulty meeting quality specifications, in part due to labor intensive nature of operations; insufficient marketing links by

\textsuperscript{iv} He projects that his next factory will be built in North Efate (not an outer island) where he believes there are sufficient coconuts and which is close enough to Vila’s export hub.

\textsuperscript{v} A 2.7 Kw 240v generator can be purchased along with the DME equipment for about AUD$2,000.

\textsuperscript{vi} AUD$15,000 estimate provided by Barry Roche, Volcanic Earth, based on the establishment of his DME factory. Full list of prices can be found on the website of the primary DME equipment manufacturer, Kokonut Pacific, at www.kokonutpacific.com.au. The website also has an economics calculator that takes inputs (e.g., production capacity, product price, business costs) that help determine viability of business using DME method.
isolated DMEs; and difficulty in obtaining valuable organic certification. Nevertheless, the report still thinks that DME is promising in Vanuatu and that it can emulate the successes in the Solomon Islands.46

**Tinytech**

Indian Tinytech cold press mills have also been used in the Pacific to produce virgin coconut oil (but they also produce non-edible oil as well). The equipment involved includes: 1) copra cutter that requires 5 H.P. motor and processes 300 kg/hour; 2) either an oil expeller machine that steam cooks and presses the copra and requires 10 H.P. electric motor or 12 H.P. diesel engine (that consumes diesel at 1.25 liters/hour) and processes 300 kg/hour OR a rotary cold press that requires a 2 H.P. motor and produces better aroma, fragrance, and nutritional value than the expeller machine but expels less oil; and 3) neutralizer (optional) that filters the oil for best health benefits and longest shelf life and that requires a 1 H.P. motor and processes 300-1000 liters/batch.47 The capital cost is low, the throughput is reasonably high (~600 kg of copra a day), and there is less labor needed than the DME method, but the oil extraction rate is lower than that of a conventional copra mill.48 Based on a 2007 South Pacific Applied Geoscience Commission (SOPAC) study in Fiji, the estimated cost of establishing a Tinytech mini mill (with oil expeller, not rotary cold press) and a small generator on a small island, including construction, equipment, and transportation/installation, is AUD$30,000, compared to AUD$20,000 for a DME factory.49

**Biofuel**

Production of coconut oil for domestic biofuel use is a growing segment of Vanuatu’s coconut industry and has potential to improve rural development in multiple ways. From a consumption standpoint, biofuels can make economic sense over diesel, especially in remote rural areas where there are high transportation costs for importing diesel. It also makes most economic sense to produce the biofuel in rural areas as well to minimize transportation costs. For example, the Tinytech oil mill is well suited as a small scale biofuel operation, as shown by a case study in Bougainville.50 Since biofuel is domestically produced, it also keeps income within Vanuatu, including rural areas where coconuts, copra, and coconut biofuel can be produced, and it can be a significant source of employment. Rural biofuel mills also benefit the copra farmer who can more easily sell copra directly to the mill without sometimes waiting 2-3 months for the next ship to sell their copra. There are also the environmental benefits of reduced pollution and greenhouse gases from biofuels versus diesel, as well as the reduction in dependence on imported diesel and its volatile prices. Therefore, from a production and consumption standpoint, coconut biofuels can be a real winner for Vanuatu, especially in rural communities.

Recently a biofuels production facility and power generator was completed in Port Olry, Santo and can serve as a pilot for rural production of coconut biofuel and electricity powered from biofuel. The EU is funding 9 coconut biofuel projects in Torba, Penama, and Malampa Provinces, and these should be closely monitored and coordinated with where appropriate by the VERD program.

**Coconut Industry Summary**

Through the collection of coconuts and the production of copra, the coconut industry will continue to be an important source of rural income. With recent developments and promising possibilities in virgin
coconut oil and biofuel production, coconuts have the potential to increase rural income generation and employment in the future as well. As laid out, there are multiple options for producing copra, virgin coconut oil, and biofuel, and further data collection, evaluation of specific sites and projects, and cost-benefit analyses can assist in deciding the path ahead for each of these. The energy requirements can largely be met by abundant locally available biomass resources, and the equipment identified with power requirements can be met through small scale generators or solar photovoltaics. While an electric grid is not necessary to achieve some income gains in the coconut industry, electricity production can be a beneficial product of improved income-generating activities, as is the case most directly with biofuels and more indirectly with the use of steam engines or biomass gasifiers for copra drying. In the long run, increased incomes in the coconut industry can also provide the means for rural communities to pay for improved energy services.

**Kava**

Kava, with deep roots in the Vanuatu kastom culture, maintains a vibrant role in Vanuatu today, supplying a strong domestic market as well as serving as one of the country’s main exports. Kava beverages are derived from the roots and stump of the kava plant which are ground and then generally prepared using simply drinking water, a bowl, and strainer. While the domestic market is primarily served with fresh kava material, ground kava can also be dried and/or frozen, or even processed further into products like kava juice, \(^{51}\) especially for export markets.

The standard kava equipment that can be used for production is as follows:

- **Grinding**
  1) Manual traditional tools of a mortar and pestle to pound and grind roots and stumps
  2) Hand-powered grain mill
  3) Mechanical grating (also called powdering if done to dried kava material) using grinders or hammer mill. Motor-run hammer mills have different power requirements depending on capacity, but one common example of one is by the Indian manufacturer JAS Enterprise that manufactures those from a capacity of 20-25 kg/hour (requiring 2 H.P.) to a capacity of 800 kg/hour (requiring 50 H.P.). For dried kava, the resulting small particle sizes (that are easier to produce with a machine) produce a higher quality beverage. \(^{52}\)

- **Refrigeration / Freezing**
  1) Pounded/ground pulp can be placed in freezer bags and frozen indefinitely (such as prior to shipping)
  2) Refrigeration of fresh kava beverage (after infusion of ground kava) can preserve for 2-3 days

- **Drying** (for preservation)
  1) Solar dehydration shed
  2) Propane gas-powered or electric drying chamber, which are needed especially during the rainy season or in moist locations\(^{53}\)
All of these processes can conceivably be done to add value at a community or local farm level, and further study is recommended to evaluate their application to rural Vanuatu. However, a leader of one local NGO notes that most rural kava growers currently sell non-dried, non-grinded kava material for use in the Vila kava market, and he believes irregular transport is a constraint on further processing in the rural areas. More specifically, once kava is picked and grinded, it needs to be used soon (before spoilage occurs) or else it needs to be preserved. Since transport to market is often unreliable or unscheduled, there is insufficient time to grind or dry the kava once the boat arrives. If the grinded kava is dried for preservation, it is difficult for the villager to maintain the strict standards for moisture content. Furthermore, kava bars in Vila, which provide a large enough market for current rural kava supply, purchase “green kava” for immediate use in beverage and therefore dried kava is not needed (only for export markets). While dried kava sells for more (~1,000 vatu/kg compared to ~300 vatu/kg for non-dried kava), it also weighs less. These are all challenges that must be taken into consideration for rural kava production.

More reliable and frequent transport and/or better preservation methods (i.e. drying and/or freezing) would need to be part of a ramped-up rural kava production effort, if deemed to make economic sense. The strict national standards concerning quality control of exported Vanuatu kava also need to be taken into account in whether small rural kava growers should continue to focus on the non-grinded non-dried kava for Vanuatu’s domestic market or expand to grinded dried kava for the overseas markets.

**Other Agriculture**

In addition to coconut and kava products, there are other agricultural products worth further study.

In particular, cocoa, the fourth largest export, has bright future prospects for overseas markets, particularly for organic cocoa. A recent report on the Vanuatu organic cocoa industry noted the success of the Vanuatu Organic Cocoa Growers Association (VOCGA) and the French organic chocolate manufacturer KAOKA in placing the industry in a strong position to sell to growing organic cocoa and single origin markets at premium prices. KAOKA is expected to launch Vanuatu single origin cocoa in 2010. The report states that there is room for growth via increased productivity and that drying techniques could be improved, and it predicts that KAOKA could easily absorb double Vanuatu’s current supply if Vanuatu production could be increased.

Further processing of raw cocoa in Vanuatu, such as through production of cocoa powder or butter, might also be feasible in the short term, and the local NGO ACTIV is considering the purchase of various equipment to do this. These include a 15 Kw power pallet (~USD$23,700), a roaster (~USD$4,400), an expeller automatic oil machine (~USD$7,300), and a winnower (~USD$4,100). ACTIV has also already secured the support of the Ministry of Agriculture to develop a mini-scale chocolate factory in Port Vila for the domestic and export markets, and it is requesting funding assistance from the EU Growth Support Programme. ACTIV will also apply for Global Environment Facility (GEF) – World Bank funding to pilot the use of a 15 Kw biomass gasifier (fueled by coconut shells and husks and other discarded biomass) to dry cocoa (as well as nuts and fruit) via direct heat (and produce electricity) in Epi.
Other potential value-added products that could be produced with additional (and sometimes electric) processing equipment include processed/prepared nangai nuts, vii peanut butter, fruit juice, flour, and rice.

**Fishing**

According to the 2007 Agriculture Census, 75% of rural households are involved in fishing. Like agriculture, much of this is simply for subsistence or small sales to the local village. The Census notes that only 25% of fishing households sell some of their fish, and only 1% sell most of their catch. Although Vanuatu has valuable fishing resources, multi-national fishing corporations and foreign consumers are reaping the vast majority of the benefits of these resources.

While there are other challenges to a more robust rural Vanuatu fishing industry that should be understood before any energy investments are made, there are some potential benefits that improved energy could bring, particularly in the area of preservation. Arguably the biggest current impediment to further development of the rural fishing industry is the inability or high cost of preserving fish so it can be sold to urban or overseas markets. The benefits would not only be higher incomes from external sales, but rural communities would also benefit by being able to preserve fish for village consumption. Greater rural consumption of domestic fish would result in better nutrition by reducing consumption of low quality and less nutritious imported tin fish (which also sends income out of Vanuatu).

There are a variety of methods for preserving fish that will now be examined. Although the focus will be on fish, many of these preservation methods could also have beneficial application for meat and other perishable goods.

An immediate need is cold storage capability closer to the source of the fish (rather than only in the big towns). This can include an ice-making machine, refrigerator, and/or freezer, and can be small units up to large cold rooms. Facilities that currently do exist are generally hindered by the high expense of transporting diesel to rural locations, and alternative energy sources or increased fuel subsidies by the government are needed to make rural storage facilities more economical. A few examples of current, planned, or proposed cold storage projects in Vanuatu include:

- Department of Fisheries has a pilot project in Futuna, with funding from the Japan International Cooperation Agency (JICA), of a storage freezer (500 kg) that is powered by solar and costs 1.5 million vatu (for freezer & solar). Acting Director of Fisheries Robert Jimmy notes that this initial project includes only a small freezer and that it also needs ice-making capability.  

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vii For example, nangai nut producers in Santo who process/prepare the nuts before selling to Vila receive a much higher price than producers on other islands who only sell the raw nuts to Vila. By adding value to the nangai nuts in rural areas rather than in Vila, rural income and employment is greater. Wallez interview. However, this may be a challenge for isolated communities that have weaker transportation links to Vila, since processed nuts do not preserve well. Stein interview.
The EU-funded Non-State Actors Program is planning a pilot project to provide an ice-making machine and storage box to the village of Matantas in Santo. Currently, transport is quite expensive to Luganville to sell the fish or purchase ice, making fishing not very profitable. The deep freezer (24 volts) would be powered by four solar panels (95 watts each). All equipment will be supplied by Vila-based Greentech and will cost around 1 million vatu (not including transport, installation, and maintenance). The EU will cover 75% of the costs, and the community 25%. Although the program manager acknowledges that this investment will not pay for itself in the end, it has potential to significantly stimulate fishing and increase incomes for this rural village and it may be a donor project worth emulating. This project is particularly worth monitoring also for the efficacy of its approach – strategically identifying a manager from the community for the project and teaching maintenance and bookkeeping skills.

Vila-based alternative energy businessman Nick Ritsinias (Energy4All) provided some estimated costs for two of his products. A small 225 liter fridge/freezer (and .3 Kw solar PV system), with a price of USD$6,000, can be used for not only micro fishing projects but also retailers, abattoirs, butcheries, medical clinics (for vaccines and medicines), and community use for produce. A large container size fridge/freezer with an approximately 6 ton capacity (and a 10 Kw solar PV system), with a price of up to USD$150,000, can be used for industrial use and could pay for itself with 1-2 shipments of fish, according to his calculation. He also stressed the importance of educating locals on how to use refrigeration to their benefit.

A Vila-based NGO leader recommends establishing a cold room for fish (and meat) at the local market in Vila to increase accessibility to the domestic market for rural fishermen (and butchers).

Like all the projects discussed in this paper, any production and energy equipment investment decisions should not be made in a vacuum but should consider other factors integral to improved performance of an income-generating activity. In the case of fishing, for example, the improvement of roads may make the investment in cold storage facilities in a village less valuable, as was the case when roads from Luganville to Port Olry were recently paved and then the fishermen stopped using the ice-making machine in the village because they could more quickly and cost effectively take their catch directly to Luganville for sale. This example also raises the question whether government/donor money is better used for improving access for rural communities to larger towns and markets or for purchasing additional infrastructure for the rural village. The multiple benefits to rural communities of good transportation infrastructure, combined with economies of scale, may point to the former as the better use of limited resources.

Besides cold storage preservation, there is utility in traditional preservation methods, which include drying, salting, bottling / vacuum packing, and smoking. These are well suited for small-scale rural operations, and the preserved fish can be used for village consumption or sold to domestic or overseas markets.

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VIII For example, yellow fin is selling in Port Vila for about USD$10 - USD$15 per kg. Therefore, 6000 kg = USD$60,000 - USD$90,000.
markets. These methods have many benefits, including low cost, little and inexpensive equipment, low freight rates due to high shelf life (except for smoked fish), and a good fit for women and lower income workers due to its labor intensive tasks and relatively simple production process. An initial assessment shows that electricity, perhaps not surprisingly, is not required for these traditional methods, and in some cases where electric alternatives exist, such as the case of fish drying, the non-electric method is the more cost-effective option. One example of the use of traditional preservation methods for fish in Vanuatu today is a Department of Fisheries / JICA project in Futuna where fish are baked and vacuum packed (without the use of electric energy) and sold at 500 vatu per 300 grams. Overall, traditional preservation methods provide an appealing addition or alternative to cold storage and warrant further evaluation.

**Tourism**

Tourism is now the leading export industry for Vanuatu and contributes between 20-40% of the nation’s GDP. It has also demonstrated continual growth since 2004. The 2006 *Government of Vanuatu Priorities and Action Agenda 2006-2015* acknowledges its importance: “Tourism is one of the most promising economic sectors for Vanuatu’s future development. It offers great potential as a source of foreign exchange as well as creating employment and fostering the development of the outer islands. Growth in the tourism sector is now underpinning growth in the economy.” However, as the Asian Development Bank / AusAID 2009 country economic report notes, its “potential is unrealized,” particularly due to the lack of infrastructure development in the outer islands. With a significant percentage of visitors limiting themselves only to Port Vila and Efate, assistance is needed to develop outer island tourism products in order to attract greater tourists and generate more income for rural Vanuatu. The most popular outer island destinations (Santo, Tanna, and Pentecost) are often only visited on day trips, limiting the benefits to rural communities.

Improved accommodations, including with more electric-powered amenities, can stimulate more tourists to stay in the outer islands and therefore benefit the rural economy, and it can allow ni-Vanuatu tourist accommodations (i.e. bungalows) to charge higher prices.

One Vila-based alternative energy supplier, Nick Ritsinias (Energy4All), noted the wide discrepancy in lodging prices between expat-run and ni-Vanuatu accommodations: $80-100/night on average for expat-run guest house type bungalows to $15-20/night for Ni-Vanuatu run bungalows. He attributed the difference largely to the absence in the ni-Vanuatu-run bungalows of the following facilities and appliances: good reading lighting, hot and cold clean running water, refrigeration, internet, and possibly other amenities that Western tourists value. His company can provide individual components, such as a 135-liter solar hot water system for $900, or complete turn-key solutions consisting of 4-5 10-15 watt CFL lights, a 225 liter 12 or 24 volt fridge/freezer, and sufficient power to run a basic Telsat or TVL internet system, all supported by an approximately 1 Kw solar system, for a total estimated cost of $10-12,000 for 2-3 bungalows. Assuming an occupancy rate of 10 days in any given month and that the

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ix A petrol generator would also be needed for back-up power in case the sun did not shine for more than a day or two. Although many bungalows and communities have them, his company could also provide one for $500.
bungalow could increase its prices from the $15-20 level to the $80-100 level, he estimates the payback for a bungalow for the complete turn-key solution to be about 12-16 months or a return on investment of between 75-100% per annum.\(^x\)

Ritsinias cited as the most relevant tourist destinations for ni-Vanuatu bungalow development as Pentecost, Malakula, Ambae, the Banks, and Santo.\(^x\) Due to limited or non-existent financing options for ni-Vanuatu bungalow operators, he recommended that the Vanuatu Tourism Board seek applications from bungalow owners and then provide 90% grants. Requiring applicants to justify their need and personally contribute their own finances to it would increase the likelihood that funding would go to enterprising and dedicated individuals who would have a greater chance of success.\(^{68}\)

Another potential application of electricity for tourist lodges would be for refrigerators and freezers for food preparation to ensure food safety.\(^{69}\)

Although further market analysis would need to validate that electrified bungalows would generate substantial income increases, it otherwise seems like a compelling investment. Especially since “leakage” of tourism expenditures away from the local economy can be quite common, targeting ni-Vanuatu bungalows directly benefits rural households, improves the experience of tourists and therefore can generate further tourism, and there would be ancillary benefits on the rural economy (from local tour operators to handicraft makers to local retail shops). Nevertheless, as in other sectors of the rural economy, there are many other challenges to outer island tourism development that need to be overcome as well and which may prevent this type of energy investment from reaching its full potential. These include the lack of knowledge by Ni-Vanuatu of tourism standards (e.g., accommodation, food, hygiene), insufficient marketing, limited rural infrastructure, limited air accessibility, shortage of skilled manpower, and high prices.\(^{70}\) Furthermore, the potential drawbacks of tourism development, including social problems and environmental degradation that sometimes accompany it, should be taken into account.\(^{71}\)

### Other Industries

Although this paper focuses on the three big rural industries of agriculture, fishing, and tourism, there are other rural income-generating activities worth alluding to for potential energy investment. In particular, two additional common livelihoods include making handicrafts and running retail stores.

While handicraft production usually can be done with just human energy and skill, improved lighting could provide time at night for women to produce baskets, mats, etc. at the community “mama house,” especially since the daylight hours are usually spent cooking, washing, and doing domestic work.\(^{72}\) Similarly, Rural Training Centers often have practicum work from which services are charged or products sold, and working in the evening could be beneficial.\(^{73}\) Current lighting sources available in the rural areas are generally kerosene or wood, both of which provide poor light quality, not to mention the

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\(^x\) Based on $80/night increase in price, or $800 increase in revenue a month.

\(^x\) In Santo in particular, a tourism boom will likely follow the planned expansion of the airport runway that will allow long haul planes to come direct from Shanghai, Tokyo, Hong Kong, Honolulu, and other locations.
environmental, health, and other drawbacks. The most immediate and cost-effective means of supplying reliable (and clean) lighting would probably be through pico-solar LED lights, such as those supplied by the recently launched Lighting Vanuatu project that are powerful enough to light a large portion of a room and can also charge a mobile phone.74

Retail shops (individual, cooperative, or community) could also benefit from improved lighting, which would allow them to stay open later, and they could use electricity to preserve perishable goods (e.g., butter) or sell new items (e.g., ice cream). However, assisting a retail shop, or other entities that produce goods and services only for within the community, does not bring additional income into the community, since no good or service was exported for outside cash. Whilst an individual within the community may see their income improved, the net gain for the community is zero, as such an activity merely represents movement of cash between individuals in a community.75 Nevertheless, the provision of additional services by a retail shop could arguably contribute to a better quality of life for community members.

Finally, improved energy services may stimulate new businesses, not just due to all the equipment that energy can power, but also because it can free up time from human-energy intensive activities (e.g., wood gathering) or reduce the amount of time performing other tasks due to increases in productivity.
Recommendations on Investment Opportunities

Based on an initial evaluation of income-generating opportunities in the rural agriculture, fishing, and tourism industries, the following investment areas appear the most promising candidates for the VERD program:

**Copra Production:** Given the prevalence of copra production in rural areas and the need for high quality copra as Vanuatu’s coconut industry shifts to higher quality products (in particular, refined or virgin coconut oil), improved copra drying can be a valuable investment in the rural economy. The most promising technology additions would be semi-direct kiln dryers, hot air dryers, or biomass fueled electrical generators (i.e. steam engines or gasifiers), all of which have the added benefit of running on discarded coconut husks from the production process. Equipment run on non-electric energy sources, such as biomass, should be considered on equal playing field as electric equipment for VERD funding assistance.

**Virgin Coconut Oil:** The Direct Micro Expelling and Tinytech virgin coconut oil production systems are designed for rural areas and a pilot project may be valuable. Although it has had mixed success in the Pacific, upfront capital costs are high, and there are marketing and cash flow challenges to be overcome, these systems are a natural fit for decentralized smallholder operations in rural areas. Besides husks to fuel the dryer, a small biofuel or diesel generator is the other energy requirement.

**Kava:** Further analysis needs be done on whether grinded (and then dried and/or frozen for preservation) kava is a worthwhile value-added process for small rural kava growers.

**Fishing:** Preservation is the greatest need for the rural fishing industry, and ice machines, freezers, and fridges could pay dividends, particularly for the more remote communities. The equipment could also be used for other perishable goods, including meat and dairy. Solar panels could be the most appropriate energy source.

**Tourism:** Electricity for rural ni-Vanuatu tourist bungalows would allow owners to charge higher prices and could stimulate an increase in tourists to outer islands, whose spending would reverberate throughout many sectors of the rural economies.

**Handicrafts:** Lighting, including through low cost pico-solar LED lights, could stimulate handicraft production in rural communities by providing a way for women to work in the evenings.
Recommendations on Strategic Approach

The following are recommendations regarding a strategic approach for Vanuatu’s rural energy program:

1) **Focus on development outcomes, such as increased incomes**

   Energy in of itself only indirectly provides benefits; it is the application of the energy that can have a direct positive impact on quality of life. Especially given the expensive and vast challenge of widespread rural electrification in Vanuatu, focusing efforts on achieving development outcomes can be a useful and most appropriate way to target limited resources. While income generation is one worthy development outcome, other development areas should also be considered, such as in education, health, and the environment. Furthermore, identifying energy projects by the specific development benefits they will bring will more likely receive buy-in and interest by the recipient populations than focusing on kilowatt capacities.

2) **Include a proactive approach to income generation, since electrification without careful attention to its productive uses will likely have limited impact on rural development**

   Although there may be other worthwhile outcomes of the rural energy program, one of them should be income generation. Broad-based economic growth is an identified objective of the Vanuatu government, rural areas suffer from a poverty of opportunity, and 8.5% of rural households lack sufficient income to meet essential basic needs (e.g., clothing, shelter, transport).

   However, increased incomes have not proven to reliably follow rural electrification efforts in other developing countries. This is because energy is only an enabler; it does not directly increase incomes or even improve the quality of life. A conscious effort should be made to target projects that will increase income and to assist with all the resources needed for improved energy to have the intended impact (e.g., training, financing, marketing).

   Increased incomes are also necessary for rural communities to afford the new energy services and the increased consumption levels that are likely to follow an increase in electrification. By focusing on relatively small-scale projects that can stimulate increased incomes, there is more likelihood that the rural community will have sufficient income to afford the sustainment of a larger scale energy system in the future.

3) **Focus on directly supporting existing and planned income generating activities rather than expecting energy projects to stimulate new businesses by entrepreneurs**

   Due to the predominance of a non-cash subsistence economy and a distinct non-Western culture in rural communities, electricity is less likely to lead to new income-generating activities than perhaps

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xii See *Electrification’s Impact on Rural Development* section in the Introduction to this paper for supporting evidence.
one might expect. Furthermore, the establishment of new businesses, regardless of location, naturally takes more time and results in more failures. Therefore, assistance should be prioritized for existing commercial activities that have demonstrated some past success and for new activities that are already planned and have some resources behind it.

4) **Understand and, when possible, mitigate non-energy related risks to the success of income-generating energy projects**

As discussed with numerous examples throughout this paper, many rural income-generating activities face other obstacles or constraints in addition to inadequate energy that may prevent improved energy from having much of an impact. These can include insufficient labor supply, limited supply materials, lack of technical or business skills, or infrequent and expensive transportation. Also, a rigorous market analysis should be conducted before investing in the production of a value-added product in rural areas to ensure that increased supply will be met by demand and that the projected price will exceed all costs, including the generally high cost of reaching markets.

5) **Promote awareness and then train users on new income-generating equipment**

An educational campaign should be conducted targeting potential users of new equipment about its clear benefits to them. For example, this paper could raise awareness for rural businesses (and any public and private partners) about potential technologies that could increase revenue. A further inventory and evaluation of production and income-generating technologies, as well as energy systems that could power them, could be a valuable source of reliable information and ideas for rural enterprises and any NGOs and government agencies that support them. Technical and business training should also be conducted to ensure benefits are realized from new equipment.

6) **Customize projects to the needs and wants of the specific enterprise and community**

Too often development projects fail because they are not rooted in on-the-ground realities or never receive the buy-in of the selected community. The beneficiaries need to understand the benefits of the project in order for it to be sustainable, especially when the external party's involvement is temporary. Ideally, recipients of financial assistance should be able to explain (i.e. via an application or interview) why they want and need support, and they should contribute at least a small amount of their own funding or other resources (e.g., labor, materials, time) toward the project.

7) **Consider the social and environmental impacts of the project**

While the project may increase incomes, it may also have negative social or environmental effects. Especially in rural communities where money does not have as central a role as in Western societies, well-intended projects should not generate cash at the expense of other positive aspects of rural life. Quality of life, as defined by ni-Vanuatu, and deeply held traditions should be valued at least as
much as the Western-defined “standard of living.” Income generation should be the means to a desired outcome by the community, not the end in itself.

8) **Energy investments should be integrated with or weighed against other rural development investments**

Since the end goal should be achieving development outcomes, energy projects should fit into a holistic development approach that also includes non-energy projects (e.g., health, education, water) which provide other valuable benefits to rural communities.

9) **Understand and develop linkages between transportation infrastructure and energy infrastructure**

Similar to energy, transportation can be a barrier or an enabler for increased income levels in rural communities. Without reliable and affordable transport, many of the value-added products discussed in this paper will not succeed in accessing domestic or overseas markets in a cost-effective way. Furthermore, improved transportation links may make certain energy investments obsolete or redundant, as easier access to equipment, energy, or markets in more developed towns may be the key for some rural enterprises to increasing income. Therefore, it is important to understand the current and planned transportation infrastructure for a rural community and to coordinate with transportation projects.

For example, if roads to a community are set to undergo significant upgrades, preservation projects may be less useful (e.g., fishermen can then go directly to market) but value-added projects might be a good investment since markets will become more accessible (e.g., transport costs for virgin coconut oil might be cut by a quarter). Rural development programs should place a high priority on transportation development, since improved transportation infrastructure has been shown to be a more reliable precursor to rural development in other countries than energy infrastructure.

10) **Maximize use of coconut biofuel for energy projects, especially versus diesel generation**

The benefits of domestically-produced coconut biofuel over imported diesel are many, especially in rural areas, where the fuel can be both produced and consumed. While biofuel projects may not bring outside cash into a community, it can reduce the amount of income leaving the community in

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xiii Allison Woodruff writes in a 2007 AusAID/SOPAC report on rural electrification in Pacific Island Countries: “Ideally, all remote communities would be electrified through electrical grid extension, in order to maximise the quality of energy services and the hours that electricity is available to households. However, this cannot always be justified on economic grounds since the costs of undertaking such a project are enormous compared with the benefits people receive. Also, greater returns to investment might be obtained if resources were invested in projects in other sectors such as health and education. Consequently, it is important that resources allocated to the energy sector are used as efficiently as possible.” p.17

xiv See Port Olry example in Fishing section of this paper.

xv Wade interview: In other developing countries, better roads usually come first, and then the power lines follow the roads.
the form of diesel payments, which has essentially the same effect as income generation from a community level perspective.

11) **Conduct monitoring and performance measuring of projects over the long term**

Too often development projects are implemented with a surge of funding and then forgotten. Proper training, maintenance, or operations may not happen, and projects can fail to deliver the benefits they were intended to bring. Project performance metrics need to capture the long-term outcomes (e.g., provided power for cold storage of x tons of fish per month for x months leading to an x increase in income), not just the immediate one-time cash outlay (e.g., installed solar-powered cold storage in x villages). Periodic reviews on the sustainability of projects are essential for improving long-term performance of development projects, which is currently poor for renewable energy projects in rural Vanuatu.

12) **Collaborate with public and private sector partners to deliver an integrated approach to rural development**

By linking the rural energy program with other development programs, synergies can be developed, redundancies avoided, best practices shared, and lessons learned, maximizing the efficient use of rural development resources. As demonstrated in this paper, while they may not be exclusively focused on rural energy, many government departments, NGOs, and energy suppliers in Vanuatu have in-depth experience working with rural communities and in many cases have implemented or are planning income-generating projects that utilize new or improved energy sources. Leveraging the knowledge, network, and funding of stakeholders is needed to fully grasp the complexities of diverse and dispersed rural Vanuatu and to make marked progress in the many facets of rural development. *See Appendix 1 for sample list of public and private partners.*
### Appendix 1: Public and Private Partners

The following table provides a sample list of public and private partners that Vanuatu’s rural energy program should consider collaborating with to promote livelihood development in rural areas.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Mission Focus</th>
<th>Related Industries/Projects</th>
<th>Point of Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Government</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department of Agriculture</td>
<td>Agriculture development</td>
<td>All industries; often works with UN Food &amp; Agriculture Organization (FAO)&lt;sup&gt;xvi&lt;/sup&gt;</td>
<td>TBD</td>
</tr>
<tr>
<td>Department of Cooperatives</td>
<td>Rural economic development</td>
<td>All industries</td>
<td>TBD</td>
</tr>
<tr>
<td>Department of Fisheries</td>
<td>Fisheries development</td>
<td>Projects include cold storage investments</td>
<td>Robert Jimmy, Acting Director</td>
</tr>
<tr>
<td>National Bank of Vanuatu (NBV)</td>
<td>Banking products &amp; services</td>
<td>Microfinance loans to small existing ni-Vanuatu rural businesses&lt;sup&gt;xvii&lt;/sup&gt;</td>
<td>TBD</td>
</tr>
<tr>
<td>National Tourism Development Office</td>
<td>Tourism development</td>
<td></td>
<td>TBD</td>
</tr>
<tr>
<td>Provincial Planning Offices</td>
<td>Provincial government</td>
<td></td>
<td>TBD</td>
</tr>
<tr>
<td><strong>Donors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AusAID Enterprise Challenge Fund (ECF)</td>
<td>Funding assistance to existing businesses</td>
<td>Provided funding to successful Volcanic Earth virgin coconut oil project</td>
<td>TBD</td>
</tr>
<tr>
<td>AusAID Technical and Vocational Education and Training (TVET) program</td>
<td>Training and business development services</td>
<td>All industries</td>
<td>Consultants: Anna Gibert or Peter Morris</td>
</tr>
<tr>
<td>U.S. Peace Corps</td>
<td>Rural development in areas of health, education, and business</td>
<td>Help develop income generating activities; vast rural network; can conduct surveys on VERD’s behalf</td>
<td>Neely Dahl, Technical Training Coordinator</td>
</tr>
</tbody>
</table>

<sup>xvi</sup> One example of a current income-generating project (with assistance from FAO) is flour production from the root crop cassava (i.e. manioc) using a grinder machine (and generator).

<table>
<thead>
<tr>
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<th>Related Industries/Projects</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Alternative Communities Trade in Vanuatu (ACTIV) Association</td>
<td>Income generation; Fair Trade</td>
<td>Cocoa production (use of biomass gasifier), handicrafts</td>
<td>Sandrine Wallez, Leader</td>
</tr>
<tr>
<td>Non-State Actors (NSA) program</td>
<td>Community and women development; EU funded</td>
<td>Ice machine/solar project in Santo village of Matantas</td>
<td>Rufino Pineda, Program Manager</td>
</tr>
<tr>
<td>Vanuatu Agricultural College</td>
<td>Training for farmers and acquisition of farming technologies</td>
<td>One example: food preservation training</td>
<td>TBD</td>
</tr>
<tr>
<td>Vanuatu Island Bungalow &amp; Tourism Association (VIBTA)</td>
<td>Tourism development</td>
<td>Includes bungalow operators, tour services, information centers, restaurants, etc.</td>
<td>TBD</td>
</tr>
<tr>
<td>Vanuatu Renewable Energy and Power Association (VANREPA)</td>
<td>Rural renewable energy</td>
<td>Futuna wind project can demonstrate electricity’s effect on income generation</td>
<td>David Stein, Team Leader</td>
</tr>
<tr>
<td>Vanuatu Rural Development Training Centre’s Association (VRDTCA)</td>
<td>Youth and rural development</td>
<td>Rural Training Centres (RTC) around country; income generating projects</td>
<td>Kathy Solomon, Director</td>
</tr>
<tr>
<td>Vanuatu Women Development Scheme (VANWOODS)</td>
<td>Microfinance</td>
<td>Individual activities (retail, sewing, kava bar, baking)</td>
<td>John Salong, Managing Director</td>
</tr>
<tr>
<td>Private Sector</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy4All</td>
<td>Alternative energy</td>
<td>Fishing, tourism</td>
<td>Nick Ritsinias, Owner</td>
</tr>
<tr>
<td>Green Power</td>
<td>Alternative energy</td>
<td>Solar LED lights/lanterns (&quot;Lighting Vanuatu&quot;)</td>
<td>David Stein, Owner</td>
</tr>
<tr>
<td>Greentech</td>
<td>Alternative energy</td>
<td>Icemaker, freezer, and solar for NSA project</td>
<td>Eric Kerres, Owner</td>
</tr>
<tr>
<td>Solar Communication and Equipment</td>
<td>Solar energy</td>
<td>Freezers/refrigeration</td>
<td>Micky Mackie, Manager</td>
</tr>
<tr>
<td>Volcanic Earth</td>
<td>Organic skin care manufacturer, wholesaler, and retailer</td>
<td>Coconut oil production and products; owns DME factory</td>
<td>Barry Roche, Partner</td>
</tr>
</tbody>
</table>

_xviii_ Contact person for Matantas project is Purity Solomon.
Endnotes

1 Wade, p.8.
3 World Bank, p.xvi.
4 Jensen, p.12.
6 ESMAP, p.2. World Bank, p.56.
7 Wade, p.28.
8 ESMAP, p.2.
10 Vanuatu Ministry of Finance and Economic Management, p.15.
16 AusAID Governance for Growth Program, p.3.
17 AusAID Governance for Growth Program, p.23.
18 AusAID Governance for Growth Program, p.28.
19 AusAID Governance for Growth Program, p.4. Also, World Trade Organization, p.197.
20 AusAID Governance for Growth Program, p.31, 43. Also, World Trade Organization, p.197.
21 Reserve Bank of Vanuatu, p.38.
22 AusAID Governance for Growth Program.
23 World Trade Organization, p.197.
24 World Trade Organization, p.197.
25 AusAID Governance for Growth Program. Also, World Trade Organization, p.197. Also, Wilfred interview.
26 FAO, ch.15.
27 Ohler, ch.16.
28 Stein interview.
29 Ohler, ch.16.
30 Ohler, ch.16.
31 FAO, ch.15.
32 FAO, ch.15.
33 Ohler, ch.16.
34 Wade interview.
35 Wallez interview.
36 Wade interview.
37 Stein interview.
38 Deamer, p.5.
39 Foale, p.20.
40 Roche interview. Also, Wade interview.
41 Roche interview.
42 AusAID Governance for Growth Program, p.48.
43 Roche interview.
44 McGregor, Warner.
45 AusAID Governance for Growth Program, p.46.
47 www.oil-refinery.com
The Vila-based Agroprocessing facility for long shelf-life kava juice is one example. It is in Vila and therefore out of the scope of this paper, and more recent information would need to be found.

http://www.australianethnobotany.com/viewtopic.php?f=6&t=2302&start=0

Ritsinias interview. Cost estimates are +/- 10-15% and will vary depending on multiple factors.

Stein interview.

Jimmy interview. Project may also expand to the Banks.

Vanuatu Ministry of Finance and Economic Management, p.15.


Ritsinias interview.

Morris interview.

Wade, p.28-32. “To help reduce poverty, the provision of energy services in the PICs should focus on the cost of providing an affordable basic service, not the cost of providing a kWh...of electricity or a litre of kerosene.”

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