



Carbon Credits from Biofuels in Electricity Generation in Vanuatu

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The Vanuatu Carbon Credits Project / Vanuatu Forests Project

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Contents

Background	3
Biofuels in Vanuatu	3
A Potential CDM Project	4
Technical Considerations: Biodiesel.....	4
Logistical Considerations: Biodiesel	5
Financial Considerations: Biodiesel	6
Copra New Generation	7
The Path Forward.....	8
Project Idea Note.....	8
Project Design.....	8
Project Implementation.....	9

Background

The Vanuatu Carbon Credits Project (also known as the Vanuatu Forests Project) was established in 2006 by Victoria University of Wellington, (New Zealand). It focuses primarily on building capacity for Vanuatu to gain access to carbon finance for reducing emissions from deforestation and forest degradation. Because strategic development in the forest sector is ultimately linked to strategic development across all sectors, this project explores potential synergies across sectors as part of an overarching strategy to assist in moving Vanuatu along a sustainable development path. It aims to assist sustainable development strategy by building capacity in Vanuatu to take advantage of private sector carbon finance now available internationally as a funding source.

The energy sector and the forest sector have different goals but activities in one can influence the other, particularly when carbon markets are brought into focus. Electricity generation and transport in Vanuatu both use diesel as a fuel source. Coconut plantations in Vanuatu also produce coconut oil which is a source of biodiesel and a potential fuel source for large scale electricity generation and transport fuel. This is one link between the forest sector and energy. The production of biofuels is a land use activity of relevance to the forest sector and is also a potential source of carbon finance through the Clean Development Mechanism of the Kyoto Protocol. This is why biofuels are being explored as part of this overall project.

Biofuels in Vanuatu

As many people in Vanuatu are aware, using coconut oil to produce biodiesel is an opportunity that has many different benefits to different sectors of Vanuatu:

- Biodiesel can be carbon neutral (so long as the emissions footprint of producing it is not high).¹
- Producing biodiesel will significantly reduce the net imports of Vanuatu.
- A biodiesel plant would be an added value activity for the copra industry.
- Biodiesel production will reduce the vulnerability of the Vanuatu economy to crude oil price shocks.
- Biodiesel production will support the copra industry in Vanuatu.
- The use of biodiesel will reduce particulate emissions from vehicles in Vanuatu if used in the transport sector..

Unfortunately none of these benefits are fully taken into account in a perfect classic market economy. The Vanuatu Government has introduced measures to provide incentives for some of these things that benefit Ni-Vanuatu. The Government has placed an import duty on many imported goods, including diesel, which should

¹ Analysis of palm oil plantations in Indonesia and Malaysia indicate that some palm oil produces more emissions through deforestation etc than are displaced by the palm oil.

encourage the local production of goods and services. The Government of Vanuatu has also supported the price of copra in the past through the Commodities Marketing Board, to support the income of so many rural families who depend on income from copra to pay for school fees and health care. To encourage added value activities, the Government of Vanuatu will sometimes give import duty exemptions for the import of industrial equipment. This was the case for the machinery imported by Coconut Oil Production Vanuatu Limited (COPV).

However, because climate change mitigation is of global benefit, it is not deemed to be solely the responsibility of developing countries to introduce pricing mechanisms to encourage reductions in greenhouse gas emissions. This is why we would like to assist Vanuatu to utilize the Clean Development Mechanism (CDM) of the Kyoto Protocol to provide incentive for climate change mitigation activities, including biodiesel production and avoided deforestation.

A Potential CDM Project

Because the use of biomass for energy is carbon neutral, the use of biodiesel significantly reduces greenhouse gases compared to ‘business as usual’ mineral diesel consumption. Because Unelco is a single user of a significant volume of mineral diesel in Vanuatu (approximately 12 million litres per year) it is a very good prospect for a CDM project.

Technically, financially, and logistically there are several approaches that could be taken in this project. As we are in Phase One of the Vanuatu Carbon Credits Project, these ideas are not final, confirmed, obligatory, or an exhaustive summary; we are simply scoping the potential for a project that can benefit Unelco, the Vanuatu economy, copra growers, the Government of Vanuatu, and the global climate system.

This analysis will focus on two options for a potential CDM project:

1. Biodiesel fuel swap and new generation
2. Copra new generation

Technical Considerations: Biodiesel

Technically, there are several ways in which Unelco could use Vanuatu biomass for electricity generation.

It is understood that Unelco has looked at using specifically grown forest biomass for generation in the past. This could be a legitimate CDM project. However, it is understood that Unelco has not pursued this idea further, and it would require significant new investment in generation equipment, and developing a biomass sources.

Unelco is currently trialling the use of raw coconut oil injected at low blends (up to 10%) with diesel in one of its two 4MW German diesel generators at Tagabé. I understand that to use a high blend of raw coconut oil would either be impossible, or would require serious modifications to Unelco’s generators. Unelco management has

suggested that serious modification is probably an undesirable outcome because of the cost and risks involved. However, a future CDM project – when extra capacity is required - may be the purchasing of a more suitable generator with the assistance of carbon finance.

One technical solution is to produce transesterified biodiesel, as is currently being experimented with by Unelco for use in Unelco vehicles. The transesterification process involves combining the oil or fat with alcohol and a catalyst. A common approach is to use methanol, which results in the production of methyl esters (a suitable alternative to diesel) and glycerine (a product used in soap and other beauty and health products). If this process can produce biodiesel that is as cheap as mineral diesel (on a vatu per calorific value basis) when taking into account economies of scale and the sale of the glycerine then it would be a very good CDM project.

Logistical Considerations: Biodiesel

There are many logistical decisions that would need to be considered for the project. The two major decisions are location and transport.

The location of the copra plantations is relatively fixed, with many plantations already existing on Santo and Malekula. There is an estimated 96,000 hectares of land that is currently planted in coconut trees.

It would make sense to have the oil mill located at either Luganville (the main town of Santo) or Port Vila as these are the principal industrial areas of Vanuatu with existing infrastructure such as ports and electricity. There is currently an oil mill in Luganville, COPV, which is under receivership and so its assets are for sale. The mill has a maximum annual capacity of 36 kilotonnes of coconut oil, but typically runs at around 24 kilotonnes per year. This is slightly more than double the capacity required by Unelco for its electricity generation operations in Vila. The surplus coconut oil could be used in transport in Vanuatu (either raw oil blended, or as a feedstock for transesterified transport biodiesel) or exported. The Vanuatu Coconut Processing Limited (VCPL) company's oil mill is also on Santo; however it does not have the capacity to meet the demand of Unelco for any more than a low blend. Therefore it would be wise to utilize the COPV oil mill, or else a new oil mill would need to be constructed.

The transesterification biodiesel plant could also be located either at Vila or Luganville where there is existing infrastructure and services. These options will take further investigation, which will depend on the availability of land at appropriate places. Some appropriate places could include Tagabé or Luganville.

The main two options for transporting the coconut oil and/or biodiesel are probably private shipping (outsourced or in-house), or to use the services of existing oil companies. This will need further consideration to find which option will be the cheapest and most satisfactory.

Financial Considerations: Biodiesel

There are several ways in which the project could be organized financially, and this summary is not completely exhaustive. The main two financial options to be looked at are how the carbon credits (called Certified Emission Reductions, or CERs) are sold, and the ownership of upstream investment.

There are two basic options for selling the CERs – they can either be sold directly on the international market after they have been generated, or they can be sold before they are generated under a long term forward contract. It is also possible to sell the CERs using a combination of selling some under a forward contract and retaining some to sell in the market at potentially higher prices when they are generated.

Selling to the market once the CERs are generated is the best way to maximize potential profits from selling the CERs, but it also exposes the seller to risks in fluctuations in market prices. Current prices are quite volatile, and depending on when the credits are delivered, prices for comparable credits have fluctuated between over €32 per credit to as low as €1.15 per credit. Current prices are at around €13 – 14, depending on the terms of the contract. If minimum prices are needed for the project to be viable, selling on the spot market may be risky – depending of course on what the minimum price needed is. Various market projects indicate prices should increase to between €20 and €30 by the end of 2012, but there is still a reasonable amount of uncertainty in this.

Selling CERs under this strategy will mean that Unelco will have to finance the development of the CDM project itself, work with a CDM company that is willing to complete the CDM documentation in return for either a fixed fee, or work with a CDM company that will prepare the CDM documents at their own expense and risk in return for a share of the profits. Some CDM developers may also provide equity.

If CERs are sold under a forward contract it is possible to lock in a fixed price for the CERs and get a commitment from a buyer to buy a certain amount (or all) CERs the project will generate before the end of 2012. It is also possible to negotiate a mixture of a fixed price and a price that changes as the market price changes. CERs are typically paid for when they are delivered to the buyer. There is currently not much of a market for CERs generated after 2012, but this can also be explored. Unfortunately CERs sold under a forward contract are usually bought at a discount. The discount can vary but can be up to a 60% reduction compared to the market price. However, when selling under a forward contract it is usually possible to negotiate an advance payment or grant to cover the costs of developing the CDM documentation. Some buyers are also able to make advance payments for CERs, but tend to want some sort of security such as a bank guarantee or letter of credit supporting this payment.

We know of a Swiss buyer who may be interested in buying the carbon credits from Unelco under a forward contract. It seems that they are prepared to pay around €12 per Certified Emission Reduction (CER) and should be able to make an advance payment to develop the CDM documentation. They may also consider an advance purchase of up to 30% of the CERs generated by the project before the end of 2012 if adequate security is available. Each CER represents one tonne of avoided CO₂ equivalent greenhouse gas emissions. The conversion factor from litres of diesel to

tonnes of CO₂ equivalent emissions will vary depending on the diesel, but is approximately 2.28 tCO₂e per 1,000 litres of diesel. The total amount of CERs generated will depend on the amount of diesel replaced with coconut oil or biodiesel, whether or not any methanol used comes from a renewable or non-renewable source, and whether or not any greenhouse gases are emitted during the production of the biodiesel. Approximately 1.5 litres biodiesel has the same calorific value of regular diesel, which means that as a rough estimate; at €12 per CER the income from the CERs should subsidize the cost of biodiesel at a rate of no more than €0.018 cents per litre, or VUV 2.48 per litre. At a price of €20 per CER, this would be at most €0.03 and VUV 4.08 per litre.² Depending on the calculations the actual number could be quite a bit less than these numbers which should be taken as maximum prices per litre of biodiesel.

To be eligible to get the CERs, the international CDM rules require that the CDM finance is necessary for the project to happen. This can be justified by the finance generating feasibility in an economic, technical, political, or other context.

The second issue to be discussed is the various options of upstream ownership. The project would require investment in an oil mill, a transesterification biodiesel plant, and transportation services. These could be invested in and owned by Unelco or another private investor or a combination of the two (resulting in partial ownership by Unelco). Advance payments for CERs could also be used for investment in any of these areas if needed to make biodiesel a reality in Vanuatu.

Copra New Generation

Another option for generating CDM credits from electricity generation using biofuels is the construction of new additional 4-5 MW generating capacity based not on biodiesel, but on copra. This would not require transesterification and would use the copra oil directly. To calculate CERs from this, one can use approximately 0.6 CERs per MWh of copra fired power generation. One option would be to develop new generating capacity as a copra burning plant as a CDM project rather than the biodiesel.

Under this scenario there are lower production costs (without the need for methanol imports and a transesterification plant) but with the capacity to generate the same or more CERs per MWh of electricity produced. It is possible to generate more CERs per MWh because there is less carbon “leakage” during the production of the fuel - biodiesel requires more processing and imported materials which decrease the number of CERs generated.

There are interesting policy implications associated with a strategy to generate CDM credits from biofuels in Vanuatu. Energy security is an important policy consideration when evaluating different options.

For example, even though it is more expensive to pursue the biodiesel option (compared with copra generation) it may be a more secure option from an energy

² The conversion of € : VUV used is €1 = 134 VUV. Current on 13th February 2007.

security perspective. When there is a copra shortage (following a hurricane - and their frequency is forecast to increase under climate change) a biodiesel generator can be switched to regular diesel. As such, the downside of establishing new generating capacity based on copra is that it is not able to be easily switched to another fuel if there is a shortage of copra. Copra-based new generating capacity would potentially expose electricity supply to unacceptable risks. On the other hand the higher price for biodiesel generation (and associated CDM opportunities) could be considered as an insurance premium for security of supply in electricity generation. These are policy issues that would need to be considered.

The Path Forward

Project Idea Note

The next step in the path forward is for Unelco to assist our team from Victoria University of Wellington, where necessary, in completing a project idea note (PIN). The PIN is a short summary of the proposed project, which does not require hard numbers. It does not represent a commitment to implement the project, but can be used to assess the feasibility of the project and test interest of any CER buyers. We have attached a template project idea note as an appendix to this document.

Completing this PIN may require some additional research to assess the feasibility of the project. Assessing feasibility will need to consider and demonstrate:

- i) There is a reliable supply of sufficient copra to generate sufficient biodiesel;
- ii) Appropriate technology is available, and the costs of obtaining and maintaining the technology are acceptable;
- iii) The project is financially sound. This should include basic price sensitivity analysis for copra and CERs;
- iv) Financing options for the project, including the impact of CDM finance.

Unelco will also need to decide on a strategy for selling CERs.

If Unelco decides to sell the CERs under a forward contract, the PIN could then be submitted to Robert O'Sullivan of ClimateFocus who would assess the merits of the project and give an indication on whether or not the Swiss may be interested in the project. It can also be submitted to other potential buyers or CDM developers if Unelco is looking for additional partners or wants to compare offers.

Project Design

If Unelco decides to go ahead with the project, a CDM expert will need to be hired to prepare the CDM documentation (the project design document (PDD)). The PDD is required by the CDM Executive Board (EB). This is a very detailed document on the proposed project, which includes a baseline methodology. The baseline methodology

is required to demonstrate how many CERs can be generated and how these CERs are monitored.

At the moment there are not any baseline methodologies for using biodiesel for transport, but it may be possible to use existing baseline methodologies if the biodiesel is used to generate electricity. If a new baseline methodology needs to be developed to take advantage of transport, this will take up to an additional year to develop, but other people are also working on this so it is possible that a methodology will be available within the next 6 -12 months.

The costs of preparing a PDD range from around €18,000 – €50,000 depending on who prepares it and where they are located. The costs of preparing a baseline methodology are approximately an additional €60,000. As mentioned above, if CERs are sold under a forward contract it should be possible to obtain an advance payment or perhaps a grant to get the PDD developed. If they are sold on the market once they are generated, Unical would need to cover the costs itself, obtain independent grant funding to do this, or pair up with a CDM expert who may consider preparing the PDD at its own cost in return for a share of the profits of the project.

After the PDD is developed there is also an additional cost of hiring an independent auditor to check the PDD against the CDM rules to make sure they comply with the rules. This can be expected to cost from between €15,000 – €25,000.

Finally, the Government of Vanuatu would also need to approve the project.

To be viable the project would probably need to generate at least 60,000 CERs before the end of 2012.

Project Implementation

The project can be implemented in parallel with the CDM procedures, but it will not be able to claim any CERs until the project is registered by the CDM Executive Board.