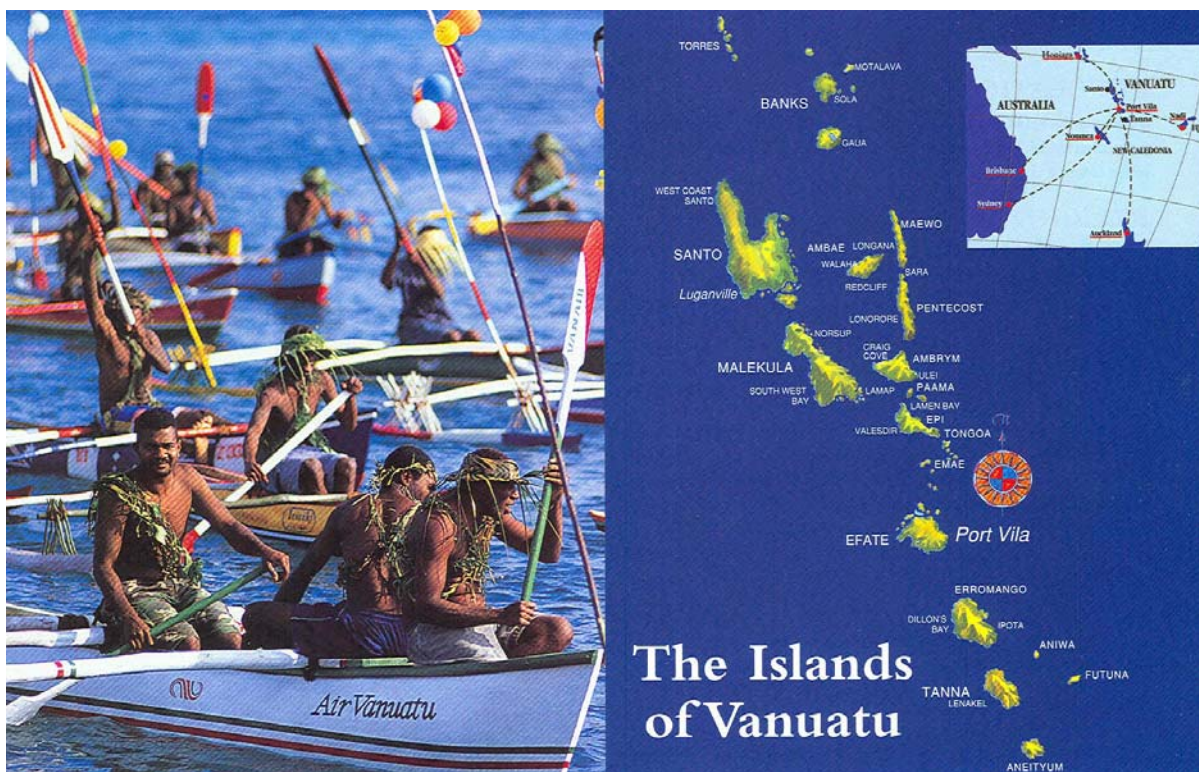




SOUTH PACIFIC APPLIED GEOSCIENCE COMMISSION

REPORT OF ENERGY MISSION TO VANUATU 26 July – 09 August 2005



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Energy Advisers, Community Lifelines Programme

February 2007

SOPAC Trip Report 383

This report is in two parts:

- Part I Outline of the Mission and details from Discussions/Consultations.
- Part II Report on the Sub-regional Workshop on Biofuels.

The report on the sub-regional workshop is also available separately as SOPAC Miscellaneous Report 602.

PART I – OUTLINE OF MISSION AND DETAILS FROM DISCUSSIONS

Introduction

This energy mission to Vanuatu was programmed as part of the 2005 Community Lifelines Work Programme. Meetings (in addition to the workshop) held during the mission were centred on the regional and national energy activities in Vanuatu and possible collaborative roles/efforts with Government Ministries/Departments, Donors, Regional Organisations, and the Private Sector.

Vanuatu's National Representative to SOPAC was appreciative of SOPAC's initiatives in the energy sector, in particular with the choice of Vanuatu to host the sub-regional workshop on biofuels.

Objectives

The mission was carried out with the following objectives:

- Conduct a sub-regional workshop on biofuels titled "Challenges and Opportunities to a Viable Biofuels Sector", attended by about 25 people; and
- Provide updates and consult key stakeholders in the land transport sector.

List of people we met and discussed energy-related issues with during the mission

- Mr Russell Nari, Director General, Ministry of Lands, Natural Resources, Geology, Mines, Energy, Environment and Rural Water Supply (Vanuatu's National Representative to SOPAC).
- Mr Leo Moli, Principal Energy Officer, Ministry of Lands, Natural Resources, Geology, Mines, Energy, Environment and Rural Water Supply.
- Mr Donald Wouloseje, Energy Economist, Ministry of Lands, Natural Resources, Geology, Mines, Energy, Environment and Rural Water Supply.
- Mr John Chaniel, General Manager, UNELCO Vanuatu Ltd.
- Mr Francois Py, Manager, Island Operation, UNELCO Vanuatu Ltd.
- Mr Willie Ben Karie, Commercial Manager, UNELCO Vanuatu Ltd.
- Mr George Brechtefeld, Acting Manager Rates & Taxes, Department of Customs and Inland Revenue.
- Mr Manasseh Tary, Director General, Ministry of Infrastructure and Public Utilities.
- Mr Patrick Haines, Programme Officer, Australian Agency for International Development (AusAID).
- Mr Nikenike Vurobaravu, Head Pacific Operations Centre, UNESCAP.
- Mr Antii Piispanen, Programme Officer, UNESCAP Pacific Operations Centre.
- Mr Tevita Tukunga, Energy Planner, Ministry of Lands, Survey and Natural Resources, Tonga.
- Mr Molipi Tausi, Energy Planner, Ministry of Works & Energy, Tuvalu.

General

The following table provides a summary of discussions held during the mission with respect to the following activities and the action(s) required.

ACTIVITY NAME – TITLE / TASK PROFILE NUMBER	ACTION
<p>Promotion of Environmentally Sustainable Transportation in the Pacific Islands – RT2002.022 [GEF – PESTRAN Project]</p> <p>The discussion with the Energy Unit was focused on finalising the national consultant to collate data and compile a country report.</p> <p>Meetings with other Ministries/Departments: Infrastructure, Customs and the Municipal Office were to introduce the project and seek support – the initiative was welcomed by the respective parties and support reaffirmed.</p>	<p>SOPAC to forward the Contract for the national consultant to the Energy Unit for signature. Data & information gathering to begin as soon as contract is signed.</p> <p><i>A draft contract has been circulated here at SOPAC for comments, will forward to SOPAC Director for signature once finalised.</i></p>
<p>Energy Resource Assessment – RT1999.060</p> <p>The Energy Unit indicated that they would like to seek assistance from SOPAC to strengthen their micro/mini hydro feasibility studies for their rural electrification programme.</p> <p>Geothermal Energy – RT2002.018</p> <p>UNELCO, the power utility, expressed its interest in looking at the geothermal potential in Efate – this is to progress work initially carried out by a company from Australia. UNELCO would like to take the work further into deep drilling to confirm the resource. It hopes that this could be tied-in to a similar initiative by the FEA.</p>	<p>The Energy Unit to request SOPAC for assistance through the SOPAC National Representative.</p> <p>SOPAC to forward UNELCO some contact details of interested parties in New Zealand and may be the USA.</p> <p><i>SOPAC has made contact with FEA and seems that there is a possibility of having FEA & UNELCO working together.</i></p>
<p>Training and Technical Assistance – RT1999.011</p> <p>The Energy Unit also would like to seek SOPAC assistance on the possibility of having one of their Officers (Engineer) on an attachment with SOPAC and the FDOE – to focus on the rural electrification programme especially on mini/micro hydro schemes.</p>	<p>Energy Unit to forward request to SOPAC with a proposal on what they would like to achieve from the attachment.</p>
<p>PIEPSAP – RT2004.004</p> <p>Discussions with the Energy Unit revealed that they are currently working towards developing an Energy Master Plan for Vanuatu. SOPAC explained that this is an area that assistance can be provided by PIEPSAP.</p>	<p>Energy Unit to make this known to the PEIPSAP Team in SOPAC.</p> <p>This has been discussed with the PIEPSAP Adviser who will follow up with Vanuatu.</p>
<p>Energy Supply / Demand Database RT1999.006</p> <p>SOPAC provided the database template, which was installed in the Energy Economist's computer. He has collated energy data but not really stored in a systematic form.</p>	<p>---</p>

PART II
REPORT ON THE SUB-REGIONAL WORKSHOP ON BIOFUELS

(SOPAC Miscellaneous Report 602)



REPORT ON WORKSHOP:

“CHALLENGES AND OPPORTUNITIES TO A VIABLE BIOFUELS SECTOR”



**1 – 5 August 2005
Port Vila, Vanuatu,**

Prepared by:

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Energy Advisers, Community Lifelines Programme

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SOPAC Miscellaneous Report 602

FINAL DRAFT COPY



ACKNOWLEDGEMENTS

SOPAC would like to acknowledge the Governments of Japan, Denmark and UNDP for funding this workshop. SOPAC is also grateful for the extensive support of the Energy Unit, Ministry of Lands, Natural Resources, Geology, Mines, Energy, Environment and Rural Water Supply. Management from UNELCO, Motor Traders and VAST Energy are also acknowledged for inviting the workshop participants on excursions as part of the programme.

PICTURE ON FRONT PAGE:

Group picture of participants at opening ceremony on Monday, 1 August.

Left to right: Jan Cloin, Rupeni Mario, Steven Wakefield, Katarina Tofinga, Peter Napwatt, David Parmenter, Jonathan Napat, Dennis Pont, Tile Tuimalealiifano, Timothy Kopial, Molipi Tausi, Hon. Willie Jimmy Tapaga Rarua, Dr Surendra Prasad, Russell Nari, Tevita Tukunga, Johnbosco Petelo, Tony Deamer, Dr Vincent Bowry, Leo Moli, John Chaniel, Stephen Tonge, Willie Ben Karie, Betty Vollrath, John Vollrath, Jeyom Segaram.



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INTRODUCTION

The SOPAC Community Lifelines Programme has been studying the international developments in biofuels during 2004 and the relevance for its member countries. In this period, the need was identified to disseminate information on technical potential and also to work together with governments, power utilities and the private sector to realise the potential benefits that biofuels can bring to the Pacific island countries.

The groundwork carried out during 2004 led to a number of activities on biofuel advancement in 2005. First, a SOPAC-headed team carried out a feasibility study for the Electric Power Corporation (EPC) in Samoa on the use of coconut oil in their power generation (CocoGen). Secondly, SOPAC organised a national workshop for the Fiji Government on March 16 and 17, 2005 at the Forum Secretariat. The third major activity on biofuels was the organisation of a sub-regional workshop on biofuels.

Vanuatu was chosen because of its relatively advanced market on biofuels. The country therefore had a lot of opportunities for relevant site-visits as excursions in the programme. Japanese funding was used from the Forum Secretariat "Copra Oil" project. Because of the relatively high costs involved in the organisation of the workshop in Port Vila as opposed to a regional centre such as Suva, additional funding was sought through the UNDP Pacific Islands Energy Policy and Action Plan (PIEPSAP) Project, funded through the Danish Government.



Objectives of Workshop

The objectives of the workshop were two-fold: firstly to exchange information between researchers, private sector, government and utility representatives on the state-of-the-art of biofuel applications both internationally and in the Pacific in particular; and secondly for each participant to produce a draft project proposal for a viable biofuel operation.

The participants would develop this proposal during the course of the workshop, with a view to implementing the opportunities identified. After the workshop, this proposal would then be finalised through consultation with the stakeholders and used as a basis for submitting to investors and/or donors for consideration.

Organisation

The Workshop Programme is in Annex 1. It involves a large degree of participation from the delegates and knowledge about the private sector activities in the country. Therefore, private sector country representatives were preferred over Energy Planners.

A circular was sent out to the SOPAC national representatives of the following member countries, copied to the Energy Contacts for submission of nominations for attending the workshop: Kiribati, Papua New Guinea, Republic of Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu. Copies were also sent to Tokelau, Fiji, University of the South Pacific and Unitech in Lae, PAPUA New Guinea.

Workshop participants are listed in Annex 2. The country Representatives for which SOPAC paid travel costs and allowances are highlighted in grey. One resource person, Mr Timothy Kopial was paid for by SOPAC. The representative for Papua New Guinea, Mr Wari Agigerega did not make it to Vanuatu due to an issue with the validity of his passport. University of the South Pacific resource person, Drs Surendra Prasad and Vincent Bowry attended at their own expense.

Prior to the workshop, the selected nominees for the nine participating countries sent SOPAC a country presentation and a biofuel energy datasheet with information on biofuel potential in their respective countries. These datasheets and presentations can be found on the CD-ROM with all the papers, presentations and outcomes of the workshop.



A press statement was prepared (Annex 3) and sent to the major newspapers of Vanuatu and the local television. Throughout the week, a number of items on different media covered the workshop.



Workshop Results

Day 1

After the word of welcome from the head of the Energy Unit of the Vanuatu Government, Minister of Lands, Natural Resources, Geology, Mines, Energy, Environment and Rural Water Supply, Hon. Willie Jimmy Tapaga Rarua officially opened the workshop. This was followed by SOPAC's opening remarks, an introduction of the participants and a presentation of the main objectives and outline of the workshop.



Mr Russell Nari, Vanuatu national Representative to SOPAC was selected as the day-chair and led the country presentations.

Figure 1: Opening Speech by Hon. Tapaga Rarua

Vanuatu: has used coconut oil fuels first in the world wars during periods of lack of diesel. It has been producing 27,000 – 34,500 tonnes of coconut oil in the last five years of which up to 17,100 tonnes were exported. Vanuatu's diesel imports in the same period have been averaging 25 million litres of which 50% was used for power generation. Tax on diesel amounts to 26 Vatu as duty plus 5 Vatu Excise tax: Coconut Oil blended with kerosene or diesel is taxed 5 Vatu (as Excise tax) only. Vanuatu has two companies that are engaged in coconut oil fuel retail and some larger mills are using coconut oil as a fuel in boilers and generators. The Power Utility, UNELCO, has been running a 200 kVA genset on a 5% blend of coconut oil recently and has plans to run a larger genset (4MW) on 5% coconut oil blend. The Meteorology Office and the Energy Unit have been using coconut oil-based biofuels in the past year and reported no serious problems. As part of a Government directive in July 2005, all Government vehicles with diesel engines are strongly encouraged to run on coconut oil-based fuel. Diesel is currently retailed at 133 Vatu and coconut oil biofuels at 110 Vatu.

Tuvalu: does not have a copra industry since subsidies were removed in 2002. There was a production of around 300 tonnes per year when the subsidy was still in place. There appears to be potential to utilise copra oil as biofuel from the outer islands, however a mill



for processing and a subsidy system would need to be established. BP is the only supplier and is retailing diesel at NZ\$ 1.00 per litre which is expected to go up soon. Half of the fossil fuels imported into Tuvalu are used for electricity generation, 29% for transport and 12% for cooking. There have been experiments with biogas from pig waste, to produce gas for cooking. This AusAID-funded project has not been successful and there appears to be a requirement for follow-up. The biggest challenges in terms of biofuel development are Tuvalu's economy size, its limited investment opportunities, institutional barriers due to the high turnover of staff.

Tonga: used to have a thriving copra industry during '50-'80s with the Tonga Copra Board and Tonga Coconut Mills and Industries as the main producer and exporter. Even though serious efforts were made to replant during the '90s, the agricultural ministry has not been successful in reviving the coconut sector. The coconuts are still available but not harvested; instead the agricultural sector focusses on the production of pumpkin and vanilla. The land tenure system is a serious challenge to the emergence of a biofuel industry. The exact size of the resource was not mentioned, however with a limited investment a small mill could be installed to process copra into usable oil to replace diesel.

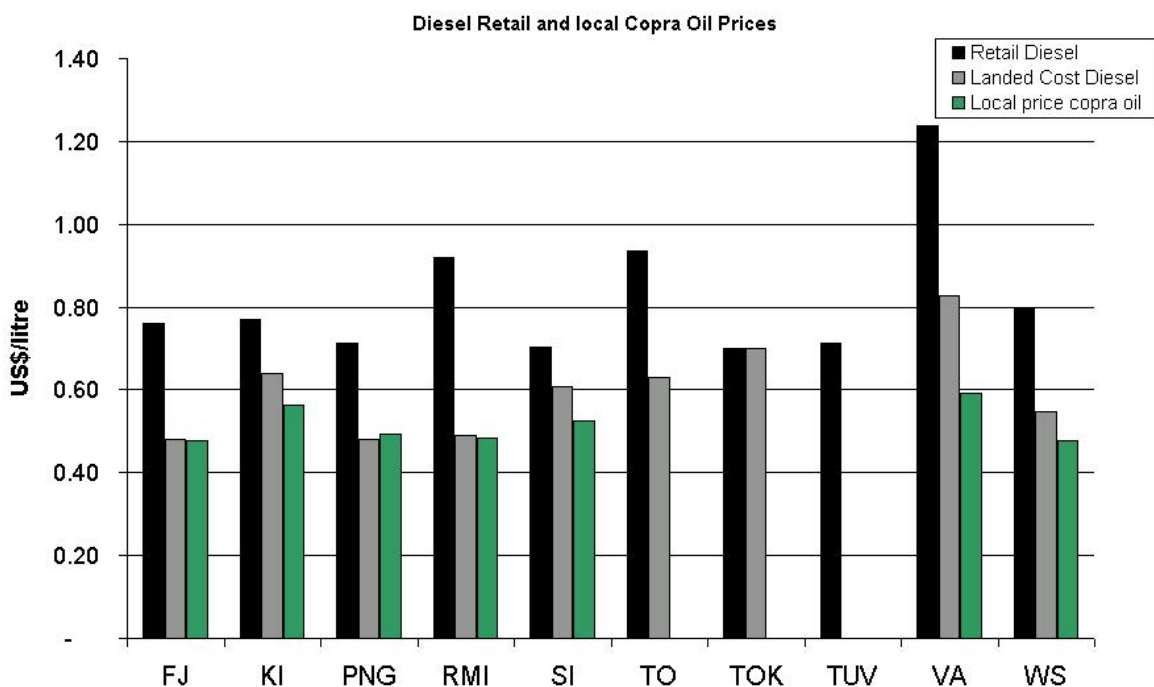


Figure 2: Regional Diesel Retail, Landed and Copra Oil prices (Source: Workshop Datasheet)

Kiribati: is currently producing over 6,000 tonnes of copra oil every year of which the majority is exported. The Government-owned KCMC1 is the only copra oil mill and is

¹ Kiribati Copra Mill Co. Ltd



exploring the opportunities to use copra oil as a fuel instead of exporting. Copra oil is currently the second largest export earner after fish. The copra industry is heavily subsidised by the Government and this hampers quality control of copra. The Energy Planning Unit of the Government is experimenting with different blends in vehicles and the PUB² is interested in using (blends of) coconut oil in their generators, especially on the outer islands.

Papua New Guinea: is the largest producer of copra oil in the region, with a peak production of 49,000 tonnes of copra oil in 2004. There are great opportunities to use (part of this) amount as biofuel. 11% of all the imports are diesel fuel and the replacement of part of this amount would have positive impacts on the balance of payment.

Solomon Islands: is recovering from its civil war and reconstructing vital sectors such as copra and copra oil production. Solomon Tropical Products (STP) is acquiring the remains of mills and getting them into production. The volume of the total production is slowly increasing every year. Bottlenecks that hamper the production is low levels of production, which requires the mill to utilise expensive flexibags for transport of the oil. The owner of STP has been driving several vehicles on a blend of 80-90% coconut oil, 10-20% JetA1 (one Toyota Hilux, a Landcruiser, a 1 tonne truck and a three tonne Mazda truck, a bulldozer and forklift). Also, they have been running a 7.5 kVA stand-by generator on the same blend. After the fuel cleansed the fuel system, the filter problems were over, mostly after 4-5 filters. After that, no problems were reported. The cost of diesel amounts to SI\$5.36 and the cost of coconut oil is SI\$ 3.30. On diesel, there is tax of 22 cents per litre and on all retailed fuel there is a 10% VAT.

Samoa: has carried out some experiments using a coconut oil fuel blend in its power generation. During the CocoGen Project, blends of 5% and later 10% coconut oil were tried in a 400kVA generator. The results were encouraging and no problems have been reported. In 1997 Samoa had a peak production of 5,500 tonnes of coconut oil, of which 8,500 tonnes were exported. Last year, only 1,800 tonnes of coconut oil were exported due to problems within the copra sector. During a recent stakeholder meeting on coconut based power production, it appeared farmers were reluctant to sell below a price of 25 sene per nut, whereas the CocoGen feasibility study only allowed for a nut price of 13 sene. Green coconuts is sold on Fugalei market as a refrigerated drink for ST\$1.

Tokelau: wants to become 100% renewable energy for its electricity generation. As a guideline its ambitions are to have 70% solar PV and 30% biofuel, but a more careful

² The Kiribati Electric Utility is known as the Public Utilities Board



resource assessment might be required. Tokelau has an energy policy and a strategic action plan to achieve the renewable energy goals. It also has composed a risk management plan and carries out research on renewable energy technology. There are often supply problems with fossil fuel apart from it being very expensive. There is no wharf on the main island and sometimes during rough weather, the drums of fuel are thrown in the water to float to shore. According to a preliminary resource assessment, there should just be enough coconuts to produce coconut oil as a fuel replacement for all the fuel use on the island, including power generation and transport.

Marshall Islands: has great potential for use of coconut oil as fuel for power generation since the copra mill is located next to the main production plant of the Marshall Energy Company (MEC). However, at current prices, it is still cheaper for MEC to run on diesel as it is supplied to them tax-free. This price advantage might change in the coming months as new supply contracts are being negotiated. There are not enough coconuts on the main islands, however in the outer islands there is plenty. There seems to be potential for use of coconut oil both on the mainland and on the outer islands, in exchange for copra. The Copra Mill has been running (newly-purchased) vehicles on pure coconut oil for the past years without any problems and is now retailing filtered coconut oil to motorists at US\$2 per US gallon, while diesel is retailing at US\$ 3.50 per US gallon.

Discussion

It appears that the main issues arising from the discussions are:

Challenges in Rural Development and the importance of decreasing urban drift;

The need for Education & Awareness;

The requirements of an establishment of Standards for Biofuel (Quality Control);

Need to Revive the Coconut / Copra Industry in many countries;

Difficulties with the current Infrastructure (Boat, Road, rural) to collect copra;

There exist many Business Opportunities in the countries discussed;

Often the price of copra is politically determined and out of line with the world market, while the price of copra oil is world market determined;

There is a need for establishing technical oil quality facilities;

There is great potential for training, however there is also a great turnover of staff, therefore the requirement to re-train;

When dealing with outer islands, there is a great cost of transport of both copra and oil, this could be solved potentially with the establishment of mini-mills; and

The perceived economic impact of the import substitution of fossil fuels is great.

Breakaway Session – How to promote the use of biofuels in the region?

The participants were divided into three groups and tasked with the following and to answer the questions posed:

Introduce your Team Name and Team Members;

How would you design a biofuel promotion campaign?;

What should you NOT do with biofuels? (5 things);

If you were Minister of Energy, list 5 things that you would do to promote the use of Biofuels.

The results from the three groups were presented during plenary and the day-chair was to 'judge' the most original presentation. Some of the pictures of the first day cover the results; Group 1



Figure 3: "CocoPower" Presentation



headed by John Chaniel, called the “CocoPower” group won the prize of a round of kava in a Nakamal.

Day 2

Day-Chair: Jan Cloin

On the second day, the presentations focussed on the theory and technical issues around the use of biomass and liquid biofuels in particular. Dr Surendra Prasad (USP) gave an overview of the biomass conversion technologies. 16% of the world's primary energy is derived from biomass. There is great potential for the use of gasification, pyrolysis and biogas digesters.

Timothy Kopial gave a presentation on the operation of a compression ignition engine and its normal operation on diesel. After that, he went into detail on how he researched the performance of a diesel engine on different blends of coconut oil and coconut oil methyl ester (COME) fuels. The results were encouraging for the use of both methyl esters and pure coconut oil. The most successful blend was found to be 60% diesel and 40% methyl ester. Problems with both methyl ester and raw coconut oil are their higher viscosity, higher solidification point. Mr Kopial proposes to use coconut oil methyl ester (biodiesel) in engines in Papua New Guinea because of the technical superiority of the fuel to both diesel and coconut oil. His technical paper can be found on the CD Rom. Future testing should focus on chemical properties of the fuels, the long-term effects of the fuels on engines, the emissions associated with the different fuel blends and the macro-economic impact of the use of different fuels on a national economy.

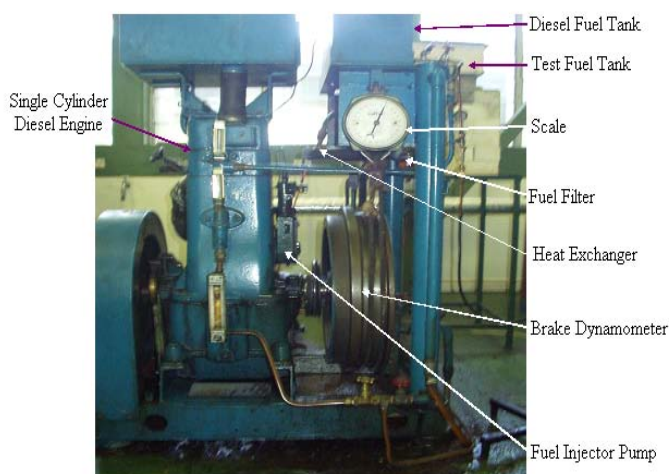


Figure 4: Test set up of Mr Kopial, Unitech Lae, for testing different blends in a compression engine.

Mr Tony Deamer gave a presentation on his experience using coconut oil-based fuels in the last 7 years. His paper is included in the CD Rom. For further details see next page of a short report on the excursion to Motor Traders' premises.



Mr Dennis Pont presented a combined Heat and Power plant, using an adapted diesel engine. His company, Kogler Energy Options is looking to develop projects in the Pacific region, using European and Australian environmentally-responsible technical solutions.

Mr. John Chaniel, general manager of Vanuatu Power Utility UNELCO presented their experience using low blends of coconut oil in the diesel of a 120kVA genset and are now looking at industrialising the use of coconut oil as a fuel. The use of coconut oil in Vanuatu is currently competitive with diesel fuel, even though UNELCO receives its fuel duty-free. UNELCO asks about experiences of the



Figure 5: UNELCO 4 MW diesel Genset in Port Vila

participants to determine the supply quality, pricing and is concerned about the continuity of supply. It is possible to purchase a dedicated generator that can run on 100% coconut oil, however this requires major investment. More interesting is the in-house development of adaptations on older generators that can run on blends of 5-10% coconut oil in the diesel. UNELCO expects to require over half a million litres of coconut oil by the end of next year. UNELCO is concerned about the long-term impact of coconut oil on their engines (4MW MANB&W) and question how often they need to check the lube-oil. UNELCO also sees the use of coconut oil as a solution to rural electrification of the outer islands.

Mr Stanley Temakon, gave an overview of the operations of the largest coconut oil mill COPV. The oil mill is aware of the emerging market for coconut oil mill as fuel and asked the participants what quality standards they would require for large-scale supply of coconut oil for fuel in transport or power generation. COPV can largely control its FFA and glycerine content, colour and has a range of filtering options.

During a presentation by Dr Vincent Bower, the participants got an introduction of the properties of biodiesel and its production process. USP is currently conducting research into lipid oil analysis and the most appropriate way to produce biodiesel in Fiji.

The technical session was closed by Peter Napwatt from Vast Energy (Vanuatu Sea Transport (VAST) – Energy branch. The company has



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Figure 6: Group picture during the excursion to Motor Traders.



been involved with cleaning and filtering of coconut oil to be retailed as a fuel, using blends with diesel. Their latest product requires processing by a proprietary process and is called “super oxygenated coconut oil” and is currently sold in a blend with 70% SOCO and 30% diesel.

The day was closed with an excursion to Motor Traders, courtesy of Tony and Eastuary Deamer. Motor Traders is retailing CocoFuel, which is a blend of filtered and centrifuged coconut oil (80-85%) and kerosene (15-20%). Motor Traders has recently acquired a licence to retail fuel and levies 5 Vatu per litre as Excise tax and 12.5% VAT. The participants were shown around the coconut fuel processing area and got a ride in cocofuel powered vehicles. Mr Tony Deamer recommends a fuel heater to be installed when using cocofuel.

Day 3

During the first session of Wednesday, Gerhard Zieroth and Jan Cloin asked the participants to break up in three groups and brainstorm on ideas to advance the biofuels industry in the Pacific region. The groups (1,2,3) were named “users”, “producers”, “government”. Participants were grouped according to their own background or where they felt most comfortable to contribute. The results are given below.

What would you do to promote the biofuel sector?

Group 1: Government

Feasibility Studies

Design Policy (Guidelines, Standards, Acts, Legislation)

Streamline Policies from Various Sectors

Encourage Foreign Investors

Provide Subsidies

Provide Training, local Human Resources

Institutional Infrastructure – Monitoring

Infrastructure Support (e.g. shipping to the outer islands)

Public Awareness Programme

Government Incentives – Soft loan scheme

Manage the waste streams (Environmental Guidelines)

Lead by example (use biofuel in own vehicles)

Group 2: Producers



General remark: What would be the problems of coconut oil usage if we did not have standards? If we don't get this thing working, all will be theories. Applying European standards for fuel won't work – what is required is a local set of standards? Simple analytical tools: taste! FFA – particles. Copra drying and copra testing for quality assurance.

Presentation for electrification for rural schools, community centres,

Do the people want electrification? It is their decision.

If yes, what volume of coconut is available in the area?

What kVA is needed for electricity provision?

Demographic Data (Babies, students) (For estimation of power demand)

Current Kerosene usage data

Economic Data

Generator sizing, expeller sizing

Community Entrepreneurs – Get the copra together

Copra gathering (cash for copra)

Expeller (oil extraction)

Power distribution (running the generator)

Money collector for amounts of energy

Demonstration Effect will convince other villages

Follow Up (to avoid rust memorials)

Group 3: Users

What we want to be able to use coconut oil fuel on a large scale:

Quality of product;

Reliability of Supply (disasters, flooding, cyclone impact);

Stable Price (fixed price increasing only with wages or inflation);

Government guarantee that there will be stocks available on the island;

Coconut oil must meet certain standard (not the fuel blend), to enable different mixtures.

After discussion, it appeared that the three groups had taken very different viewpoints in addressing the issue of a great market for biofuel. The approach clearly reflects the participant composition for the workshop. The above ideas also demonstrates that the private sector is focussed on specific projects that actually addresses specific issues such as electricity for schools, quality of coconut oil and sustainable supply. Whilst on the other hand the government seem to look at it from a policy level.



In a second session, people were divided randomly in different groups (A,B,C), to enable revived discussions.

Exercise:

Develop 5 Project Proposals and describe the activities, partners and funding required.

Results:

Group C:

Process: first brainstorming: what ideas do we have?

Copra dryer (centralised, quality control)

Regeneration of the crop

Transportation

Human Resource Issues

Mini-mills for outer islands

Testing Facilities

Diesel Engine Support Services

After that, the group selected 5 projects:

Copra Drying

Partners: cutters (private individuals) technology (designers), government.

Activities: Designing the Copra Dryer, Test the Dryer, Revise. Training personnel, Funding Application.

Funding: Government and Copra Mills

Regeneration of the Crop

Partners: Ministry of agriculture, farmers

Activities: Promotion of coconut crop, resolve land issues, promote replanting, nursery, distribute seedlings, dedicate pieces of land for replanting or replacement of old trees

Funding: bilateral aid, multilateral aid, grass-root development.

Transportation Issues

Partners: Government, Private Sector, Growers, Mill

Activities: Need to have efficient and reliable service, training of the crew, mini-mills might be a part solution on the remoter islands.

Funding: Government, Private, Copra Mill



Testing Facility

Partners: Government, private sector, SOPAC, USP

Activities: Design and build, equip the laboratory, train personnel, determine and meet standards. Institute affordable testing methods

Funding: Government and Donors

Diesel Engine Support Services

Partners: Government, private sector, Regional org's, engine manufacturers, mechanical engineers report

Activities: Promote use of biofuel, examine engine requirements so that standards are established, and provide training

Funding: Government, aid donors

Organise a workshop

Group B

Self-funding projects

Strategic Storage / Supply Facility

Activities: (would give security of supply for utilities, would allow oil processors to avoid influence from world market price fluctuations, climatic conditions, natural hazards such as cyclones)

Partners: utilities and oil processors

Replanting of coconut plantations

Activities: replace aging trees (VARTC), decide on most appropriate seedlings for the participating islands

Partners: Oil processors, ministry of Agriculture, farmers

Utilisation of By-products from coconut oil production

Activities: Meal to be processed into high value animal feed, Shells into activated carbon filters NZ AU markets

Partners: Marketing organisation, mills, ministry of agriculture

Schools

Activities: Selection of Campus, boarding school, CHP unit installed to provide electricity and heating / cooling; through provision of coconut oil and gasification of by-products; includes educational project on energy education

Partners: Education Dept., Energy Company



Eco-tourism resort

Activities: Aim at EU eco-tourists, adjacent of coconut plantation

Partners: Tourism promoters, UN (eco-tourism programme)

Funding: Green Credit (EU)

Cassus (hardwood) plantation for use in Gasifiers

Activities: Electricity Generation (UNELCO), job provisions on plantations, save on electricity costs, to avoid world price fluctuations, save coconut oil for transport.

Partners: UNELCO, Ministry

Funding: Bank

Group A

Use of Coconut Oil for Power Generation

Activities: protect from unstable costs fossil fuels, reduce dependency, technical support, replanting of coconut plantations.

Partners: Farmers, Government, Oil producers, Power Utility, Gasification Equipment Suppliers, Ministry of Agriculture.

Use coconut oil to blend with diesel

Activities: produce and treat coconut oil, sell waste products

Chicken farm

Activities: Use of Coconut Meal as animal feed, use water pump, increase yields of chicken farm through daylight simulation at night. (production + 75%, + 4% more feed)

Partners: Supermarket, hotels, farmers

Use of chicken waste for biogas – cooking

Tilapia (fish) Farm

Activities: Install water tanks and pumps to breed fish and use coconut by-products and chicken farm waste to feed fish

Soap making



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Figure 7: Copra oil processing at FNTM

Activities: Small-scale community based industry soap making using coconut oil.

No large financial support required. Finance required for gasifiers, mill, rest will support itself.

After the presentations of these project ideas, Mr Patrick Haines – Australian Government, AusAID gave an overview of requirements for external funding of project proposals through AusAID. The presentation is included in the CD-Rom.

After closing of the day, the participants went on an excursion to the FNTM (Copra / Sandalwood Mill) and VAST (Fuel oil production and retail). At FNTM, currently 1000 litres of coconut oil are produced, dedicated for fuel at VAST. At VAST the participants were shown the retail bowser and had a look at the wharf where they used to receive copra from the outer islands.

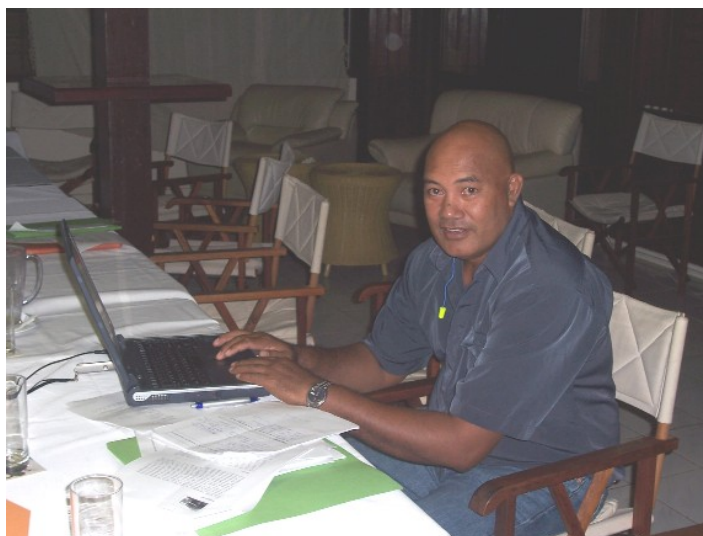


Figure 7: Participant from Tokelau writing his biofuel project proposal.

Day 4

After a short introduction, the participants were asked to work on a project proposal template for a biofuel project. There were some short presentations as well.

Mr Gerhard Zieroth presented his feasibility study for coconut oil fuel to be retailed as transportation fuel and used for power generation in Kiribati.

Mr. N. Godden from the Customs Department presented on the Vanuatu Government excise duty on biofuel. The duty structure on transport fuels in Vanuatu is as follows:

Product	Duty (Vatu)	Excise (Vatu)
Diesel	26	5
Island Fuel ³ (total mixture)	-	5
VAST ⁴	Diesel is duty free (exemption)	5 (on total mixture)

³ Island fuel mixture is 15% kerosene; 85% coconut oil (no duty)



Pure Coconut Oil	0	0
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For supply of fuels, certification required (110,000 Vatu)

All fuels sold: 12.5% VAT applied

Mr Nikenike Vurobaravu (UNESCAP) presented on the guidelines of UNESCAP on funding proposals. The presentation can be found on the CD-Rom. The guidelines provided inspiration for participants and an appreciation for seeking the overlap of their own interests and donor interests.

The day was closed with an excursion to the new power plant of UNELCO with a 4 MW diesel genset that will be running on 5% coconut oil before the end of the year. As this machine is very carefully monitored, the experiment will generate a lot of data on the impact of coconut fuel blends on larger machines.

Day 5

During Friday, the participants were asked to individually present their project proposals to the group. A list of the subject of the proposals is given below. After each presentation of about 10 minutes; 5 minutes of discussion followed to further explain the proposal or to make it more market-oriented.

Fiji⁵ – 5000 litre per day biodiesel production plant

Vanuatu – Government and UNELCO to install a copra oil mill in Malekula (including the upgrading of existing oil mills on Santo

Kiribati / Tuvalu – National workshop on biofuels

Tonga – 300 litres per day pilot copra mill for biofuels

PNG – Biodiesel Research Facility at Unitech

Solomon Islands – Hospital / School Electrification

Samoa – 2-MW Gasification Unit

Tokelau – Mini-mill for Rural Electrification

Marshall Islands – Biofuel Research Facility

⁴ VAST fuel mix is 30% diesel and 70% coconut oil

⁵ One of the participants took the interest to develop something for Fiji



The exact proposals can be found on the CD-Rom. It was agreed that SOPAC Energy staff would work with the participants after the workshop to improve the proposals and to submit for funding.

After lunch, the participants discussed the contents of the recommendations going out from the workshop. See Annex 4 for the final recommendations.



Figure 8: Participant from Tuvalu receives the workshop T-shirt and group picture.

The workshop was closed by Mr Russell Nari, Director-General for the Ministry of Lands, Natural Resources, Geology, Mines, Energy, Environment and Rural Water Supply and National Representative of Vanuatu to SOPAC, at 15.30 hrs, followed by a function hosted by the Government of Vanuatu.



Annex 1: Programme

Sub-regional Workshop on Biofuel, Vanuatu “Challenges and Opportunities to a viable biofuel sector”

Introduction

In the Pacific, opportunities exist to utilise copra oil and other vegetable oils as a fuel for transport and electricity generation. Technologies exist to combust crude copra oil in adapted compression engines or by means of esterification into biodiesel, using standard compression engines. The initiatives undertaken in various Pacific island countries have had varying degrees of success. Given the high landed cost of fuel and ever-rising world market oil prices, the economic benefits of diversity into biofuels for Pacific island economies are substantial.



Objectives

The aim of the workshop is to produce a draft project proposal for each participating country. The participants will develop this proposal during the course of the workshop, with a view to implementing the opportunities identified. After the workshop, this proposal can then be finalised through consultation with the stakeholders and used as a basis for submitting to investors and/or donors for consideration.

Participation

The Workshop will have participants representing utilities and the private sector from Kiribati, Papua New Guinea, Republic of Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, Tokelau and Vanuatu. Further contributions are expected from the University of the South Pacific, Technical University of Lae, Vanuatu Air and Sea Transport, Copra Oil Production Vanuatu and Motor Traders.

Venue

Wild Pig Hotel, Vanuatu

The Wild Pig Hotel features the widest variety of accommodation styles in the South West Pacific.

The Wild Pig Hotel is centrally located 5 minutes walk from down town Port Vila. It is near all major attractions, Vila's night spots, Shopping, Beaches and Dive Spots. Service Bus and Taxi's are available every minute.



The Wild Pig Hotel is proud to offer the following facilities; Colardeaus Restaurant, 20-metre Saltwater Swimming Pool, Guest Internet centre,

Tours desk & advisory services, the Wild Pig Bar, outdoor BBQ Area, poolside cafe, full security and all-hour access, common kitchen and guests lounge area, games room, nightly bar entertainment and best-value cocktails and a guest laundry.
(<http://www.wildpighotel.com>)



Time	Subject	Resources
Monday 1 August 2005		
<i>Master of Ceremony Opening: Mr. Rupeni Mario - SOPAC</i>		
8.30 – 8.40	Word of Welcome	Mr Leo Moli – Vanuatu Energy Unit
8.40 – 8.50	Prayer	Pastor of SDA (nc) ⁶
8.50 – 9.10	Opening Ceremony by Hon. Willie Jimmy TAPAGA RARUA, Minister of Lands, Natural Resources, Geology, Mines, Energy, Environment and Rural Water Supply.	
9.10 – 9.20	Statement by SOPAC	Mr Paul Fairbairn – SOPAC
9.20 – 9.30	Introduction of Participants	Mr Rupeni Mario
9.30 – 9.50	Background and Objectives of workshop	Mr Jan Cloin - SOPAC
9.50 – 10.00	Official Photograph	
10.00 – 10.30	Morning Tea	Govt. of Vanuatu
	Appointment of Day-Chair	Mr Russell Nari
10.30 – 10.45	Country presentation Vanuatu	Mr Donald Wouloseje
10.45 – 11.00	Country presentation Tuvalu	Mr Molipi Tausi – Energy Planner Tuvalu
11.15 – 11.30	Country presentation Tonga	Mr Tevita Tukunga – Energy Planner Tonga
11.30 – 11.45	Country presentation Kiribati	Ms Katarina Tafinga – CEO Kiribati Copra Oil Mill Co. (Ltd)
11.45 – 12.00	Country presentation Papua New Guinea	Mr Wari Agigerega – Managing Director Kokonas Industrial Oil (PNG) (Ltd.)
12.00 – 12.30	Discussion on Country Presentations	Mr Rupeni Mario
12.30 – 13.30	Lunch	SOPAC
13.30 – 13.45	Country presentation Solomon Islands	Mr John Vollrath – Director Solomon Islands Tropical Products
13.45 – 14.00	Country presentation Samoa	Mr Tile Tuimalealiifano – Manager Generation, Electric Power Company
14.00 – 14.15	Country presentation Tokelau	Mr Johnbosco Petelo – Manager Power Utility Tokelau
14.15 – 14.30	Country presentation Republic of Marshall Islands	Mr Steve Wakefield – Manager Special Projects Marshalls Electricity Co.
14.30 – 15.00	Discussions on Country Presentations	Mr Rupeni Mario
15.00 – 15.30	Afternoon Tea	Govt. of Vanuatu
15.30 – 16.00	Breakaway Session – How to promote the use of biofuels in the region?	3 groups
	Presentation of the three groups	
16.15 – 16.30	Wrap-Up Day One	Day-Chair

⁶ NOTE: (nc) means not confirmed



Time	Subject	Resources
Tuesday 2 August 2005		
8.30 – 8.35	Prayer	
	Appointment of Day-Chair	
8.35 – 9.25	Biofuel Energy Theory	Dr Surendra Prasad – University of the South Pacific
9.25 – 10.00	Introduction to Compression Ignition Engine Theory	Mr Timothy Kopial – PNG Technical University, Lae
10.00 – 10.30	Morning Tea	Govt. of Vanuatu
10.30 – 11.00	Engine Performance Using Coconut Oil and its Derivatives	Mr Timothy Kopial – PNG Technical University, Lae
11.00 – 11.30	Conversion of compression ignition cars to run on straight coconut oil – experiences in Vanuatu	Mr Tony Deamer – Motor Traders
11.30 – 11.45	Power and Heat Generation with Renewable Fuels	Mr Dennis Pont – Energy Options
11.45 – 12.15	Power Generation Experiences on Copra Oil	Mr John Chaniel – UNELCO
12.15 – 12.30	Discussion – Some Examples using vegetable oil in compression ignition engines – Gilles Vaitilingom	Mr Jan Cloin –SOPAC
12.30 – 13.30	Lunch	SOPAC
13.30 – 14.00	Copra Oil Production & Quality Standards	Mr Stanley Temakon, Manager, COPV Santo
14.00 – 14.30	Fuel Production from Coconut Oil – Biodiesel Options	Dr Vincent Bowry – University of the South Pacific
14.30 – 15.00	Alternative Fuel Blending / Distribution issues in Vanuatu	Mr Peter Napwatt, Agriculture project officer – VAST
15.00 – 15.15	Wrap-Up Day Two	Day-Chair
15.15 – 15.30	Afternoon Tea	Govt. of Vanuatu
15.30 – 16.45	Excursion to Biofuel Operation Vila	Mr Tony Deamer

Time	Subject	Resources
Wednesday 3 August 2005		
8.30 – 8.35	Prayer	
	Appointment of Day-Chair	
8.35 – 9.00	Development of Biofuel Venture Ideas	SOPAC, Gerhard Zieroth
9.00 – 10.00	Break-up in 3 groups to develop Biofuel Venture Ideas – Brainstorming	SOPAC, Gerhard Zieroth, Rupeni Mario, Jan Cloin
10.00 – 10.30	Morning Tea	Govt. of Vanuatu
10.30 – 11.30	Presentation of Biofuel Venture Ideas by 3 Groups, Plenary Discussions	SOPAC, Gerhard Zieroth
11.30 – 12.30	Break-up in 3 groups to develop in Biofuel Venture in further detail	SOPAC, Gerhard Zieroth, Rupeni Mario, Jan Cloin
12.30 – 13.30	Lunch	SOPAC
13.30 – 14.00	Economic / Financial Feasibility Study Biofuel Venture	Jan Cloin
14.00 – 14.30	Policy Issues / Institutional Setting of Biofuel Venture	Gerhard Zieroth
14.30 – 15.00	Requirements for external funding of project proposals	Mr Patrick Haines – Australian Government, AusAID
15.00 – 15.15	Wrap-up Day Three	Day-Chair
15.15 – 15.30	Afternoon Tea	Govt of Vanuatu
15.30 – 16.30	Excursion to FNTM (Copra / Sandalwood Mill) and VAST (Fuel oil production)	



Time	Subject	Resources
Thursday 4 August 2005		
8.30 – 8.35	Prayer	
	Appointment of Day-Chair	
8.35 – 8.50	Objectives of Proposal Writing – Introduction of Template	SOPAC, Jan Cloin, Rupeni Mario, Gerhard Zieroth
8.50 – 10.00	Writing of Your Project Proposal	SOPAC, Jan Cloin, Rupeni Mario, Gerhard Zieroth
10.00 – 10.30	Morning Tea	Govt of Vanuatu
10.30 – 11.00	Vegetable Oil Quality Standards – A start	Dr Vincent Bowry
11.00 – 12.30	Proposal Writing	SOPAC, Jan Cloin, Rupeni Mario, Gerhard Zieroth
12.15 – 12.30	Discussion arising from Writing Proposal	Rupeni Mario
12.30 – 13.30	Lunch	SOPAC
13.30 – 14.00	Introduction of model to calculate Economic / Financial Feasibility Project Proposal	SOPAC, Jan Cloin
14.00 – 14.15	UNESCAP Guidelines for Funding Proposals	Nike Vurobaravu
14.15 – 14.45	Excise Tax on Biofuels in Vanuatu	N. Godden, Customs Department
14.45 – 15.00	Wrap-Up by Day-Chair	
15.00 – 15.30	Afternoon Tea	Govt of Vanuatu
15.30 – 16.30	Excursion to UNELCO Power Plant	UNELCO

Time	Subject	Resources
Friday 5 August 2005		
8.30 – 8.35	Prayer	
	Appointment of Day-Chair	
8.35 – 8.45	Introduction of Project Proposal Presentations	SOPAC, Rupeni Mario
8.45 – 9.00	Proposal presentation Vanuatu	Mr Donald Wouloseje
9.15 – 9.30	Proposal presentation Tuvalu	Mr Molipi Tausi
9.30 – 9.45	Proposal presentation Tonga	Mr Tevita Tukunga
9.45 – 10.00	Proposal presentation Kiribati	Ms Katarina Tafinga
10.00 – 10.30	Morning Tea	Govt. of Vanuatu
10.30 – 10.45	Proposal presentation Papua New Guinea	Mr Timothy Kopial
10.45 – 11.00	Proposal presentation Solomon Islands	Mr John Vollrath
11.00 – 11.15	Proposal presentation Samoa	Mr Tile Tuimalealiifano
11.15 – 12.00	Proposal presentation Tokelau	Mr Johnbosco Petelo
12.00 – 12.15	Proposal presentation Republic of Marshall Islands	Mr Steve Wakefield
12.15 – 12.30	Discussion on Proposal Presentations	Mr Rupeni Mario
12.30 – 13.30	Lunch	SOPAC
13.30 – 14.30	Discussion on The Way forward with Project Proposals & Adoption of Recommendations	Mr Jan Cloin / Rupeni Mario
14.30 – 14.50	Wrap up Workshop	Day-Chair
14.50 – 15.00	Closing of Workshop by Mr Russell Nari standing in for –	Director-General for Infrastructure
15.00 – 15.30	Afternoon Tea	Govt of Vanuatu

Annex 2: List of Participants

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Sub-regional Workshop on Biofuels, Vanuatu 1-5 August 2005

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Annex 4: Recommendations of Workshop

Recommendations of Sub-regional workshop on Biofuels in Vanuatu, 1 to 5 August 2005: “Challenges and Opportunities to a viable Biofuel Sector”

Acknowledging the Governments of Japan, Denmark and the United Nations Development Programme (UNDP) in funding, and the Government of Vanuatu for hosting the sub-regional workshop on biofuels;

Considering the role of fossil fuels in Climate Change and the great economical, environmental and social benefits from the use of local biofuels as opposed to imported fossil fuels;

Recognising the great technical progress that has been made worldwide, in the Pacific region in general and in Vanuatu in particular on the use of Biofuels;

Noting that there is great potential for the application of biofuels in the region, coconut oil can replace an estimated 110 million litres per annum with the current resources and double this amount after successful re-planting and re-structuring programmes;

Noting also that ethanol production has a technical potential of replacing over 200 million litres of petrol per annum with the appropriate production and blending facilities in place;

Recognising the role of Governments, International Donors, University of the South Pacific, University of Technology in Lae (PNG), South Pacific Applied Geoscience Commission (SOPAC) in creating an enabling environment in the Pacific region for biofuel usage;

Recognising the commitment of the University of the South Pacific, through its head of Physics and Chemistry department, to include applied biofuel research in its area of activities;

Acknowledging the often pioneering however essential role of the private sector to make for a vibrant and viable biofuel sector.

The workshop participants recommend:

SOPAC to continue its work on biofuel promotion in the Pacific region;

The biofuel project proposals formulated during this workshop to be considered for funding through the existing programmes administered by SOPAC, or to be submitted for consideration to International Donors⁷;

SOPAC together with the country representatives to continue working transparently on a regional support programme to be submitted for funding to donors on the advancement of biofuel usage in the region;

SOPAC to establish a Pacific Biofuel Network by means of a website and a mailing-list with free access to anyone interested;

⁷ This includes multi-lateral and bi-lateral donors, to be identified



SOPAC to assemble recommended quality specifications of vegetable oil to be used as fuel in compression ignition engines;

University of the South Pacific Chemistry Department to support applied research in the analysis of biofuels, in particular the production of biodiesel and the assistance in simple vegetable oil quality assessment methodologies and work towards accreditation for biolipid analysis;

University of the South Pacific Physics Department to continue to support applied research in the usage of biomass for energy in general, and for at least two post-graduate students to carry out MSc. research in the area of biofuels;

University of Technology in Lae (PNG) to continue its work in the applied research of compression ignition engines on biofuels such as coconut oil;

SOPAC, in a collaborative effort, to investigate the total economic impact of partial/total displacement of fossil fuels imports by home-grown biofuels in its member countries, considering balance of payments, job creation, rural development, environmental costs and benefits, international green credits and the impact on remaining oil supply logistics.

Governments of Pacific island countries, given the benefits of biofuel usage over imports of fossil fuels, to consider implementing tax incentives for biofuels used in transport and electricity generation to support the emergence of a local biofuel sector.

The Governments of the Pacific island countries to continue to support appropriate educational and training needs of staff working in the areas of renewable energy in general and biofuel research and development in particular.

Signed,
Representatives from Kiribati, Papua New Guinea, Republic of Marshall Islands, Independent State of Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, University of the South Pacific, University of Technology in Lae.

Port Vila, 5 August 2005.



Annex 3: Press Statement

PRESS STATEMENT 31 July 2005 – For immediate release

South Pacific Applied Geoscience Commission (SOPAC) organises together with the Government of Vanuatu:

WORKSHOP

“Challenges and Opportunities to a viable Biofuels sector”
Wild Pig Hotel, Vila

From Monday 1 to Friday 5th of August, SOPAC, in close co-operation with The Government of the Republic of Vanuatu, Ministry of Lands, Geology, Mines, Energy, Environment and Rural Water Supply, will organise a sub-regional workshop on Biofuels. Biofuels are renewable alternatives to fossil fuels, are environmentally friendly and are locally available.

The minister for Ministry of Lands, Geology, Mines, Energy, Environment and Rural Water Supply, honourable Willie Jimmy TAPANGA RARUA will open the workshop in the conference room of the Wild Pig Hotel at 8.30 am on August 1, 2005.

Participants from Tuvalu, Tonga, Kiribati, Papua New Guinea, Solomon Islands, Samoa, the Marshall Islands and Tokelau will get together for a week to discuss the potential for biofuels in their respective countries. The aim of the meeting is to share experiences and to formulate project proposals for funding by banks and / or donor community. Resource people include representatives from PNG's Lae University of Technology, the University of the South Pacific, Vanuatu experts from the business community and SOPAC.

The opportunities for the application of biofuels the region are many and diverse, dependent on the local circumstances. There are a number of common circumstances to all the islands states participating. These include remoteness from the world markets, large potential to produce biofuels and a vast agricultural based workforce to produce these biofuels. As outcome of the workshop, it is envisaged to formulate concrete proposals for the sustainable promotion and development of biofuels not only within your own countries but if possible within the Pacific region more generally.

As the leading regional organisation in energy, The South Pacific Applied Geoscience Commission (SOPAC) has taken up the challenge of organising this workshop as part of its ongoing work in the promotion of biofuels in the region. SOPAC is grateful for funding through the Japanese Government and the Danish Government.

Vanuatu was chosen as the venue for this workshop, because of its well-developed market for biofuels. Whenever in the region biofuels are discussed, Vanuatu is often referred to as the 'example for the region'. Pioneers in the area of Biofuel production and distribution include Motor Traders and VAST Energy, but it is understood that also UNELCO, COPV and the Lory Co-operation utilise indigenous biofuels for their operation.

In the region, there are currently many trials using biofuels, but the participants hope to learn from the wide experience in Vanuatu to take back home.



The use of biofuels in the transport and electricity generation sectors has great advantages over the use of regular fossil fuels.

- Firstly they are indigenous resources that do not need to be imported and therefore have a positive impact on the balance of payments.
- Secondly, they are renewable, and with proper management (replanting) will continue to provide us with energy in the years to come.
- Thirdly, the use of biofuels is clean, as compared to its fossil counterpart with reduced emissions.
- Finally, the use of biomass has no net carbon dioxide emissions.

The potential to produce biofuels in the region is large. If all the countries in the region stopped exporting copra oil, they could produce 100 million litres of coconut oil to replace diesel. In addition, sugar producing countries such as Fiji and PNG have the potential to produce the same amount of ethanol as a petrol replacement.

For more information, please contact:

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